Hydro Tech Environmental, Corp.

Main Office
77 Arkay Drive, Suite G
Hauppauge, New York 11788
T (631) 462-5866 • F (631) 462-5877

NYC Office
15 Ocean Avenue, 2nd Floor
Brooklyn, New York 11225
T (718) 636-0800 • F (718) 636-0900

WWW.HYDROTECHENVIRONMENTAL.COM

September 1, 2011

New York City Office of Environmental Remediation
City Brownfield Cleanup Program
c/o Shaminder Chawla
100 Gold Street, 2nd Floor
New York, NY 10038

Re: 12CBCP020M
E-Des # 11EHAN220M
2329 Frederick Douglas Boulevard
Remedial Action Work Plan (RAWP) Stipulation List

Dear Mr. Chawla:

Hydro Tech Environmental Corp. hereby submits a Remedial Action Work Plan (RAWP) Stipulation List for the subject site to the New York City Office of Environmental Remediation (NYCOER) on behalf H & H Builders. This letter serves as an addendum to the RAWP to stipulate additional content, requirements and procedures that will be followed during the site remediation. The contents of this list are added to the RAWP and will supersede the content in the RAWP where there is a conflict in purpose or intent. The additional requirements/procedures include the following Stipulation List below:

1. The criterion attached in **Addendum 1** will be utilized if petroleum containing tank or vessel is identified during the remedial action or subsequent redevelopment excavation activities. All petroleum spills will be reported to the NYSDEC hotline as required by applicable laws and regulations. This contingency plan is designed for heating oil tanks and other small or moderately sized storage vessels. If larger tanks, such as gasoline storage tanks are identified, OER will be notified before this criterion is utilized.

2. Collection and analysis of endpoint Samples will be conducted to evaluate the performance of the remedy with respect to attainment of Track 1 SCOs over 90% of the Site and a Track 2 Restricted Commercial SCO over the remainder. A map

indicating post-remedial endpoint sampling locations will be prepared and attached as **Addendum 2**.

3. Preparation of an approved Site Management Plan (SMP) in the RAR for long-term management of residual contamination. This plan must be in compliance with the New York State law, which requires that the building occupants be notified of an active vapor mitigation protocol implemented as part of Site remediation.

4. Certified stamped architect and engineering plans including cross-sectional diagrams and structural diagrams are attached in **Addendum 3**.

5. Certified stamped architect project description letter providing details of excavations for footings and other related development activities and final cover slab is included in **Addendum 4**.

6. Signage for the project will include a sturdy placard mounted in a publically accessible right of way to building and other permits signage will consist of the NYC BCP Information Sheet (attached **Addendum 5**) announcing the remedial action. The Information sheet will be laminated and permanently affixed to the placard.

7. E-Designation Noise & Air Quality Remedial action Plan (RAP) for 2329 Frederick Douglas Boulevard is attached in **Addendum 6**.

8. The vapor barriers planned for this project include a GSE 30 mil High Density Polyethylene (HDPE) Geomembrane to be installed beneath the building slab and Grace 60 mil (1.5 mm) Bithutene 4000 membrane to be installed along the below grade foundation walls. These barriers are impermeable membranes that are capable of preventing the migration of soil vapor into the new building. Design and Technical Specification for the Vapor Barriers are attached in **Addendum 7**.

9. An active Sub-Slab Depressurization System (SSDS) will be installed under the building slab for an active soil vapor mitigation. Design and Technical Specification for the active SSDS are also attached in **Addendum 7.**

10. The Truck route is attached in **Addendum 8**: Upon leaving the Site head northeast on Frederick Boulevard toward West 125th Street; Take the 2nd left onto West 126th Street; Turn right onto Amsterdam Avenue; Turn left onto West 133 Street; Turn right and then merge onto New York 9A N; Take exit 14 toward I-95/George Washington Bridge and then follow signs for New Jersey.

11. An updated project Schedule is attached in **Addendum 9**.

12. A CD containing the final RAWP including this approved Stipulation List will be placed in the library that constitutes the primary public repository for project documents.

13. This NYC BCP project is not eligible for an exemption from New York State hazardous waste disposal fees including but not limited to New York State Department of Environmental Conservation Special Assessment Tax (ECL 27-0923) and Hazardous Waste regulatory Fees (ECL 72-00402) .

14. Pre-approval letters from all disposal facilities will be provided to NYC OER prior to any soil/fill removal. The OER will be notified immediately should a different disposal facility for the soil/fill material is selected.

15. Hydrogen Releasing Compounds (HRC) will be introduced at the bottom of Site excavation at localized areas to remediate the groundwater contamination. The HRC will be injected through a number of direct push injection points around the treatment zones. The amount of HRCs, the number of injection points and the depth of application will be coordinated with the OER prior to Site remediation. The USEPA Groundwater Compliance Section will be notified of HRC injections in accordance to their Underground Injection Control (UIC) Program regulations.

Very Truly Yours,

Paul I. Matli
Senior Project Manger
Hydro Tech Environmental, Corp.

cc:

J. Shah.
T.Woodrum

Addendum 1

Generic Procedures for Management of Underground Storage Tanks Identified under the NYC BCP

Prior to Tank removal, the following procedures should be followed:

- Remove all fluid to its lowest draw-off point.
- Drain and flush piping into the tank.
- Vacuum out the “tank bottom” consisting of water product and sludge.
- Dig down to the top of the tank and expose the upper half.
- Remove the fill tube and disconnect the fill, gauge, product, vent lines and pumps. Cap and plug open ends of lines.
- Temporarily plug all tank openings, complete the excavation, remove the tank and place it in a secure location.
- Render the tank safe and check the tank atmosphere to ensure that petroleum vapors have been satisfactorily purged from the tank.
- Clean tank or remove to storage yard for cleaning.
- If the tank is to be moved, it must be transported by licensed waste transporter. Plug and cap all holes prior to transport leaving a 1/8 inch vent hole located at the top of the tank during transport.
- After cleaning, the tank must be made acceptable for disposal at a scrap yard, cleaning the tanks interior with a high pressure rinse and cutting the tank in several pieces.

During the tank and pipe line removal, the following field observations should be made and recorded:

- A description and photographic documentation of the tank and pipe line condition (pitting, holes, staining, leak points, evidence of repairs, etc.).
- Examination of the excavation floor and sidewalls for physical evidence of contamination (odor, staining, sheen, etc.).
- Periodic field screening (through bucket return) of the floor and sidewalls of the excavation, with a calibrated photoionization detector (PID).

<u>Impacted Soil Excavation Methods</u>

The excavation of the impacted soil will be performed following the removal of the existing tanks. Soil excavation will be performed in accordance with the procedures described under Section 5.5 of Draft DER-10 as follows:

- A description and photographic documentation of the excavation.
- Examination of the excavation floor and sidewalls for physical evidence of contamination (odor, staining, sheen, etc.).
- Periodic field screening (through bucket return) of the floor and sidewalls of the excavation, with calibrated photoionization detector (PID).

Final excavation depth, length, and width will be determined in the field, and will depend on the horizontal and vertical extent of contaminated soils as indentified through physical examination (PID response, odor, staining, etc.). Collection of verification samples will be performed to evaluate the success of the removal action as specified in this document.

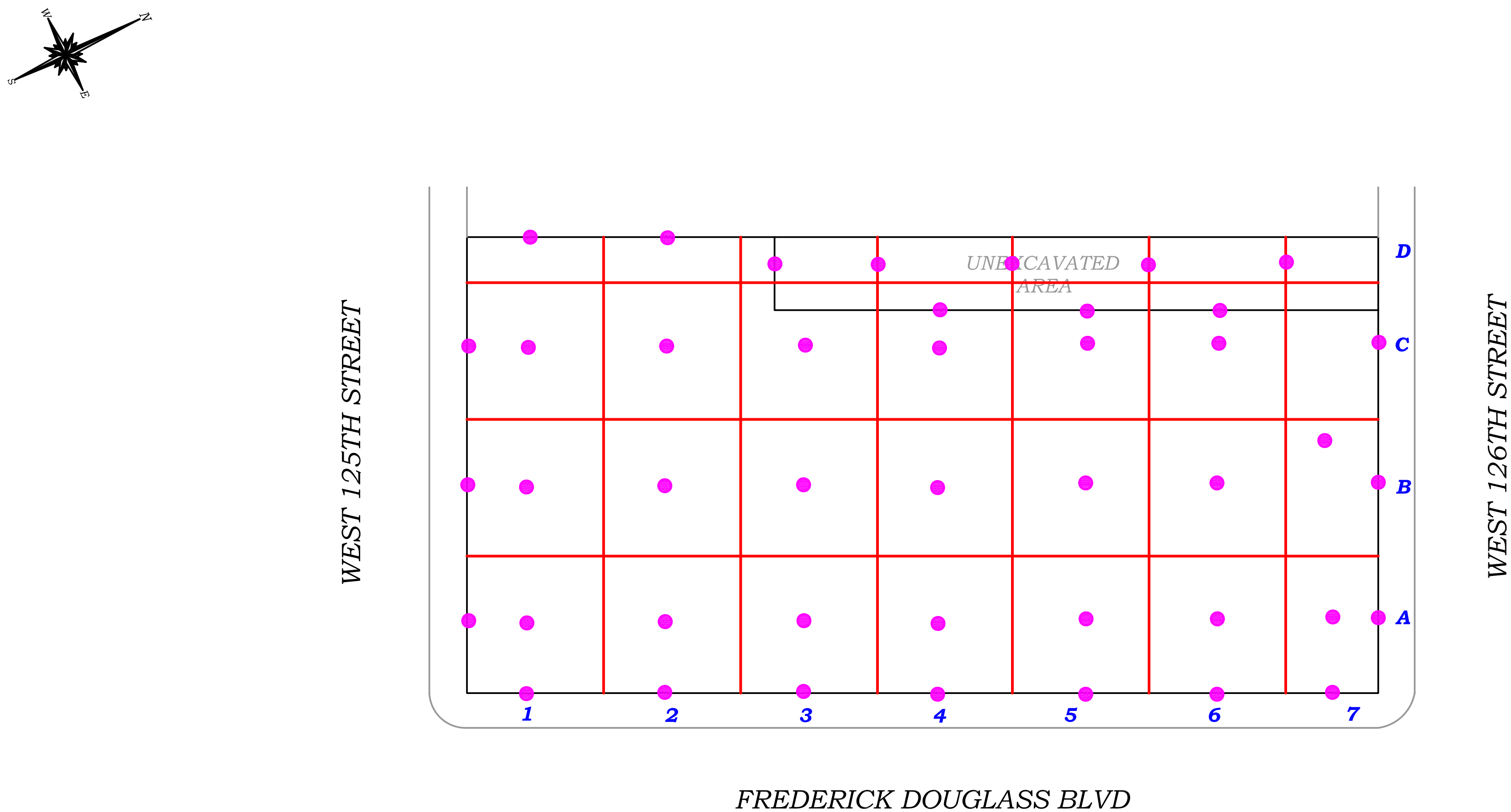
The following procedure will be used for the excavation of impacted soil (as necessary and appropriate):

- Wear appropriate health and safety equipment as outlined in the Health and Safety Plan.
- Prior to excavation, ensure that the area is clear of utility lines or other obstructions. Lay plastic sheeting on the ground next to the area to be excavated.
- Using a rubber-tired backhoe or track mounted excavator, remove overburden soils and stockpile, or dispose of, separate from the impacted soil.
- If additional UST's are discovered, the NYSDEC will be notified and the best course of action to remove the structure should be determined in the field. This may involve the continued trenching around the perimeter to minimize its disturbance.
- If physically contaminated soil is present (e.g., staining, odors, sheen, PID response, etc.) an attempt will be made to remove it, to the extent not limited by the site boundaries or the bedrock surface. If possible, physically impacted soil will be removed using the backhoe or excavator, segregated from clean soils and overburden, and staged on separated dedicated plastic sheeting or live loaded into trucks from the disposal facility. Removal of the impacted soils will continue until visibly clean material is encountered and monitoring instruments indicate that no contaminants are present.
- Excavated soils which are temporarily stockpiled on-site will be covered with tarp material while disposal options are determined. Tarp will be checked on a daily basis and replaced, repaired or adjusted as needed to provide full coverage. The sheeting will be shaped and secured in such a manner as to drain runoff and direct it toward the interior of the property.

Once the site representative and regulatory personnel are satisfied with the removal effort, verification of confirmatory samples will be collected from the excavation in accordance with DER-10.

Addendum 2

Endpoint Sampling Plan



LEGEND:

● END POINT SAMPLE LOCATIONS

0' 20' 40' 60'

SCALE IN FEET (FT.)

HYDRO TECH ENVIRONMENTAL CORP.

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631)462-5866 F (631)462-5877

NYC OFFICE:
15 OCEAN AVENUE, 2nd Floor
BROOKLYN, NEW YORK 11225
T (718)636-0800 F (718)636-0900

www.hydrotechenvironmental.com

2329 Frederick Douglass Blvd
New York, NY.

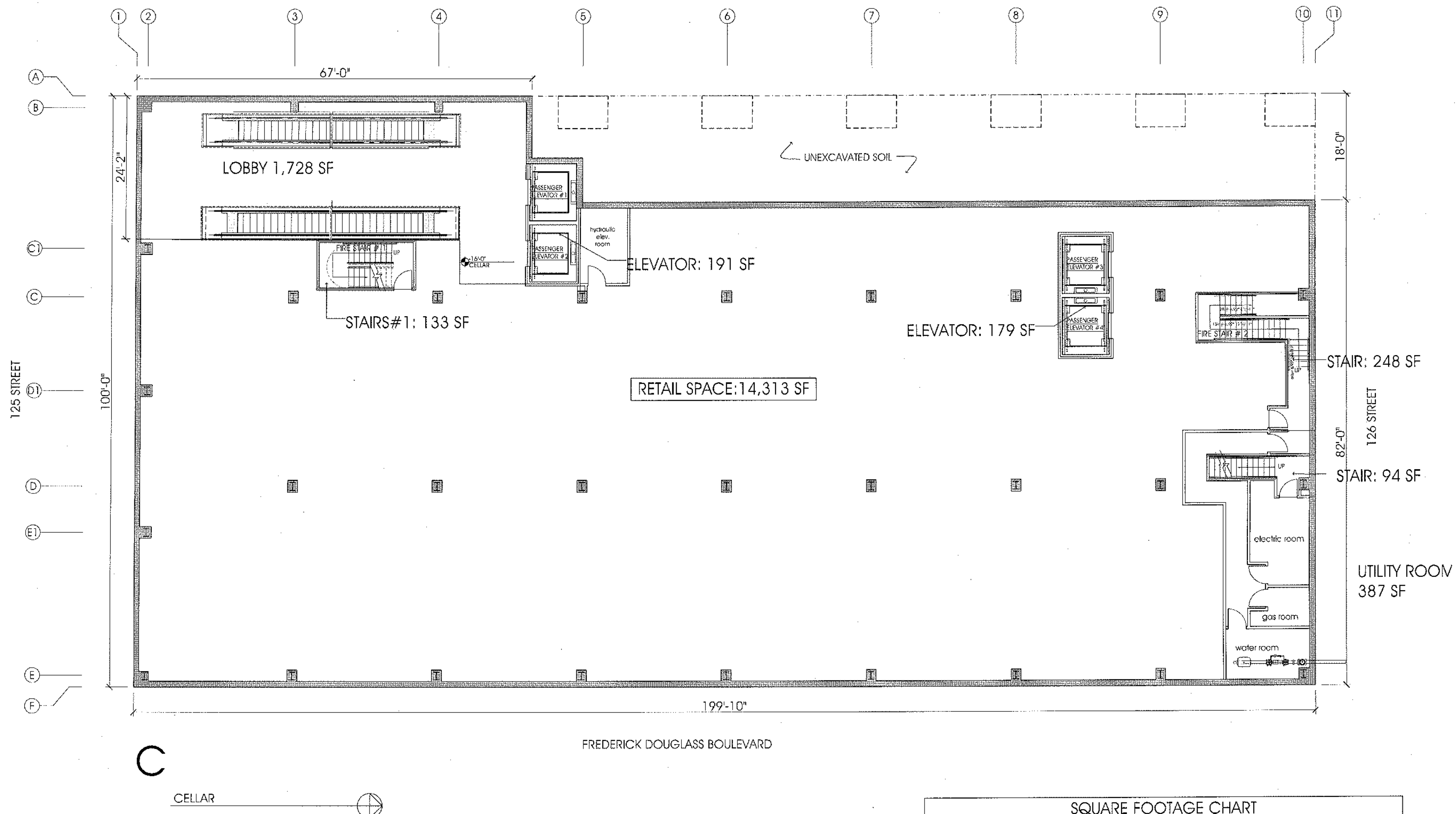
Drawn By:	C.Q
Reviewed By:	M.R
Approved By:	M.S
Date:	09/06/11
Scale:	AS NOTED

TITLE:

FIGURE 1: PROPOSED ENDPOINT SAMPLING LOCATION

Addendum 3

Certified/Stamped Architect and Engineering Plans



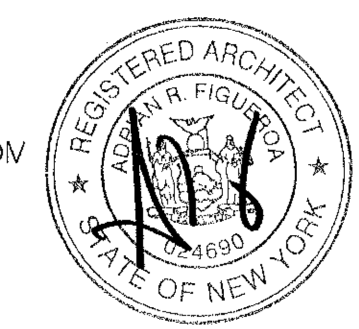
SQUARE FOOTAGE CHART				
FLOOR	LOCATION		AREA	TOTAL
CELLAR	COMMON AREAS	ELEVATORS	379 SF	3,344 SF
		STAIRS	531 SF	
		LOBBY	1,728 SF	
		OTHER	706 SF	
	RETAIL		14,313 SF	14,313 SF
TOTAL GROSS AREA			17,657 SF	17,657 SF

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-
	-	-



SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
CELLAR LAYOUT

DATE: Jan. 28, 2011 | SC | PROJ. #:01-1103
SCALE : SCALE: 1/8" = 1'-0"

DWG. NO. A-100.00
01 of 27

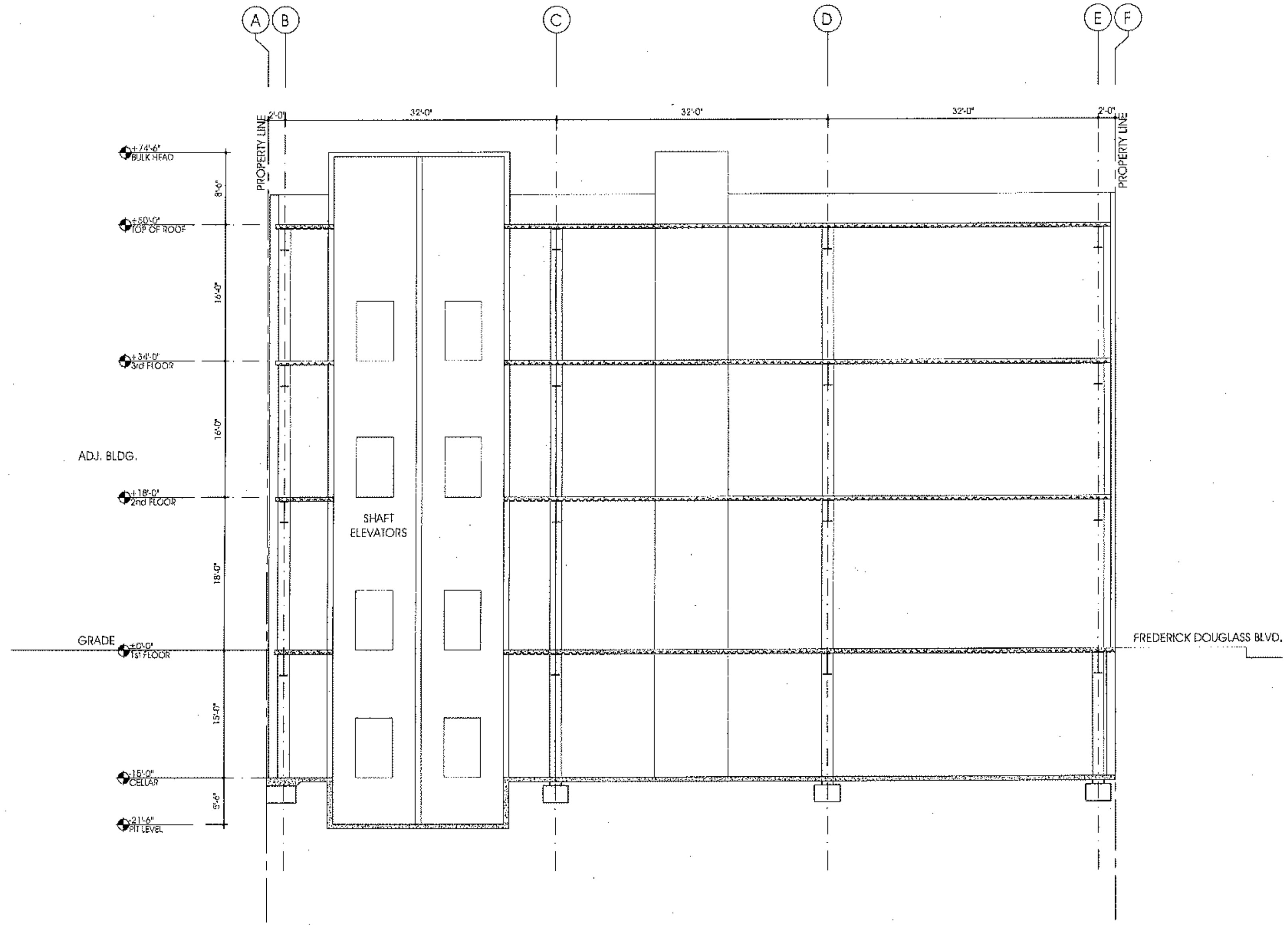
NEW BUILDING
COMMERCIAL

2329 FREDERICK
DOUGLASS BLVD.
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-
	-	-



2 EAST-WEST SECTION BETWEEN EDGE 8 & 9 - LOOKING NORTH
Scale: 1/8" = 1'-0"

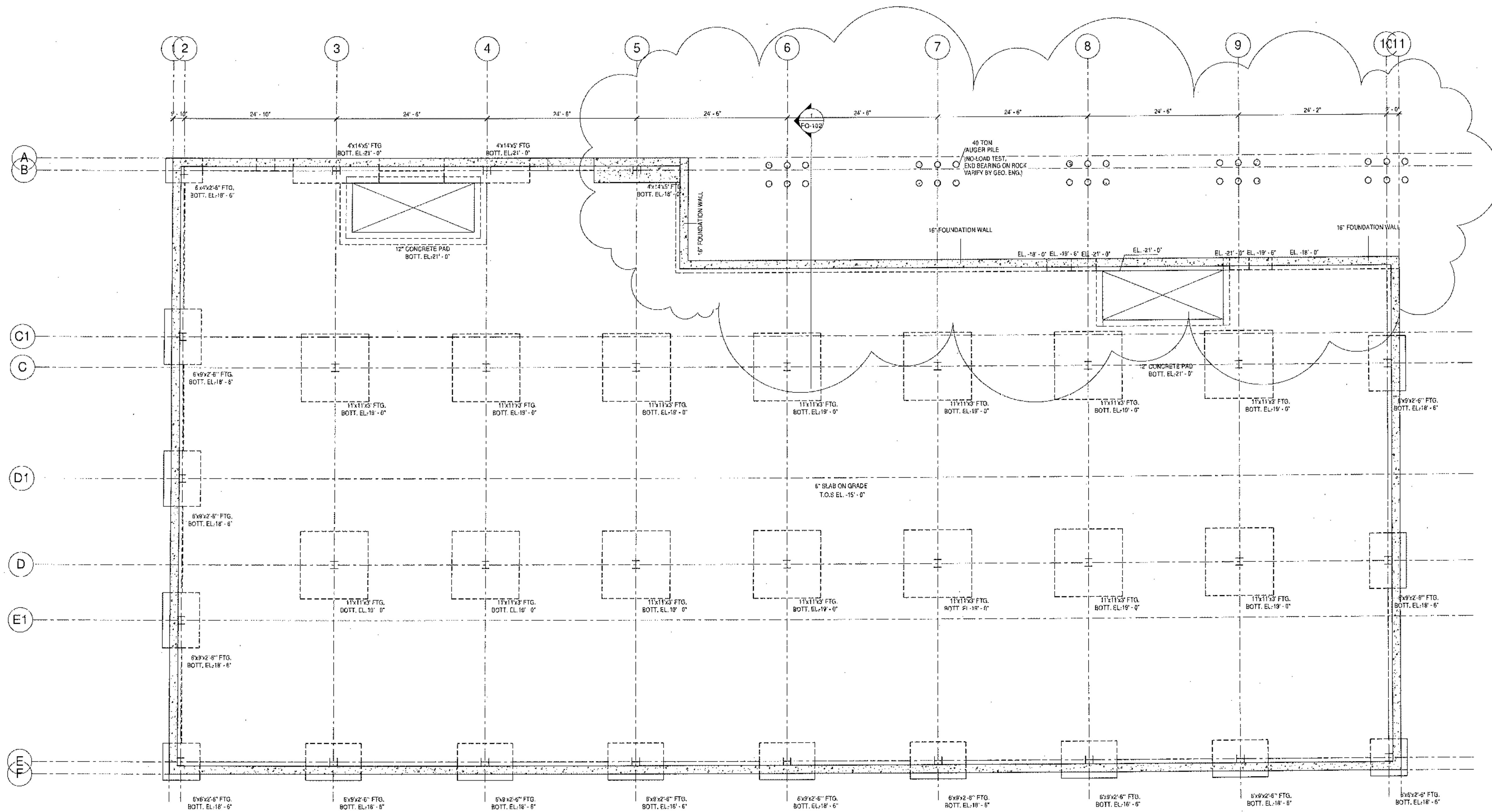
SEAL:

DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
BUILDING SECTION
"2"

DATE: Jan. 28, 2011 | SCA | PROJ. #: 01-1103
SCALE: 1/8" = 1'-0"
DWG. NO.
A-302.00
00 of 00



NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

GMS STRUCTURAL ENGINEERS
GILSANZ.MURRAY.STEFICEK.LLP

REGISTERED ARCHITECT ADRIAN R. FIGUEROA 024690 STATE OF NEW YORK

No.	Description	Date
1	DOB FILING	04.04.2011
2	Revision 2	Date 2

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
FOUNDATION

DATE: 06-23-2011 PROJ.#: 11015
SCALE: 1/8" = 1'-0"

DWG. NO. FO-101.00

Addendum 4

Certified Descriptions of Project Development

SRA
Architecture + Engineering, P.C.

July 29, 2011

Ref: **2329 Frederick Douglass Boulevard**
Manhattan, New York City
Block 1952, Lot 29

PROJECT DESCRIPTION:

The New Development project shall be identified as 301 West 125^{th} Street, Manhattan, NY; Block 1952, Lot 29, located on Frederick Douglass Boulevard between West 125^{th} and West 126^{th} Streets.

The site is 19,983 SF. The building covers the entire site and the cellar space of 17,691 SF of the gross area. The New Development project is a three (3) story commercial building with a cellar. The building has 77,640 SF of gross commercial area, located on all levels.

The following slab, foundation and footings are proposed. Typically, bottom of a 6" slab will be 16'-0" below grade. The localized conditions are as follow:

1. 14 columns footing (11'-0" x11'-0"x3'-0" each) will require excavation to a depth of approximately 19'-0" below grade
2. 13 columns footings (6'-0"x9'-0"x2'-6") at edges C1/2, D1/2, E1/2, E/3 thru 9, D/10, C/10, will require excavation to the depth of 18'-6" below grade.
3. 2 columns footings (6'-0"x4'-0"x2'-6") at edges E/2 & E/10, will require excavation to the depth of 18'-6" below grade
4. 2 columns footings (4'-0"x14'-0"x5'-0") at edges B/2 & B/4, will require excavation to the depth of 18'-6" below grade
5. 1 column footing (4'-0"x14'-0"x5'-0") at edges B/3, will require excavation to the depth of 20'-0" below grade.
6. The elevator & escalators pits, approximately 21'-0" below grade.
7. 6 pile caps (8'-6" x 5'-6" x 3'-9") at edges B/5, 6, 7, 8, 9 & 10, will require excavation to the depth of 6'-3" below grade.
8. The NW corner will not be excavated, will be removing 4'-0" of soil, 18'-0" from the property line on the West and 124'-0" from Property line on 126^{th} Street to the South. Edges A/ 5 to 11.

Please see plan attached for reference.

Respectfully,
SRA Architecture + Engineering, P.C.

Adrian R. Figueroa, R.A.

312 Sprint Street • New York, NY 10013
phone (212) 505-1986 • fax (212) 505-2794

Addendum 5

Signage

NYC Brownfield Cleanup Program

This property is enrolled in the New York City Brownfield Cleanup Program for environmental remediation. This is a voluntary program administered by the NYC Office of Environmental Remediation.

For more information, log on to:
www.nyc.gov/oer

If you have questions or would like more information, please contact:

Shaminder Chawla at (212) 788-8841
or email us at brownfields@cityhall.nyc.gov

2329 Fredercik Douglas Boulevard
Site #: 12CBCP020M

Addendum 6

E-Designation Noise & Air Quality Remedial action Plan (RAP)

Air Quality / Noise
Remedial Action Plan

For

2329 Frederick Douglas Boulevard
Manhattan, New York
Block 1952, Lot 29

E-Designation E-201
CEQR # 07DCP030M
125th Street Corridor Rezoning and Related Actions

OER Project # 11EHAN220M
NYC BCP Number: 12CBCP020M

Prepared for:

301-303 West 125th Street, LLC.
400 West 14th Street, 3rd Floor
New York, NY 10014

Prepared by:

Hydro Tech Environmental, Corp.
15 Ocean Avenue, 2nd Floor
Brooklyn, NY 11225
718-636-0800

AUGUST 25, 2011

CERTIFICATIONS

I, Shaik A. Saad, am a Professional Engineer licensed in the State of New York. I have primary direct responsibility for implementation of the remedial action for the 2329 Frederick Douglass Boulevard Site. I certify that all architectural and engineering plans, specifications and associated designs included in the RAP have been personally developed by me or under my direct supervision, meet industry standards, and are appropriate for the intended purpose established in this Plan.

Shaik A. Saad
Name

071078
NYS PE License Number

PE/RA Stamp

Signature

8/25/2011
Date

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.

REMEDIAL ACTION PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

FIGURES

APPENDICES

LIST OF ACRONYMS

Acronym	Definition
A/C	Air Conditioning
AMV	Alternate Means of Ventilation
CEQR	City Environmental Quality Review
HVAC	Heating, Ventilating and Air Conditioning
IR	Installation Report
NYC DEP	New York City Department of Environmental Protection
NYC DOB	New York City Department of Buildings
NYC OER	New York City Office of Environmental Remediation
OITC	Outdoor-Indoor Transmission Class
PE	Professional Engineer
PTAC	Packaged Terminal Air Conditioning
QA/QC	Quality Assurance/Quality Control
RA	Registered Architect
RAP	Remedial Action Plan
STC	Sound Transmission Class

EXECUTIVE SUMMARY

Site Description, Physical Setting and Site History

The Site is identified as 2329 Frederick Douglas Boulevard in Manhattan, New York, and is further described as Block 1952, Lot 29. The Site is associated with a Little “E” Restriction for “HAZMAT/NOISE/AIR”, **E-201, CEQR #07DCP030M** as a part of 125th Street Corridor Rezoning and Related Actions and was assigned a New York City Mayor’s Office of Environmental Remediation (OER) case **#11EHAN220M**. The Site was also assigned New York City Brownfield Cleanup Program ID # **12CBCP020M**.

The Site is approximately 20,000 square feet and is bounded by Frederick Douglass Boulevard to the east, West 126th Street to the north, West 125th Street to the south and a 3-story and a 1-story commercial building to the west and northwest, respectively.

Currently, the Site is developed with 11 multi-story commercial and residential buildings with basements; most of the former commercial buildings (both commercial and residential) have been vacant for approximately twenty-five (25) years, while the former residential ones have been only recently vacated. Most of the buildings are interconnected. The northwest portion of the property consists of a parking lot. The Site was previously associated with the following alternative addresses:

- 303 West 125th Street
- 301 West 125th Street/2329 Frederick Douglas Blvd.
- 2331-2333 Frederick Douglas Boulevard
- 2335 Frederick Douglas Boulevard
- 2337-2339 Frederick Douglas Boulevard
- 2341 Frederick Douglas Boulevard
- 2343 Frederick Douglas Boulevard
- 2345 Frederick Douglas Boulevard

The topography of the Site and its vicinity is generally level. The surrounding property uses are predominantly residential and commercial.

301-303 West 125th Street, LLC, the owner of the property, is developing this property into a 3-story commercial building with a cellar. The building will be developed throughout the entire property. The cellar will not extend beneath the northwestern portion of the building.

Summary of Past Uses of Site

Based on a review of Fire Insurance Maps and Regulatory Agency documents from Phase I Environmental Site Assessments (ESAs) dated January 2009 and February 2011 and prepared by Roux Associates and Hydro Tech, respectively, a Site history was established. Historic uses of the Site included a parking lot, residences, hotels, community facilities, entertainment facilities, retail shops, printing shop, offices, a storage warehouse, a drycleaner, restaurants, factories, and a photo development lab. The printing shop was located on the second floor of the building in the northeastern portion of the Site from 1951 to 2005. Two manufacturing facilities and a photo development lab were located in the southern portion between 1927 and 2000. The drycleaner was located in the western-southwestern portion from 1983 to 1988. All buildings at the Site are currently vacant. 301-303 West 125th Street, LLC is the current owner of the Site.

Summary of the Air Quality and/or Noise E-Designation requirements

An E-Designation for Air Quality and Noise (**E-201**) was declared for the Site identified as Block 1952, Lot 29 by the New York City Department of City Planning (DCP) as part of the 04/30/2008, 125th Street Corridor Rezoning and Related Actions (CEQR number **07DCP030M**).

Under this declaration, any new residential and or/commercial development must ensure that the heating, ventilation and air conditioning stacks are located at least 84 and 65 feet for oil No. 4 and No. 2 from the lot lines or use natural gas as the type of fuel for space heating and hot water (HVAC) systems. In addition, this declaration requires that future residential/commercial uses must provide a closed-window condition with a minimum of 30 dBA and 40 dBA window /wall attenuation on some facades in order to maintain an acceptable interior noise level of 45 dBA using windows with special design features. In order to maintain the closed-window condition, an alternate means of ventilation including but not limited to central air conditioning must be provided.

Upon further investigation of the declaration associated with 125th Street Corridor Rezoning and Related Actions, the OITC rating of 30 dBA is required for the building façade facing Frederick Douglas to the east and the OITC rating of 40 dBA is required for the building façades facing East 125th Street to the south.

Since the new development is specifically designed for commercial use, the developer received permission from OER to reduce the required OITC ratings by 5 OITC points. Therefore, an OITC rating of 25 dBA would be required for the building façade facing Frederick Douglas and 35 dBA for the building façades facing East 125th Street.

Summary of the Remedial Plan

This remedial plan will achieve all of the objectives established for the project by the E-Designation requirements for Air Quality and Noise. The remedial plan is effective in both the short-term and long-term and is cost effective, implementable and uses standards methods that are well established in the industry.

1. Utilization of natural gas for space heating systems
2. Installation of 6 electric water heaters
3. Installation of 12 heating furnaces inside the building
4. Installation of 4 packaged gas/electric heating units on roof top of building
5. Installation of 12 Split system air conditioning units on roof top of building
6. Installation of windows with glazing of 1" insulated glass (¼"annealed exterior glass, ½" airspace, ¼" annealed interior glass) with OITC of 26 dBA along the eastern façade of the building and 1- ¾"glass (1/4" laminated glass, ½" airspace, ¼" laminated glass, ½" airspace and ¼" laminated glass) with OITC of 35 dBA along the southern façade.

REMEDIAL ACTION PLAN

1.0 INTRODUCTION

301-303 West 125th Street, LLC is developing a 0.46 acre (20,000 - sq.ft.) site located at 2329 Fredrick Douglass Boulevard in Manhattan, New York City. Commercial use is proposed for the property. The remedial action described in this document will address all of the requirements of the Air Quality and Noise the E-Designation requirements, complies with applicable environmental standards, criteria and guidance and conforms to applicable City, State, and Federal laws and regulations.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located in Manhattan, New York City and is identified as Block 1952 and Lot 29 on the New York City Tax Map. This project has been assigned project # **11EHAN220M** by the NYC Office of Environmental Remediation (OER) and Site # **12CBCP020M** by New York City Brownfield Cleanup Program under the management of OER. Figure 1 shows the Site location. The Site is 0.46 acre (20,000 - sq.ft.) and is bounded by is bounded by Frederick Douglass Boulevard to the east, West 126th Street to the north, West 125th Street to the south and a 3-story and a 1-story commercial building to the west and northwest, respectively. A map of the site boundary is shown in Figure 2. Currently, the Site is the Site is developed with 11 multi-story commercial and residential buildings with basements; most of the former commercial buildings (both commercial and residential) have been vacant for approximately twenty-five (25) years, while the former residential ones have been only recently vacated. Most of the buildings are interconnected. The northwest portion of the property consists of a parking lot

An E-Designation for Air Quality and Noise was placed pursuant to the 125th Street Corridor Rezoning and Related Actions (CEQR # **07DCP030M**) to render the Site protective of Air Quality and Noise impacts.

1.2 PROPOSED DEVELOPMENT SCENARIO

The future use of the Site will consist of commercial use and will include a 3-story building with a cellar. The building will occupy the entire footprint of the lot. The proposed construction requires demolition of the existing on-site structures and excavation to approximately 16 feet below grade surface. The parking lot currently located in the northwestern portion of the Site will only be excavated to a depth of 4 feet for the layout of a building slab on grade. The building slab will be approximately 6 inches in thickness. The cellar top slab elevation is proposed to be approximately 15 feet 6 inches below surface grade. The height of the building will be approximately 58 feet. The new development will have fixed type windows installed along the southern and eastern facades of the building (See further discussion under Section 2.2.1, Window/Wall Attenuation). Packaged gas/electric heating units and air conditioning units will be installed on roof top of the building. Gas fired furnaces for space heating and electric hot water heaters will be installed inside the building. (See further discussion of A/C units under Section 2.2.2, Alternate Means of Ventilation). The layout of the Site development is presented in Figure 3.

The current zoning designation, as per Department of City Planning NYC zoning maps, is C4-4D commercial district. The proposed use is consistent with existing zoning for the property. This RAP may only be implemented for this proposed development scenario.

Appendix A shows copies of the RA stamped architectural drawings.

1.3 ADJACENT PROPERTIES

The Site is located on a commercial street within a residential and commercial neighborhood. The property directly to the north consists of a vacant community garden (Clayton Williams Garden). The property directly to the east consists of a 4-story commercial and office building. The property directly to the west consists of a 4-story commercial and office building. The property directly to the northwest consists of a 1-story commercial building. The property directly to the south consists of 4-story commercial and office building. The properties directly to the east and northeast consist of four multi-story commercial and office buildings (See Figure 2).

There are no day care facilities, hospitals, rivers, streams, wetlands or other sensitive receptors were identified within 450-foot from the Site.

Previous Figure 2 shows the surrounding land usages .

2.0 E-DESIGNATION REQUIREMENTS

The proposed action satisfies the requirements of the E-Designation for Air Quality and Noise for the intended use of the property. The proposed action(s) will achieve all of the E-Designation requirements for the project. The proposed action(s) is effective in both the short-term and long-term, is cost effective and implementable, and uses standards methods that are well established in the industry.

Based on E-201, the following requirements have been identified for this Site:

1. Air Quality E-Designation requirements for Block 1952 and Lot 29 requires the installation of stacks for No. 4 and No. 2 heating systems at specified distance from the lot lines or the use natural gas as the type of fuel for space heating and hot water systems.
2. Noise E-Designation requirements for Block 1952 and Lo 29 requires specific window /wall attenuation features in order to maintain an acceptable interior noise level of 45 dBA and alternate means of ventilation.

A copy of the E-Designation documents and requirements found in the EIS is shown in Appendix B.

2.1 AIR QUALITY

The Air Quality E-201 for Block 1952 and Lot 29 requires that any new residential and/or commercial development on the above-referenced property must ensure that the heating, ventilating and air conditioning stack(s) are located at least 84 and 65 feet for Oil No. 4 and No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating, hot water, or HVAC systems, to avoid any potential significant adverse air quality impacts.

2.1.1 FUEL TYPE

In order to satisfy the requirements of E-201, natural gas will be utilized at the site by HVAC systems. Water heaters will be powered by electricity.

The HVAC systems to be installed at the proposed new development will consist of the following:

- Four (4) 20 Ton Trane roof top packaged gas/electric heating units with a capacity of 191,000 BTUs, Model #TWE240.
- Eleven (11) 20 Ton Trane roof top air cooled condensing units with a capacity of 200,000 BTUs, Model #TTA240.
- One (1) 10 Ton Trane roof top air cooled condensing unit with a capacity of 120,000 BTUs, Model #TTA120.
- Eleven (11) Trane indoor duct furnaces with a capacity of 300,000/240,000 BTUs, Model GLND030EDG will each be installed inside the cellar (3 units), the first floor (4 units) and second floor (4 units).
- One (1) Trane indoor duct furnace with a capacity of 150,000/120,000 BTUs, Model GLND015EDG will be installed inside the second floor.
- A total of 6 water heaters, AO Smith Model #GPVH50 will be installed in the cellar (1 unit), first floor (2 units) second floor (2 units) and third floor (1 unit).

A copy of catalog cut sheets for HVAC systems are provided in Appendix C.

2.1.2 STACK LOCATION

In order to satisfy the requirements of E-201, four stacks associated with the 12 indoor duct furnaces will be located on the roof. Two Stacks will be setback 10 feet from the western line of lot with the first one located 73 feet from the northern line and the second located 73 feet from the southern line. Two stacks will be setback 10 feet from the eastern line of lot with the first one located 60 feet from the northern line and the second located 76 feet from the southern line.

Copies of the certified mechanical drawings are provided in Appendix D.

2.2 NOISE

The Noise E-201 for Block 1952 and Lot 29 requires that future residential and /or commercial uses must provide a closed-window condition with a minimum of 30 dBA and 40 dBA window /wall attenuation on some facades in order to maintain an acceptable interior noise level of 45 dBA using windows with special design features. In order to maintain the closed-window condition, an alternate means of ventilation including but not limited to central air conditioning must be provided.

Upon further investigation of the declaration associated with 125th Street Corridor Rezoning and Related Actions, the OITC rating of 30 dBA is required for the building façade facing Frederick Douglas to the east and the OITC rating of 40 dBA is required for the building façades facing East 125th Street to the south.

Since the new development is specifically designed for commercial use, the developer received permission from OER to reduce the required OITC ratings by 5 OITC points. Therefore, an OITC rating of 25 dBA would be required for the building façade facing Frederick Douglas and 35 dBA for the building façades facing East 125th Street.

2.2.1 WINDOW/WALL ATTENUATION

In order to satisfy the requirements of E-201 and consistent with OER permission to reduce the required OITC ratings by 5 OITC points, a window/wall attenuation of 25 dBA will be achieved for the building façade facing Frederick Douglas Bourlvard and 35 dBA for the building façades facing East 125th Street.

In order to achieve these attenuation levels, fixed windows manufactured by AKK AP America Model YCW 750 OG, with a glazing made of 1/4" annealed exterior glass, ½" airspace, ¼" annealed interior glass will be installed on the eastern façade of the building facing Frederick Douglas Bourlevard and windows manufactured by Solutia, Inc., Model specified as Laminated Glass with Saflex Interlayer, with a glazing made of 1/4" laminated glass, ½" airspace, ¼" laminated glass, ½" airspace and ¼" laminated glass will be installed on the southern façade of the building facing East 125th Street. The proposed window glazing models have been rated with an OITC of 26 dBA for YCW 750 OG windows and 35 dBA for Laminated Glass with Saflex Interlayer as certified by the Lab Test Report attached to this document. Appendix E includes copies of catalog cut sheets, model, manufacturer information and acoustical laboratory test report of the proposed windows.

2.2.2 ALTERNATE MEANS OF VENTILATION

In order to satisfy the requirements of E-201 Alternate Means of Ventilation (AMV) will be installed in order to maintain a closed window condition. AMV for this project will be achieved by installing roof-top HVAC units. The HVAC s will consist of Four (4) 20 Ton Trane roof top packaged gas/electric heating units (Model #TWE240), eleven (11) 20 Ton Trane roof top air cooled condensing units (Model #TTA240), one (1) 10 Ton Trane roof top air cooled condensing unit (Model #TTA120), eleven (11) Trane indoor duct furnaces (Model GLND030EDG), one (1) Trane indoor duct (Model GLND015EDG) and six 6 water heaters (Model AO Smith Model #GPVH50). The location of the alternate means of ventilation for new building are clearly marked on drawing sheet(s) M-100 to M-104 provided in Appendix D. The roof-top HVAC unit includes a fresh air make-up system. The HVAC units are manufactured by Trane Company. Copies of RA certified mechanical drawings depicting the HVAC components are provided in Appendix D.

3.0 INSTALLATION REPORT GUIDLINES

An Installation Report (IR) will be submitted to OER following implementation of the remedial action defined in this RAP. The IR will document that the remedial work required under this RAP has been completed and has been performed in compliance with this plan. The IR will include:

<u>Air Quality E-Designation</u>

1) Letter stamped with a PE or RA seal certifying the completion of the installation of the HVAC system and/or boilers, as per the commitments specified in the Notice to Proceed and approved RAP. The letter must specify the system and/or units' manufacturer, model, type of fuel's usage and where required, the location of the stack (e.g., distance from each edge of the building). In addition, the letter should include a brief description of the project (e.g., number of floors, building height, number of units/rooms, total square footage, etc.). If requesting a Notice of No Objection for a Temporary Certificate of Occupancy, the letter must specify the reasons for requesting it, the areas of the building for which the installations have and have not been completed, the floors and/or the residential units which will be covered by the TCO.
2) Signed letter from the HVAC system and/or boiler's manufacturer (on company letterhead) certifying the purchase of the system/units. The letter must include the model and type of fuel.
3) Letter from contractor (on company letterhead) certifying the installation of the HVAC system and/or boiler(s). The letter must include the model and type of fuel.
4) Mechanical drawings showing the natural gas line and/or the location of the fuel tank (highlighted). The drawing must stamped with a PE of RA seal.
5) Drawing showing the location of the stack (highlighted) and the distances (highlighted) from each edge of the building. The drawing must stamped with a PE of RA seal.
6) Pictures of natural gas meter, tank where present, line connection to the HVAC system or boiler(s), HVAC system or boiler(s), stack.

<u>Noise E-Designation</u>

1) Letter stamped with a PE or RA seal certifying the completion of the installation of all the windows and alternate means of ventilation's components, as per the commitments specified in the Notice to Proceed and approved RAP. The letter must specify the windows' manufacturer, model, and glazing composition (e.g., ¼-inch glass, ½-inch air space, ¼-inch glass), and the alternate means of ventilation's manufacturer and model. In addition, the letter should include a brief description of the project (e.g., number of floors, building height, number of units/rooms, total square footage, etc.). If requesting a Notice of No Objection for a Temporary Certificate of Occupancy, the letter must specify the reasons for requesting it, the areas of the building for which the installations have and have not been completed, the floors and/or the residential units which will be covered by the TCO.
2) Letter from the windows' manufacturer (on company letterhead) certifying the purchase of the windows. The letter must include the windows' model, and glazing composition (e.g., ¼-inch glass, ½-inch air space, ¼-inch glass).
3) Signed letter from the alternate means of ventilation's manufacturer (on company letterhead) certifying the purchase of the units (e.g., PTAC) or system (e.g., central HVAC).
4) Signed letter from contractor (on company letterhead) certifying the installation of the windows and alternate means of ventilation. The letter must include the windows' model, and glazing composition (e.g., ¼-inch glass, ½-inch air space, ¼-inch glass).
5) Pictures (maximum of two 4" X 6" or larger photos per page) of each façade of the building, installed windows (interior and exterior) and alternate means of ventilation (interior and exterior).

3.1 INSTALLATION REPORT CERTIFICATION

The following certification will appear in front of the Executive Summary of the Installation Report. The certification will include the following statements:

I, Shaik A. Saad, am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the 2329 Frederick Douglas Boulevard Site (NYC Block 1952 and Lot 29).

I certify that the Site description presented in this IR is identical to the Site description and associated amendments presented in the Notice to Proceed issued by DEP/OER to the NYC DOB on [date].

I certify that the OER-approved Remedial Action Plan dated [month, day, year] and Stipulations in the Notice to Proceed [month, day, year] were implemented and that all requirements in those documents have been complied with.

I certify that the remedial activities were observed by qualified environmental professionals under my supervision and that the remediation requirements set forth in the Remedial Action Plan have been achieved.

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

____
Name

____
NYS PE/RA License Number

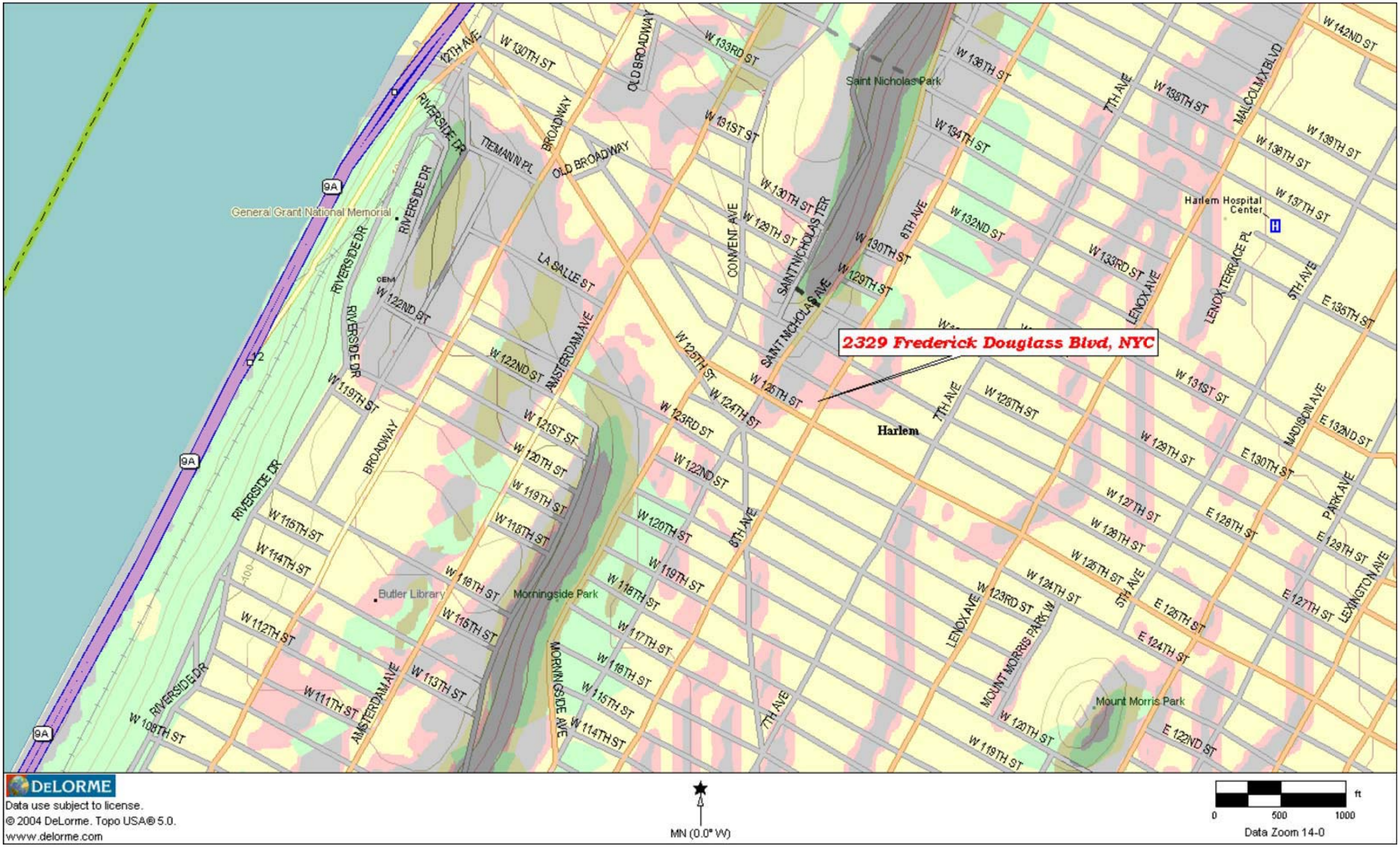
PE/RA Stamp

____
Signature

____
Date

FIGURE 1

Site Location Map



HYDRO TECH ENVIRONMENTAL CORP.

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631)462-5866 F (631)462-5877

NYC OFFICE:
15 OCEAN AVENUE, 2nd Floor
BROOKLYN, NEW YORK 11225
T (718)636-0800 F (718)636-0900

www.hydrotechenvironmental.com

2329 Frederick Douglass Blvd
New York, NY.

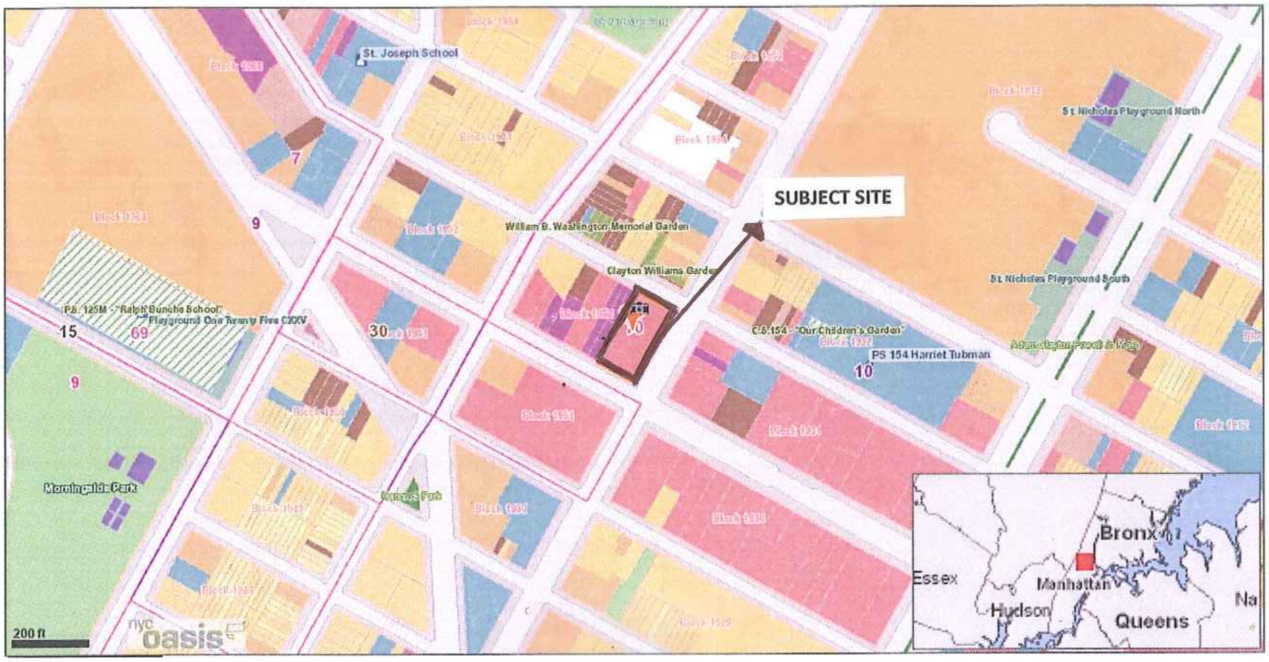
Drawn By: C.Q
Reviewed By: M.R
Approved By: M.S
Date: 06/13/11
Scale: AS NOTED

TITLE:

FIGURE 1: SITE LOCATION MAP

FIGURE 2

Site Boundary and Surrounding land-Uses



Legend

Transit, Roads, Reference Features

Roads, ferries, commuter rail, neighborhood names

Roads
Neighborhood/Town Labels
Major Roads
County Boundaries
Interstate Highways
Ferry
Tunnels
Commuter Rail

NYC subway routes and stations

Parks, Playgrounds, & Open Space

- Parks & Public Lands
- Open Space (NYC Dept of City Planning)
- Forested Areas (NJ)
- Federal Land
- Community Gardens
- School property with garden
- Playgrounds
- Green Spaces Along Streets
- Golf Courses
- Baseball/Soccer/Football Fields
- Tennis/Basketball/Handball Courts & Tracks
- Cemeteries

Land Use

Block/Lot Boundaries

(Building footprints in gray)

- 1 & 2 Family Residential
- Multi-family Residential
- Mixed Use
- Open space & outdoor recreation
- Commercial
- Institutions
- Industrial
- Parking
- Transportation / Utilities
- Vacant Lots

Water & Wetlands

- Watershed Areas (12-digit hydro units)
- Freshwater Wetlands

Tidal Wetlands

- Formerly Connected
- Fresh Marsh
- High Marsh
- Intertidal Marsh

National Wetlands Inventory

- Estuary/Marine
- Freshwater - Emergent
- Freshwater - Forested/Shrub
- Freshwate
- Rivers & S
- Other Fre

Location Report

Property Information (1)

2329 FRED DOUGLASS BLVD, MANHATTAN 10027

Commercial / Office Building

Owner: 301-303 WEST 125TH LL
Block: 1952 **Lot:** 29
Property Characteristics:
Lot Area: 19,983 sq ft (199.83' x 100')
# of Buildings: 12 **Year built:** 1900 (Year built is an estimate)
# of floors: 5 **Building Area:** 46,167 sq ft
Total Units: 38 **Residential Units:** 0
Primary zoning: C4-4D **Commercial Overlay:** None
Floor Area Ratio: 2.31 **Max. FAR:** 6.02
FAR may depend on street widths or other characteristics. Contact City Planning Dept. for latest information.

MORE INFO:

- **Zoning Map#:** 6a (how to read NYC zoning maps)
- **Historical Zoning Maps:** 6a
- NYC Dept. of Buildings
- Property transaction records
- NYC Dept. of Finance Assessment Roll
- NYC Digital Tax Map
- NYC zoning guide
- NYC Watershed Resources

OASIS shortcut to this property:
http://www.oasisnyc.net/printmap.aspx?zoomto=lot:1019520029
Source: The Bytes of the Big Apple (TM) PLUTO (TM) and Tax Block & Tax Lot files are copyrighted by the New York City Department of City Planning, 2010 (ver. 10v1).

YAHOO! Local search results for this address:

Know of something that's missing? Add it to YAHOO!

Mannahatta (1)

The area covered by 125th & 126th between Fredrick Douglass Blvd & St Nicholas Ave was part of a vibrant ecosystem in 1609. Find out more at TheMannahattaProject.org

Source: The Wildlife Conservation Society's Mannahatta Project, 2009.

Stewards (3)

Sanidad Del Cielo
Feedback? Email Us.
WE ACT For Environmental Justice
Feedback? Email Us.
YM &YWHA of Washington Heights and Inwood
Feedback? Email Us.

Stewards with large turfs (not mapped)

Community District (1)

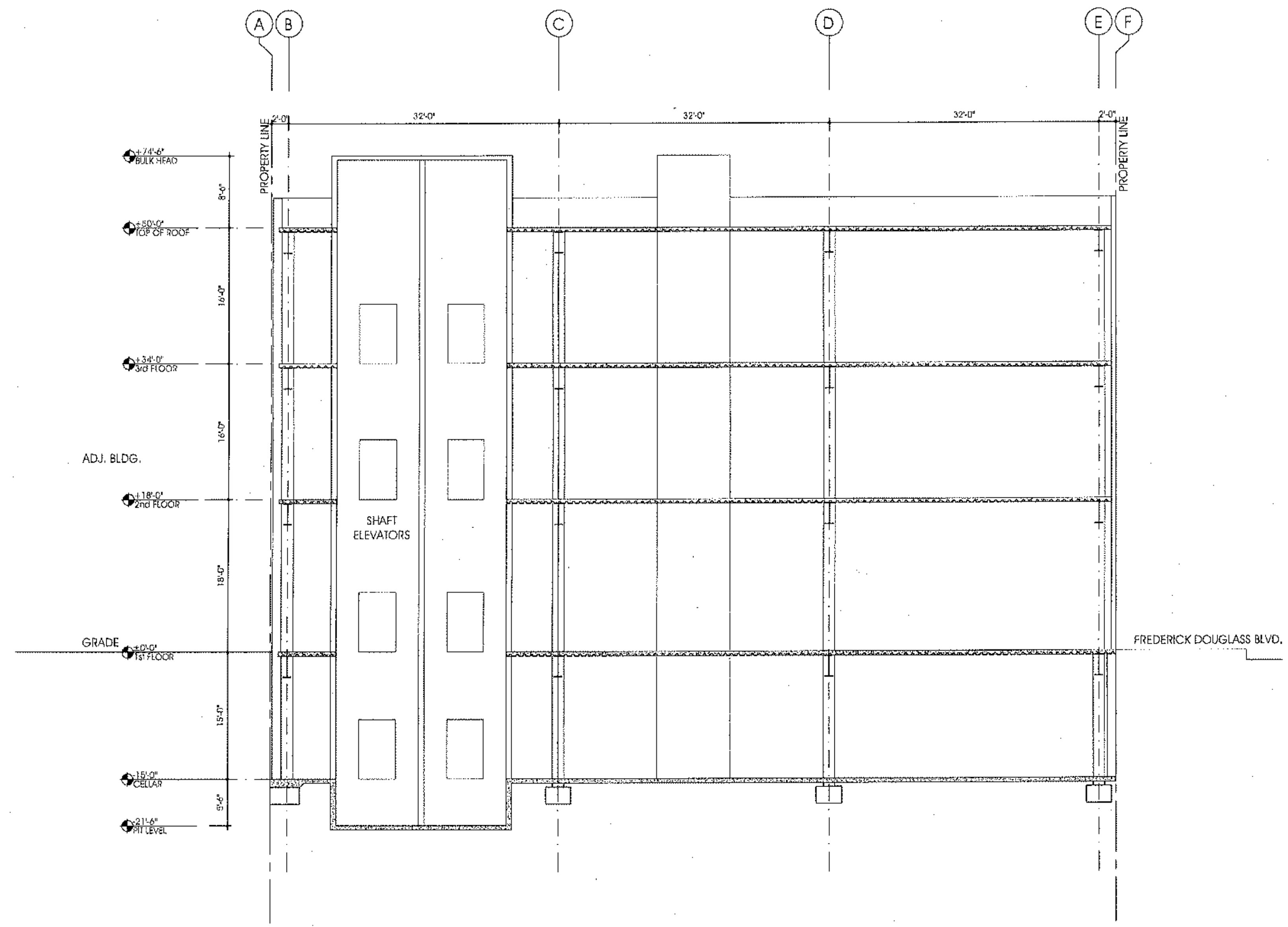
Manhattan 10 Community District Information
Chairperson: Mr. W. Franc Perry
District Manager: Paimaan Lodhi, AICP
Address: 215 West 125th Street, New York, NY, 10027
Phone: 212-749-3105 **Email:** plodhi@cb.nyc.gov
Website:
Meeting Information: 215 West 125th Street, New York, NY 10027
Go to District Profile by NYC Dept. of City Planning

Political Districts (5)

NYC Council: District 9
NYS Assembly: District 70
NYS Senate: District 30
US House of Representatives: District 15
US Senate: New York

FIGURE 3

Site Development Plan



2 EAST-WEST SECTION BETWEEN EDGE 8 & 9 - LOOKING NORTH
Scale: 1/8" = 1'-0"

NEW BUILDING
COMMERCIAL

2329 FREDERICK
DOUGLASS BLVD.
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-
	-	-

REGISTERED ARCHITECT
ADRIAN R. FIGUEROA
024690
STATE OF NEW YORK

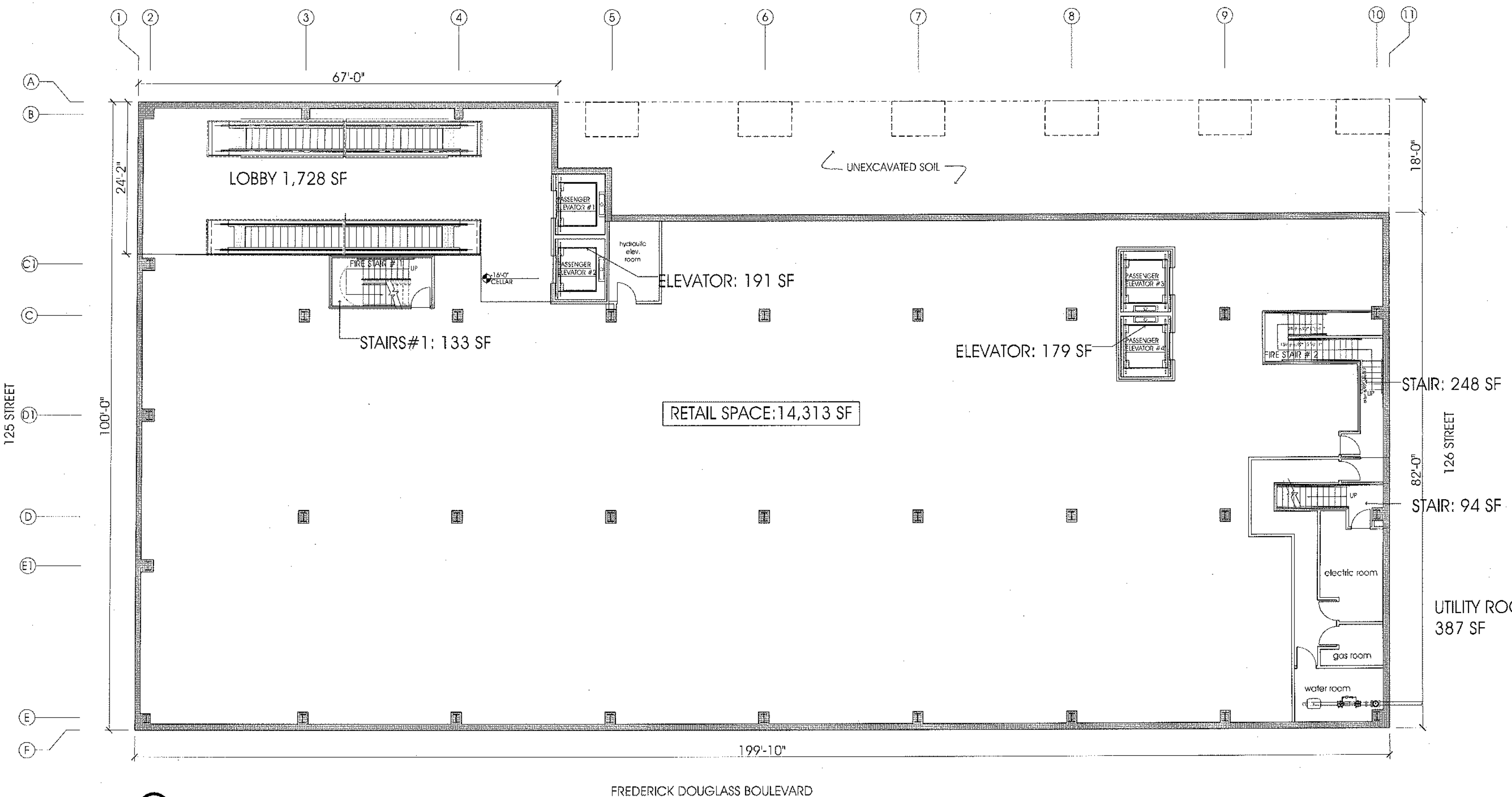
SEAL:

DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
BUILDING SECTION
"2"

DATE: Jan. 28, 2011 | SCA | PROJ. #: 01-1103
SCALE: SCALE: 1/8" = 1'-0"
DWG. NO.
A-302.00
00 of 00



C

CELLAR

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-
	-	-

REGISTERED ARCHITECT
ADRIAN R. FIGUEROA
024690
STATE OF NEW YORK

SEAL:

SQUARE FOOTAGE CHART

FLOOR	LOCATION		AREA	TOTAL
CELLAR	COMMON AREAS	ELEVATORS	379 SF	3,344 SF
		STAIRS	531 SF	
		LOBBY	1,728 SF	
		OTHER	706 SF	
	RETAIL		14,313 SF	14,313 SF
TOTAL GROSS AREA			17,657 SF	17,657 SF

120616057
DEPT. OF BLDGS
DOC # 01

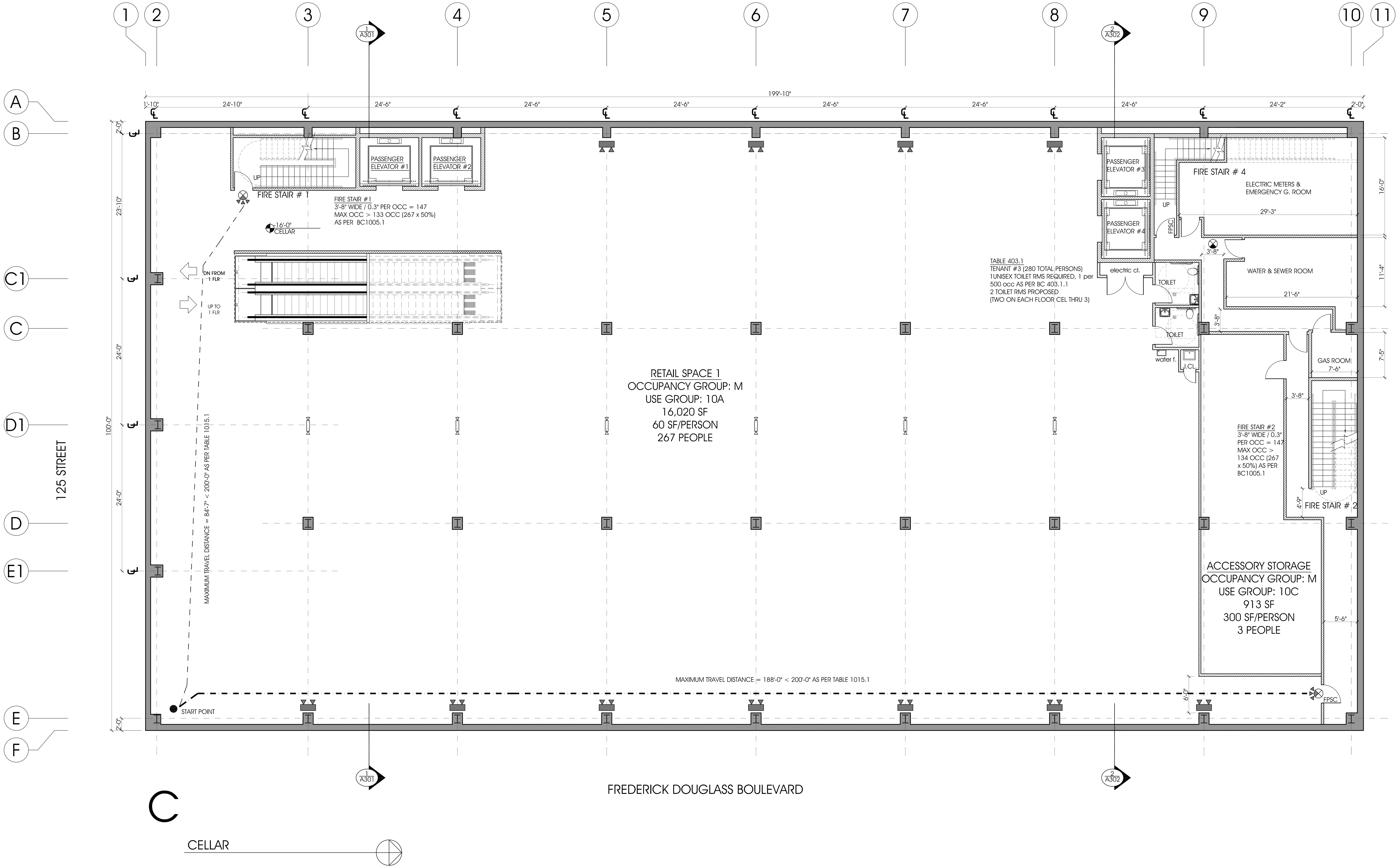
This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
CELLAR
LAYOUT

DATE: Jan. 28, 2011 | SC | PROJ. #:01-1103
SCALE: SCALE: 1/8" = 1'-0"
DWG. NO.
A-100.00
01 of 27

APPENDIX A

Stamped Architectural Drawings



NOTE: FULLY WET SPRINKLERED
SPRINKLER WORK TO BE FILED UNDER A SEPARATE APPLICATION

LEGEND	
EXIT SIGN	NON RATED PARTITION
EMERGENCY LIGHT/ EXIT SIGN	1HR PARTITION
EMERGENCY LIGHTING (TRIPLE LIGHTS AT EXITS) (DOUBLE LIGHTS AT 25'-0" O.C.)	2HRS PARTITION
EMERGENCY LIGHTING (CEILING MOUNTED)	EXTERIOR PARTITION

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

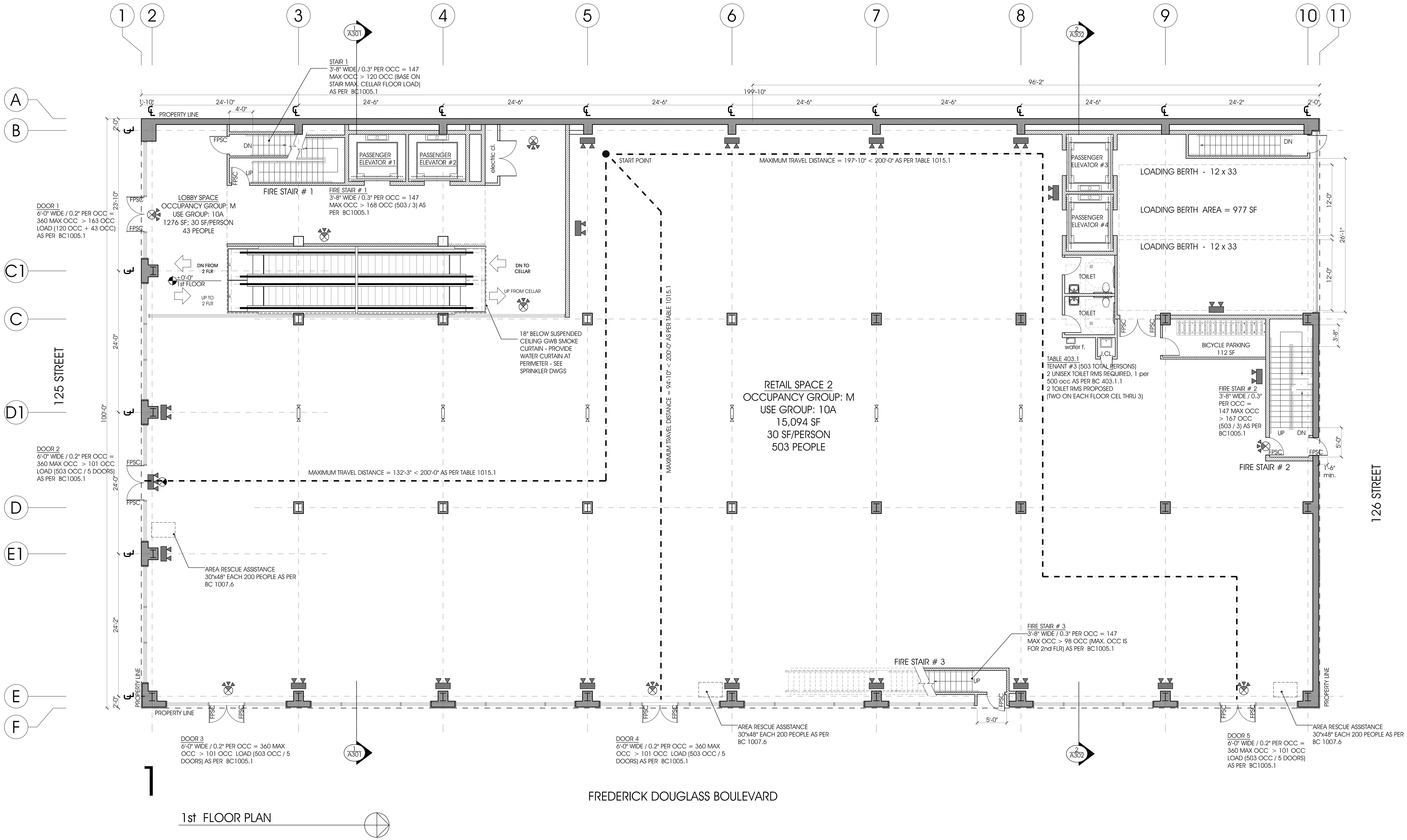
This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE: CELLAR LAYOUT

DATE: Jan. 28, 2011 SC PROJ. #: 01-1103

SCALE: 1/8" = 1'-0"

DWG. NO. A-100.00



1

1st FLOOR PLAN

NOTE: FULLY WET SPRINKLERED
SPRINKLER WORK TO BE FILED UNDER A SEPARATE APPLICATION

LEGEND

EXIT SIGN	NON RATED PARTITION
EMERGENCY LIGHT/ EXIT SIGN	1HR PARTITION
EMERGENCY LIGHTING (TRIPLE LIGHTS AT EXITS) (DOUBLE LIGHTS AT 25'-0" O.C.)	2HRS PARTITION
EMERGENCY LIGHTING (CEILING MOUNTED)	EXTERIOR PARTITION

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

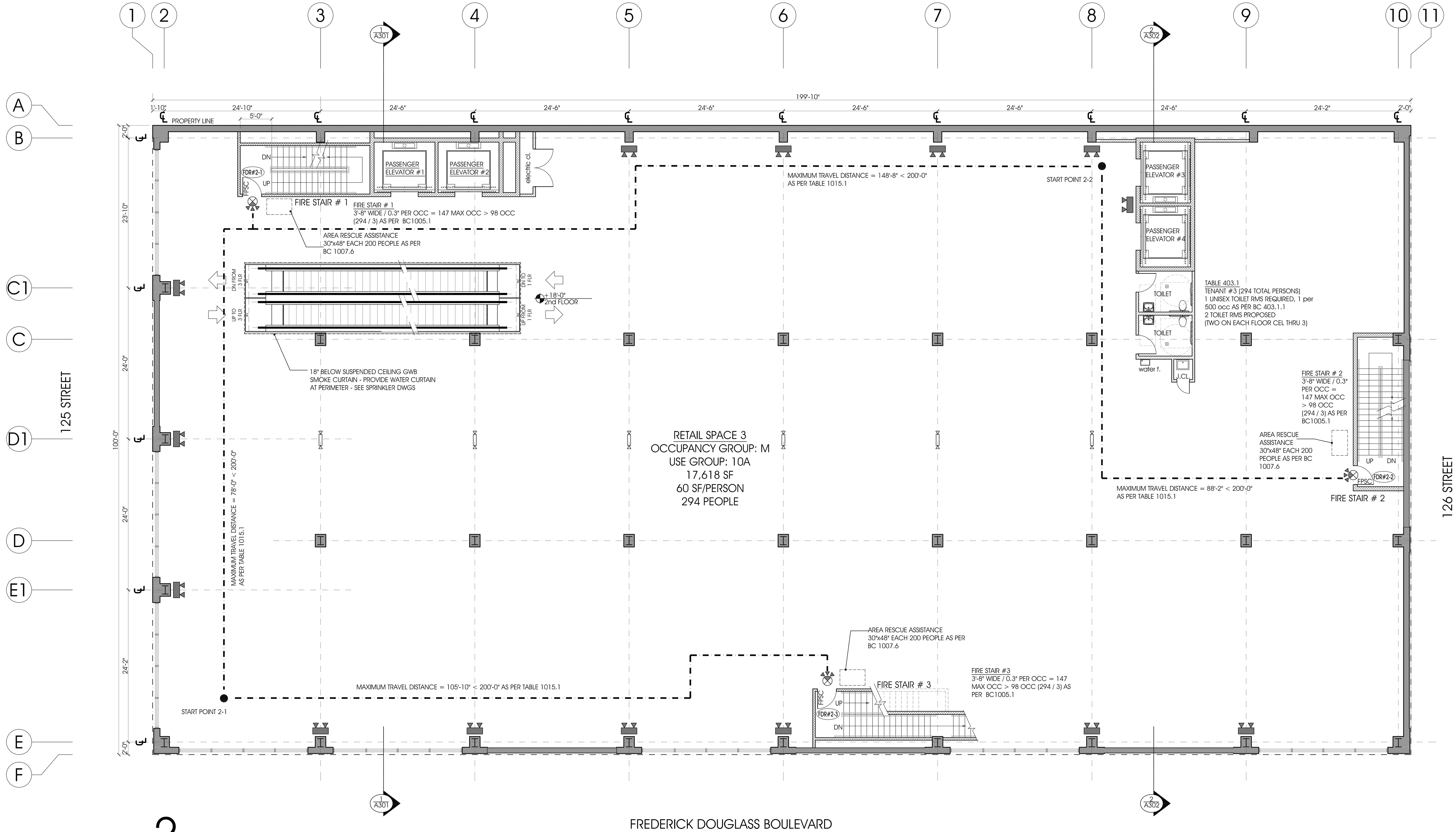
This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE: 1st FLOOR LAYOUT

DATE: Jan. 28, 2011 SC PROJ. #:01-1103

SCALE: 1/8" = 1'-0"

DWG. NO. A-101.00



2

2nd FLOOR PLAN

NOTE: FULLY WET SPRINKLERED
SPRINKLER WORK TO BE FILED UNDER A
SEPARATE APPLICATION

LEGEND

	EXIT SIGN		NON RATED PARTITION
	EMERGENCY LIGHT/ EXIT SIGN		1HR PARTITION
	EMERGENCY LIGHTING (TRIPLE LIGHTS AT EXITS) (DOUBLE LIGHTS AT 25'-0" O.C.)		2HRS PARTITION
	EMERGENCY LIGHTING (CEILING MOUNTED)		EXTERIOR PARTITION

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

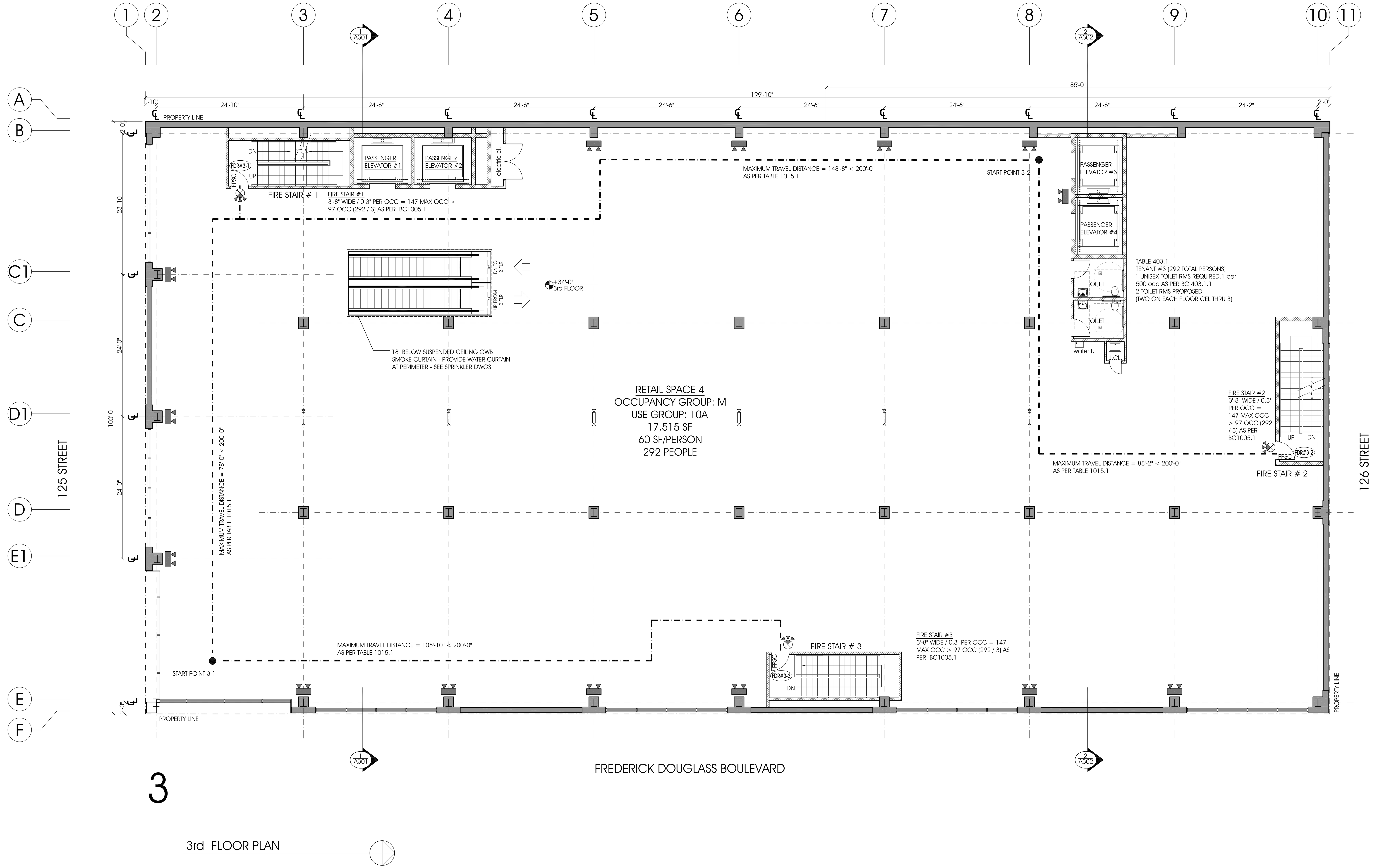
This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE: 2nd FLOOR LAYOUT

DATE: Jan. 28, 2011 SC PROJ. #: 01-1103

SCALE: 1/8" = 1'-0"

DWG. NO. A-102.00



NOTE: FULLY WET SPRINKLERED
SPRINKLER WORK TO BE FILED UNDER A SEPARATE APPLICATION

LEGEND

EXIT SIGN	NON RATED PARTITION
EMERGENCY LIGHT/ EXIT SIGN	1HR PARTITION
EMERGENCY LIGHTING (TRIPLE LIGHTS AT EXITS) (DOUBLE LIGHTS AT 25'-0" O.C.)	2HRS PARTITION
EMERGENCY LIGHTING (CEILING MOUNTED)	EXTERIOR PARTITION

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-

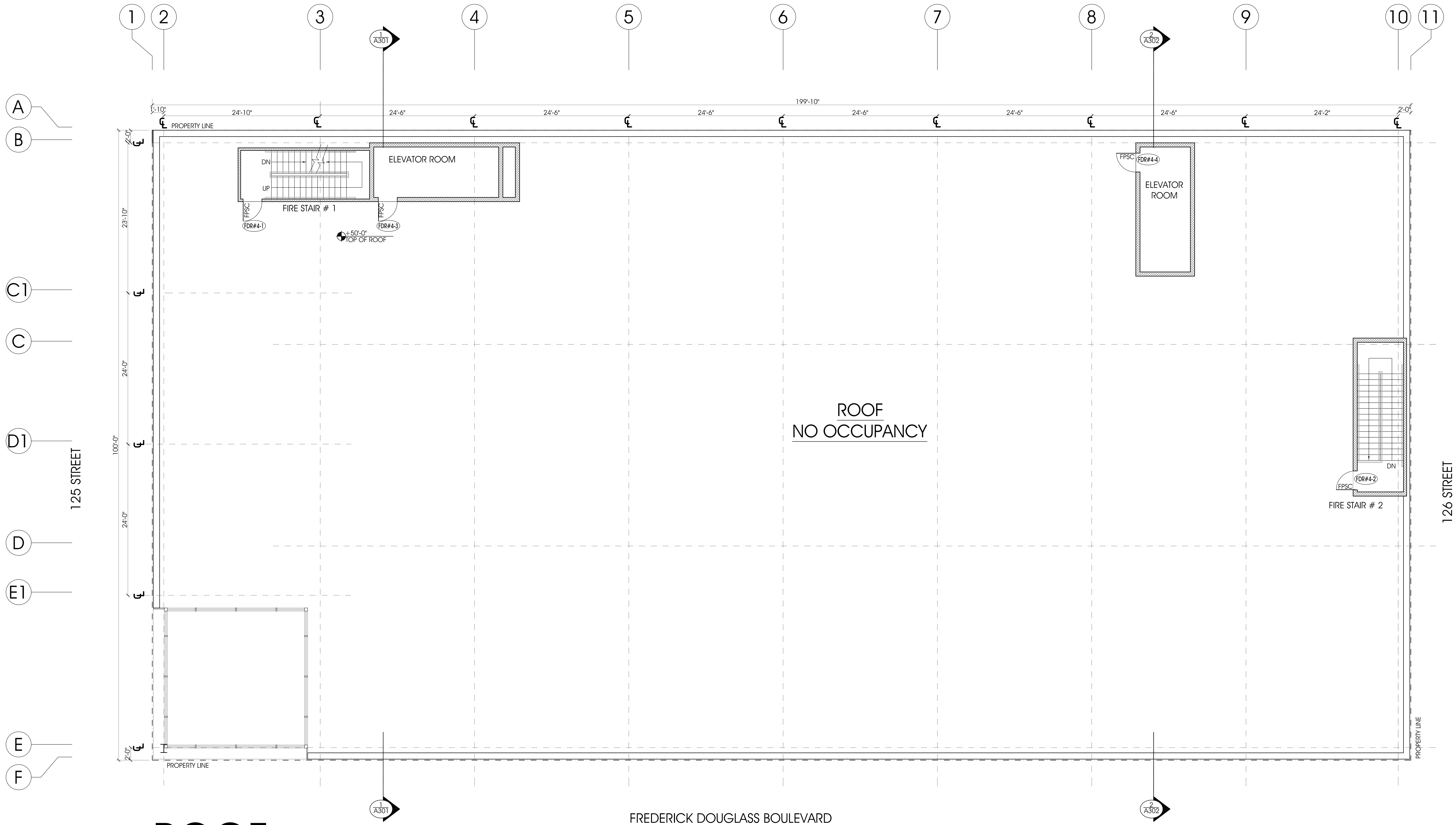
SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
3rd FLOOR LAYOUT

DATE: Jan. 28, 2011 SC PROJ. #:01-1103
SCALE: 1/8" = 1'-0"
DWG. NO. **A-103.00**



ROOF

ROOF PLAN

NOTE: FULLY WET SPRINKLERED
SPRINKLER WORK TO BE FILED UNDER A SEPARATE APPLICATION

LEGEND

- EXIT SIGN
- EMERGENCY LIGHT/ EXIT SIGN
- EMERGENCY LIGHTING (TRIPLE LIGHTS AT EXITS) (DOUBLE LIGHTS AT 25'-0" O.C.)
- EMERGENCY LIGHTING (CEILING MOUNTED)
- NON RATED PARTITION
- 1HR PARTITION
- 2HRS PARTITION
- EXTERIOR PARTITION

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

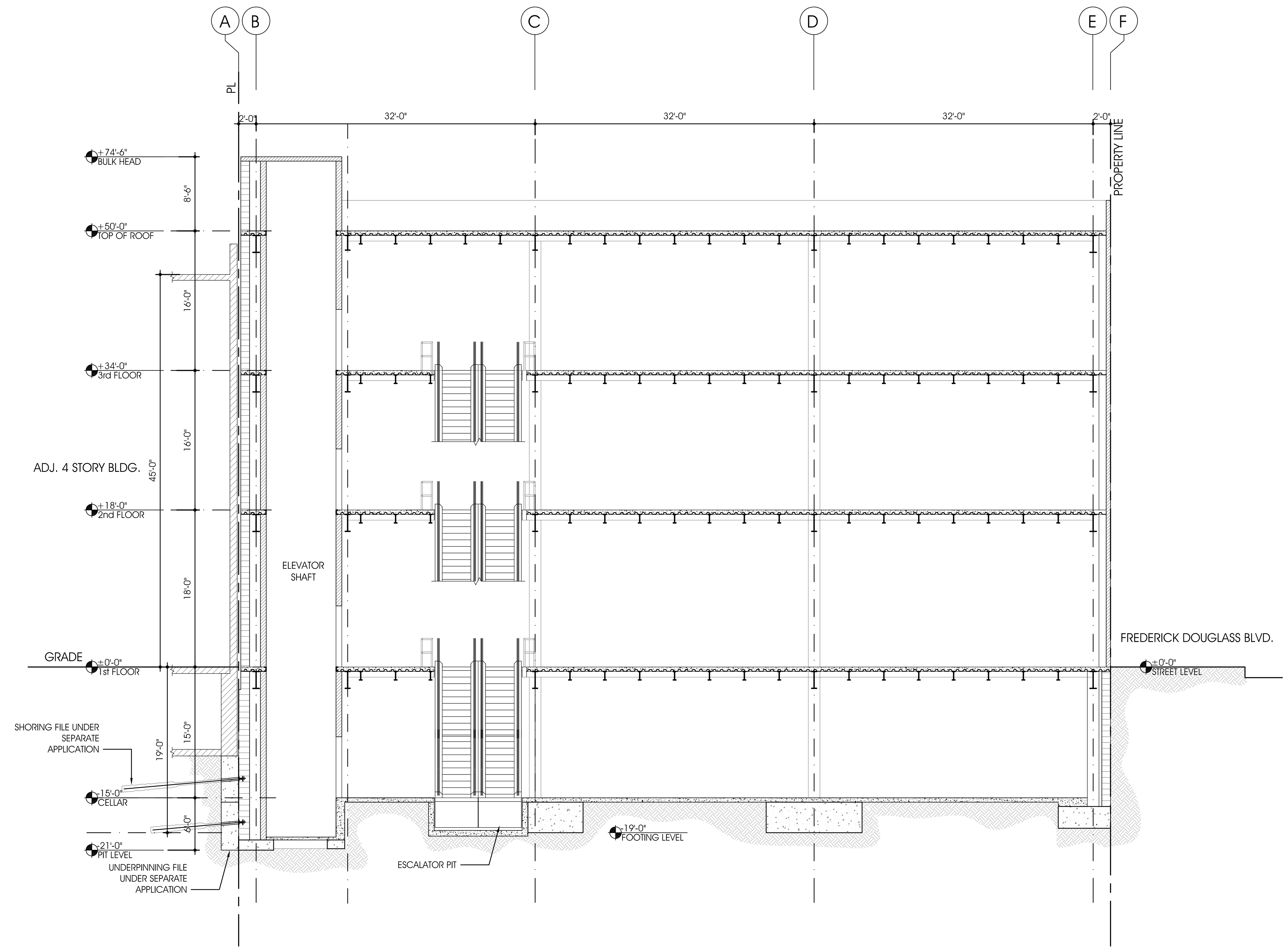
This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE: ROOF LAYOUT

DATE: Jan. 28, 2011 SC PROJ. #: 01-1103

SCALE: 1/8" = 1'-0"

DWG. NO. A-104.00



1 EAST-WEST SECTION - LOOKING NORTH
Scale: 1/8" = 1'-0"

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
	-	-
	-	-

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
BUILDING SECTION
"1"

DATE: Jan. 28, 2011 SC PROJ. #: 01-1103
SCALE: SCALE: 1/8" = 1'-0"
DWG. NO.
A-301.00

APPENDIX B

E-Designation Documents and Requirements E-201

125th Street Corridor Rezoning and Related Actions

CEQR # 07DCP030M

Certification 04/30/2008

3.18 NOISE

INTRODUCTION

The proposed action would not result in significant adverse impacts related to noise. As described in Chapter 3.1, "Project Description," it would generate new, medium to high density residential and commercial uses in an area historically occupied by similar land uses. As part of the proposed action, (E) designations would be placed on the zoning map for all projected and potential development sites where there is the potential for significant adverse noise impacts. Residential, commercial and community facility development on lots mapped with an (E) designation would be required to provide sufficient noise attenuation to maintain interior noise levels of 45 dBA or lower. The (E) designations on the projected and potential development sites would preclude the potential for the proposed action to result in significant adverse noise impacts.

An analysis was prepared to evaluate the potential effect of the proposed action on noise levels at existing and potential future noise sensitive locations in the surrounding area. Existing noise levels are predominantly the result of vehicular traffic. At some locations, the Metro-North railroad also contributed to noise levels. Future noise sensitive locations include areas that may be redeveloped for residential, commercial and community facility uses.

In order to assess the potential for significant adverse noise impacts, an analysis was conducted that considered changes in noise due to increases in traffic and the introduction of sensitive receptors into an area with existing ambient noise levels classified as "Marginally Unacceptable" and "Clearly Unacceptable," as defined in the *CEQR Technical Manual.* The noise analysis addresses two factors: 1) the change in noise levels from the existing condition in the area as a result of the proposed action; and 2) the location of new sensitive receptors and the degree to which window/wall attenuation would provide acceptable interior noise levels.

No stationary sources of noise were identified within the project corridor. As a result further analysis of stationary source noise was not conducted.

3.18.1 NOISE FUNDAMENTALS

Noise is "unwanted sound" and, by this definition, the perception of noise is a subjective process. Noise in the environment can be characterized by three distinguishing characteristics: loudness, pitch, and time variation.

- The loudness or magnitude of noise is a measure of its intensity, and it is measured in units called decibels (dB). The decibel unit is based on a logarithmic scale, and it compresses a large range of sound pressures into manageable numbers. For example, on the decibel scale, environmental noise ranges from 40 dB from the rustling of leaves to over 80 dB from a truck passage and up to 100 dB at the front rows of a rock concert. The louder the sound, the greater is its decibel value.

- Pitch describes the character and frequency content of noise. Measured in Hertz (Hz), the pitch is used to identify annoying characteristics of noise and help in determining appropriate mitigation to minimize annoyance. The human ear is sensitive to noise frequencies between 20 Hz (low-pitched noise) and 20,000 Hz (high-pitched noise). For example, a noise may be characterized as a low-pitched "rumble" from stereo sub-woofers or a high-pitched "whine" from a train whistle or a train wheel squeal.

- Time variation describes the pattern of the sound over the observation period. Time variation of environmental noise can be characterized as: 1) continuous, such as noise from a building ventilation fan; 2) intermittent, such as noise from a train passage; or 3) impulsive, like noise from a car backfire. Time variation is used in combination with loudness and pitch to determine the sound energy exposure from a particular noise during a period of time, such as a 24-hour day.

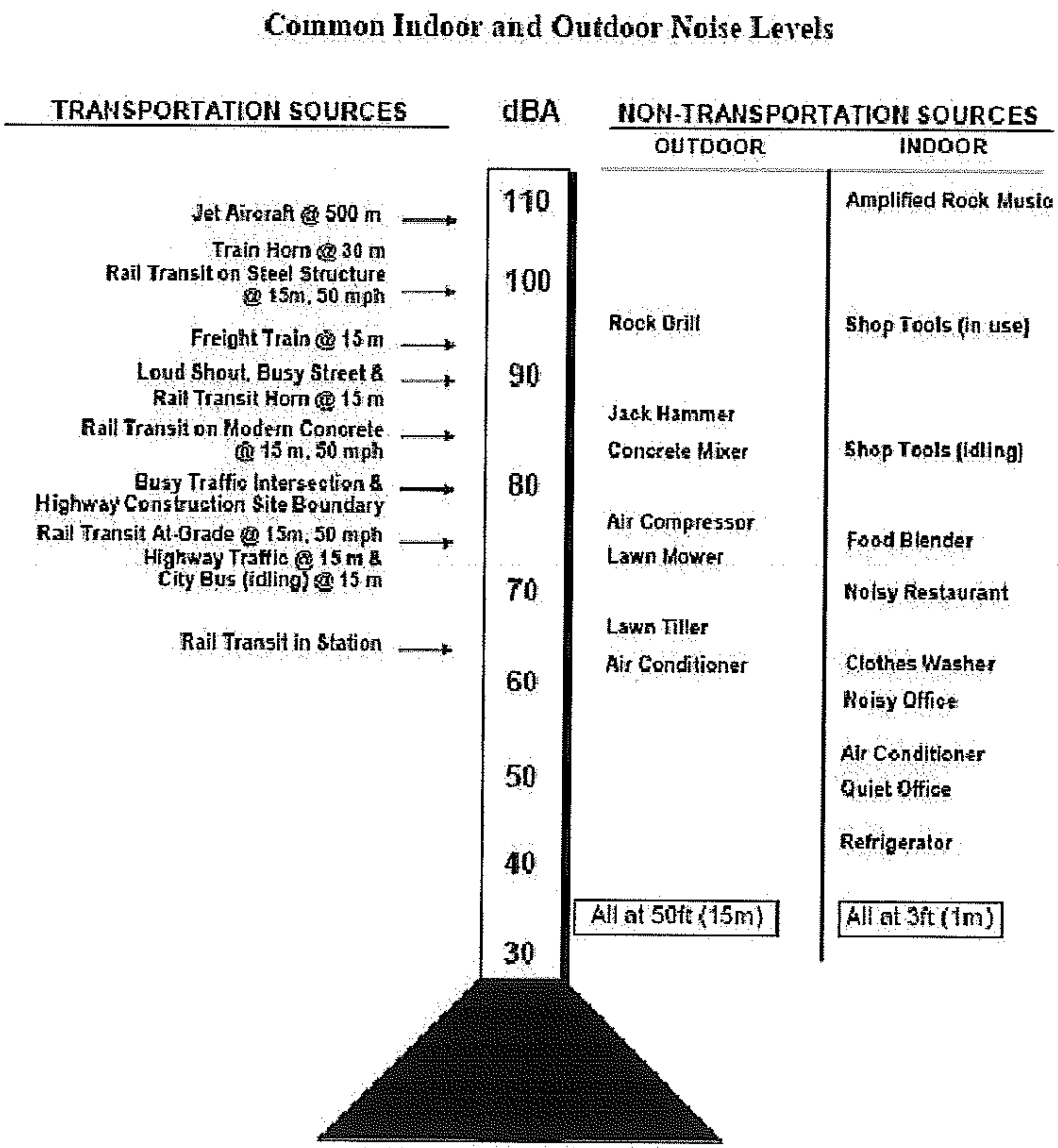
3.18.2 HUMAN PERCEPTION OF NOISE AND NOISE DESCRIPTORS

Since the human ear does not respond equally to all frequencies, measured sound levels (in decibel units at standard frequency bands) are often adjusted or weighted to correspond to the frequency response of human hearing. The weighted sound level is expressed in units called "A"-weighted decibels (dBA) and is measured with a calibrated noise meter. A 10 dBA increase in noise level is generally perceived as a doubling of loudness, while a 3 dBA increase in noise is just barely perceptible to the human ear. Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived. A change in sound level of 5 dBA is subjectively noticeable. Typical A-weighted noise levels in the environment lie in the range of 0 dBA (approximate threshold of hearing) to 120 dBA (jet aircraft at 500 feet) (see Figure.3.18-1).

The following A-weighted noise descriptors (noise metrics) are typically used to determine impacts from noise sources.

- L_{eq} represents the level of a constant noise containing the same acoustical energy as a fluctuating noise (e.g., highway traffic) observed during a given interval, typically one hour. The L_{eq} is commonly used to describe energy average levels at places with primarily daytime uses such as offices, schools, and churches. L_{eq} (1 h) represents the cumulative noise exposure from all events averaged over one hour.
- L_{90}: Noise level in dBA exceeded 90 percent of the observation time. L_{90} is often considered to represent the "background" noise in a community.
- L_{10}: Noise level in dBA exceeded 10 percent of the observation time. This unit is used in CEQR regulations and establishes threshold levels for acceptable noise exposure.

Outdoor A-weighted sound levels were used in the measurements and analysis of the noise effects from the proposed action, as dBA correlates well with the human perception of noise. Noise descriptors selected for this analysis were the one-hour equivalent continuous noise level (L_{eq} (1h) in dBA), and the noise level exceeded 10 percent of the time (L_{10} in dBA).



m = meters; mph = miles per hour.

Sources: FTA Report DOT-T-95-16, "Transit Noise and Vibration Impact Assessment: Final Report", April 1995

Figure 3.18-1 - Common Indoor and Outdoor Noise Levels

Criteria

The New York City Department of Environmental Protection (NYCDEP) Division of Noise Abatement sets standards for external noise exposure. These standards are classified into four main categories: "Acceptable"; "Marginally Acceptable"; "Marginally Unacceptable"; and "Clearly Unacceptable" (see Table 3.18-1). The 2001 *CEQR Technical Manual* provides guidance for assessing project-generated noise impacts at sensitive receptors based on the category of external noise exposure at these receptor sites. These guidelines are used in this analysis to determine the applicable interior noise levels of sensitive uses, including potential future residential sites based on external noise exposure. For example, at a potential residential site located within areas with "Marginally Unacceptable" external noise levels, a minimum of 30 to 35 dBA reduction below daytime external noise level would be required according to CEQR guidelines to satisfy the interior noise level criteria.

Under the *CEQR Technical Manual,* increases in daytime noise levels as a result of the proposed action are not considered significant unless the resulting noise levels exceed 65 dBA. At night and during the day where the No-action noise levels exceed 65 dBA, a 3dBA increase from the No-action condition is considered a significant adverse impact. In addition, the introduction of sensitive uses such as residences into an area with noise levels above 70 dBA constitutes a significant adverse impact unless interior noise levels for the buildings are attenuated to 45 dBA.

Table 3.18-1, Noise Exposure Standards for Use in City Environmental Impact Reviews

Receptor type	Time period	Acceptable General External Exposure	Airport Exposure[3]	Marginally Acceptable General External Exposure	Airport Exposure[3]	Marginally Unacceptable General External Exposure	Airport Exposure[3]	Clearly Unacceptable General External Exposure	Airport Exposure[3]
1. Outdoor area requiring serenity and quiet[2]		$L_{10} \le 55$ dBA	$L_{dn} \le 60$ dBA						
2. Hospital, Nursing Home		$L_{10} \le 55$ dBA		$55 < L_{10} \le 65$ dBA	$60 < L_{dn} \le 65$ dBA	$65 < L_{10} \le 80$ dBA	(I) $65 < L_{dn} \le 70$ dBA, (II) 70 dBA $\le L_{dn}$	$L_{10} > 80$ dBA	$L_{dn} \le 75$ dBA
3. Residence, residential hotel or motel	7 AM - 10 PM	$L_{10} \le 65$ dBA		$65 < L_{10} \le 70$ dBA		$70 < L_{10} \le 80$ dBA		$L_{10} > 80$ dBA	
	10 PM - 7 AM	$L_{10} \le 55$ dBA		$55 < L_{10} \le 70$ dBA		$70 < L_{10} \le 80$ dBA		$L_{10} > 80$ dBA	
4. School, museum, library, court, house of worship, transient hotel or motel, public meeting room, auditorium, out-patient health facility		Same as Residential Day (7 AM – 10 PM)		Same as Residential Day (7 AM – 10 PM)		Same as Residential Day (7 AM – 10 PM)		Same as Residential Day (7 AM – 10 PM)	
5. Commercial or office		Same as Residential Day (7 AM – 10 PM)		Same as Residential Day (7 AM – 10 PM)		Same as Residential Day (7 AM – 10 PM)		Same as Residential Day (7 AM – 10 PM)	
6. Industrial, public areas only[4]	Note 4	Note 4		Note 4		Note 4		Note 4	

Source:
New York City Department of Environmental Protection (adopted by DEP for use in CEQR-1983)

Notes:
(I) In addition, any new activity shall not increase the ambient noise level by 3 dBA or more:
1. Measurements and projections of noise exposures are to be made at appropriate heights above site boundaries as given by ANSI Standards; all values are for the worst hour in the time period.
2. Tracts of land where serenity and quiet are extraordinarily important and serve an important public need and where the preservation of these qualities is essential of the area to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks or open spaces dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet. Examples are grounds for ambulatory hospital patients and patients and residents of sanitariums and old-age homes.
3. One may use FAA-approved Land contours supplied by the Port Authority, or the noise contours may be computed from the federally approved INM Computer Model using flight data supplied by the Port Authority of New York and New Jersey.
4. External Noise Exposure standards for industrial areas of sounds produced by industrial operations other than operating motor vehicles or other transportation facilities are spelled out in the New York City Zoning Resolution, Sections 42-20 and 42-21. The referenced standards apply to M1, M2, and M3 manufacturing districts and to adjoining residence districts (performance standards are octave band standards).

3.18.3 TRAFFIC NOISE ASSESSMENT

EXISTING CONDITIONS

Noise Monitoring Locations

Information about land use in the rezoning area and trip assignment for potential future uses was reviewed to select monitoring sites and assess future noise impacts on sensitive sites. The fifteen monitoring sites depicted on Figure 3.18-2 are representative of the sensitive land uses in the area and of locations where additional new vehicle trips are expected, which could result in an increase in noise. Measured noise levels represent the existing noise exposure conditions at these locations. Noise monitoring was performed on two weekdays (November 9 and 15, 2006) and on three weekend days (November 4, 11 and 18, 2006.). The time periods chosen for noise monitoring included AM peak (7 AM to 9 AM), Midday Peak (11 AM to 1 PM), PM peak (4 PM to 6 PM) and weekend Saturday (12 PM – 2 PM). These time periods are the peak hours when the majority of existing and future project-generated traffic, would be passing these locations. Weekend monitoring takes into account heavy retail and residential traffic while weekday AM and PM monitoring takes into account the peak work week and school traffic. The duration of the measurements varied from 15 to 20 minutes and simultaneous traffic counts were taken. In addition to $L_{eq}(h)$ and L_{10} noise levels, other statistical noise descriptors (L_{50}, L_{90}, Lmax and Lmin) were also sampled at all locations for all time periods. For the Proposed Action, the analysis of potential noise impacts utilized the L_{10} and $L_{eq}(h)$ descriptors. Other noise descriptors collected during the monitoring program were collected to assist in the characterization of the existing noise environment.

The monitored noise levels are summarized in Table 3.18-2.

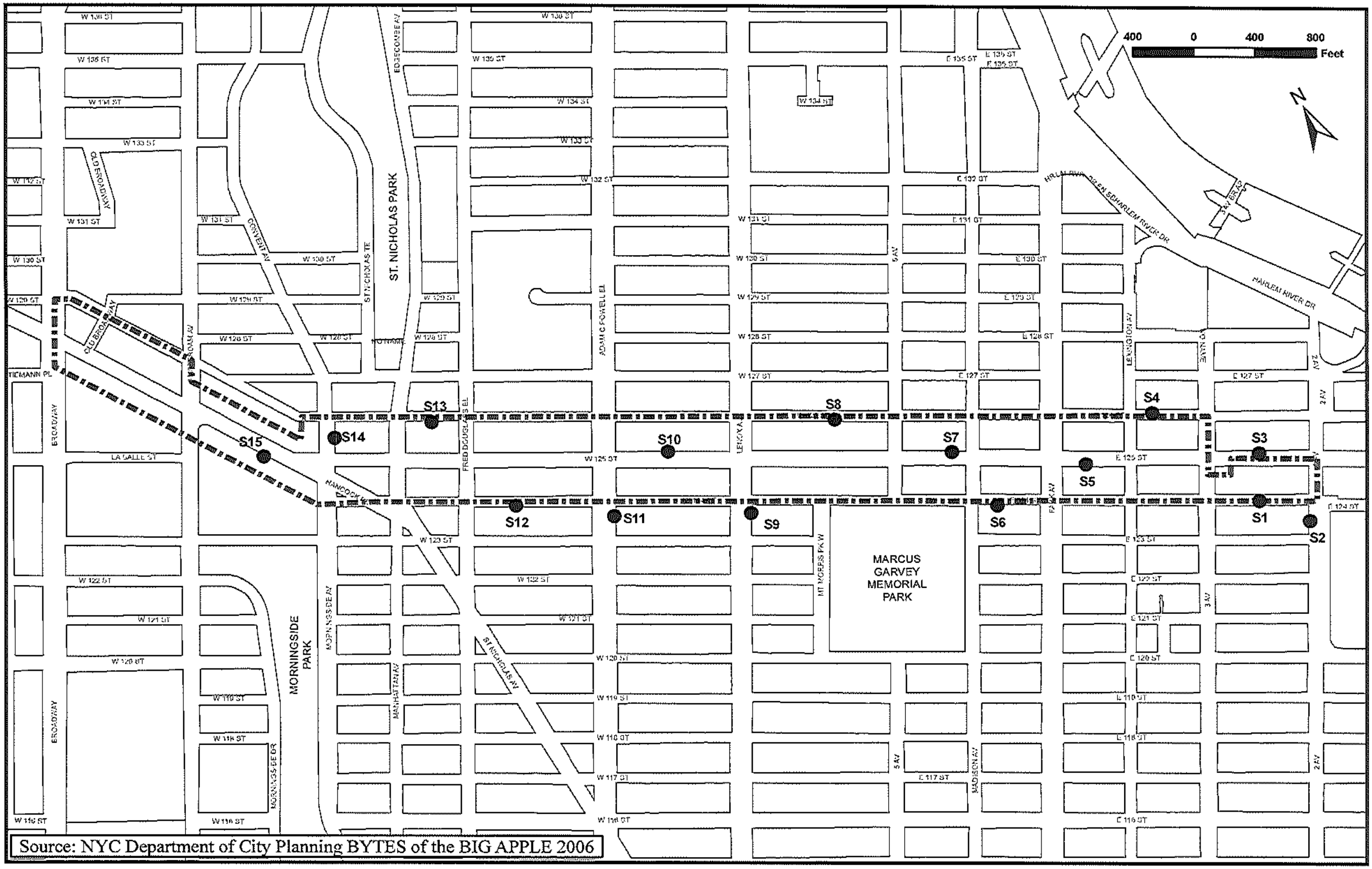
Equipment Used in Noise Monitoring

Noise measurements were taken with a Larson & Davis Model 820 Type I sound level meter. A windscreen was placed over the microphone for all measurements. The meter was properly calibrated for all measurements using a Larson & Davis Model Cal250 calibrator. There were no significant variances between the beginning and ending calibration measurements. Weather conditions during all measurements consisted of sunny skies and temperatures of approximately 50 - 60 degrees Fahrenheit.

Results of Baseline Noise Measurements

The results of baseline noise measurements are presented in Table 3.18-2. Daytime noise levels at all of the receptor sites are fairly typical of noise levels in the study area. A steady background noise exists at all locations due to consistent traffic movement on nearby streets. The background noise level L_{90} (lowest average minimum level) is in the range of 56.5 to 70.8 dBA. The highest L_{10} monitored noise level was measured during the AM peak period at site S10 (120 West 125th Street) and it is represented by a noise level of 80.0 dBA. This level of exposure places this site, along with thirteen others under the CEQR defined "Marginally Unacceptable" category. Site 13 (311 West 126th Street) with a monitored noise level of 69.2 would be placed in the CEQR defined "Marginally Acceptable" category. The categorization of these monitoring sites is based on the results of baseline noise monitoring and *CEQR Technical Manual* noise exposure standards (see Table 3.18-1).

Noise measurements for the $L_{eq}(h)$ and L_{10} noise descriptors were also conducted at an elevated location on the platform of the existing Metro-North Railroad at Park Avenue. The platform measurement was conducted to identify the contribution of the elevated train to the surrounding noise environment. This monitoring took place on Tuesday, April 10, 2007 during the AM, Midday, and PM peak periods. Monitoring was conducted for one hour. Monitoring during the peak weekday periods is a conservative approach since there would be substantially more train traffic during peak weekday than the peak weekend period. The monitored $L_{eq}(h)$ noise levels at the elevated platform were,80.8 dBA, 73.5 dBA and 82.5 dBA for the AM, Midday and PM peak periods, respectively. The monitored L_{10} noise levels at the elevated platform were 85.3 dBA, 75.7 dBA and 86.0 dBA for the AM, Midday and PM peak periods, respectively.



Legend

- Noise Monitoring Location
- Proposed Rezoning Area

Figure 3.18-2- Locations of Noise Monitoring Sites

125th Street Corridor Rezoning and Related Actions EIS

NYC Department of City Planning

Table 3.18-2, Existing Short-term Noise Levels at Monitoring Sites S1 through S15 during November 4 through 18, 2006

Site #	Location	Measurement Times*	Existing Noise Levels				CEQR Noise Exposure Category*
			Leq	L_{10}	L_{50}	L_{90}	
S1	221 East 124th Street	7:00 - 9:00 AM	68.6	72.0	65.9	61.0	Marginally Unacceptable
		12:00 - 2PM	67.8	69.6	63.9	58.9	
		4:00 - 6:00 PM	75.8	**78.0**	73.2	67.1	
		12:00 - 2:00 PM	70.4	72.9	69.2	65.2	
S2	2425 2nd Avenue	7:00 - 9:00 AM	74.7	77.6	73.5	70.1	Marginally Unacceptable
		12:00 - 2PM	72.4	75.0	70.9	68.0	
		4:00 - 6:00 PM	75.5	**78.2**	74.0	70.2	
		12:00 - 2:00 PM	62.9	64.8	61.4	58.3	
S3	231 East 125th Street	7:00 - 9:00 AM	76.0	79.0	74.5	68.6	Marginally Unacceptable
		12:00 - 2PM	73.2	74.7	69.6	66.2	
		4:00 - 6:00 PM	77.6	**79.5**	72.4	67.6	
		12:00 - 2:00 PM	70.6	73.7	67.3	63.9	
S4	145 East 126th Street	7:00 - 9:00 AM	69.9	72.8	67.5	63.8	Marginally Unacceptable
		12:00 - 2PM	68.5	71.5	64.7	61.5	
		4:00 - 6:00 PM	70.2	**73.5**	64.7	61.7	
		12:00 - 2:00 PM	66.8	69.0	66.1	61.0	
S5	116 East 125th Street	7:00 - 9:00 AM	76.0	77.9	73.4	68.5	Marginally Unacceptable
		12:00 - 2PM	75.1	**78.2**	72.4	68.5	
		4:00 - 6:00 PM	75.0	77.0	73.7	70.8	
		12:00 - 2:00 PM	73.4	76.1	72.2	67.4	
S6	55 East 124th Street	7:00 - 9:00 AM	70.9	75.0	66.5	61.5	Marginally Unacceptable
		12:00 - 2PM	67.9	71.0	65.8	62.9	
		4:00 - 6:00 PM	71.5	**75.4**	67.6	60.8	
		12:00 - 2:00 PM	66.3	69.3	62.5	59.0	
S7	35 East 125th Street	7:00 - 9:00 AM	76.6	**79.7**	74.0	68.2	Marginally Unacceptable
		12:00 - 2PM	73.1	75.8	71.2	66.9	
		4:00 - 6:00 PM	72.8	75.2	71.3	68.5	
		12:00 - 2:00 PM	71.6	73.6	68.7	64.7	
S8	9 East126th Street	7:00 - 9:00 AM	68.9	**72.8**	62.9	58.5	Marginally Unacceptable
		12:00 - 2PM	67.0	70.8	61.8	56.5	
		4:00 - 6:00 PM	66.9	70.9	61.4	56.5	
		12:00 - 2:00 PM	65.4	68.6	62.3	58.3	
S9	274 Lenox Avenue	7:00 - 9:00 AM	70.9	73.5	69.1	64.5	Marginally Unacceptable
		12:00 - 2PM	69.3	72.3	67.6	64.4	

Site #	Location	Measurement Times*	Existing Noise Levels				CEQR Noise Exposure Category*
			L_{eq}	L_{10}	L_{50}	L_{90}	
		4:00 - 6:00 PM	71.5	**74.4**	70.1	65.1	
		12:00 - 2:00 PM	67.0	69.7	65.3	61.5	
S10	120 West 125th Street	7:00 - 9:00 AM	77.2	**80.0**	72.0	67.9	Marginally Unacceptable
		12:00 - 2PM	70.2	73.1	67.5	63.9	
		4:00 - 6:00 PM	71.0	74.0	69.1	65.8	
		12:00 - 2:00 PM	69.8	72.7	67.8	63.8	
S11	2075 Adam Clayton Powell Blvd	7:00 - 9:00 AM	69.2	72.5	67.8	61.5	Marginally Unacceptable
		12:00 - 2PM	69.4	72.6	67.0	62.3	
		4:00 - 6:00 PM	70.5	**73.6**	68.6	64.0	
		12:00 - 2:00 PM	67.8	70.2	65.8	60.7	
S12	243 West 124th Street	7:00 - 9:00 AM	68.3	70.4	65.3	59.2	Marginally Unacceptable
		12:00 - 2PM	69.5	**72.6**	64.4	60.3	
		4:00 - 6:00 PM	65.7	68.5	64.4	61.1	
		12:00 - 2:00 PM	66.4	69.4	62.4	59.2	
S13	311 West 126th Street	7:00 - 9:00 AM	64.7	66.7	62.4	60.2	Marginally Acceptable
		12:00 - 2PM	62.8	64.8	60.4	58.6	
		4:00 - 6:00 PM	66.3	**69.2**	62.7	59.9	
		12:00 - 2:00 PM	62.9	65.5	61.5	59.7	
S14	145 Morningside Avenue	7:00 - 9:00 AM	69.1	**71.4**	67.1	63.1	Marginally Unacceptable
		12:00 - 2PM	69.7	71.2	67.6	64.1	
		4:00 - 6:00 PM	70.3	71.2	66.4	63.4	
		12:00 - 2:00 PM	66.1	68.8	65.2	61.3	
S15	429 125th Street	7:00 - 9:00 AM	70.1	72.9	68.9	66.1	Marginally Unacceptable
		12:00 - 2PM	71.7	**74.9**	70.3	65.7	
		4:00 - 6:00 PM	68.5	70.8	66.9	63.8	
		12:00 - 2:00 PM	69.9	72.7	67.8	64.6	

* Noise exposure category classification was based on the highest noise level measured during any of the four time periods

3.18.4 FUTURE WITHOUT THE PROPOSED ACTION

As per *CEQR Technical Manual* Guidelines, in order to predict the noise levels in the future without the proposed action, monitored noise levels were projected by using a proportional modeling technique to take into account the increases in traffic associated with area growth. First, future traffic volumes were obtained by adding future 2017 No Action traffic volumes to the existing baseline conditions. Then, vehicular traffic volumes under the existing and future No Action conditions were converted into Passenger Car Equivalent (PCE) values. For this conversion, one medium truck is estimated to generate the noise equivalent of 13 cars, one bus is estimated to generate the noise equivalent of 18 cars, and one heavy truck generated the noise equivalent of 47 cars. Future No Action noise levels are calculated using the following equation:

$$\text{Future No Action Noise Level} = 10 * \log\left(\frac{NoAction\ PCE}{Existing\ PCE}\right) + Existing\ Noise\ Level$$

As indicated in Table 3.18-2, the individual existing L_{10} noise levels range from the "Marginally Acceptable" to the "Marginally Unacceptable" category at the monitored sites. Future No Action noise levels at fourteen of the fifteen monitoring sites as shown in Table 3.18-3 would be higher than the existing noise levels, with increases in the range of 0.2 to 1.8 dBA. Changes of this magnitude would be below the threshold of human perception.

3.18.5 FUTURE WITH THE PROPOSED ACTION

In order to predict noise levels in the future with the proposed action, the additional increase in traffic noise associated with the proposed action was added to the future No Action traffic noise condition. Future proposed action traffic volumes utilized in the mobile source noise analyses were based on unmitigated traffic conditions. Using the methodology previously used to calculate No Action traffic noise, there would be no perceptible increases in traffic noise levels at the Projected and Potential Development Sites as a result of increases in traffic associated with the proposed action (see Table 3.18-3). At site S3, where the greatest increase in traffic volumes is expected, and at sites S5, S7, S9, S10, S11 and S15, the increase in noise level conditions in the future with the proposed action compared to the future no action condition noise levels is predicted to be in the range of 0.1 dB to 0.8 dB. This increase at these locations would be considered insignificant and imperceptible. At the remaining eight monitoring sites (S1, S2, S4, S6, S8, S12, S13 and S14), the increase in future traffic volume would result in no increase in noise levels over the future no action condition. As result of the proposed action, the increase in the proposed action noise level over the no action noise level would not exceed the 3 dBA CEQR threshold at any of the receptor sites. Therefore, significant adverse noise impacts from mobile sources are not predicted to occur.

Table 3.18-3, Existing and Future Traffic Noise Levels (L_{eq}) at Monitored Sites

Noise Site #	*Site Description*	*Peak Traffic Time Period*	*Existing PCEs*[1]	*Future No Action PCEs*[1]	*Future Proposed Action PCEs*[1])	*Existing Noise Level (dBA)*	*Predicted Future No Action Noise Level (dBA)*	*Proposed Action Noise Level (dBA)*	*Future Proposed Action Minus Future No Action (dBA)*	*Impact (Yes/No)*
S1	221 East 124th Street	PM	4050	4256	4256	75.8	76.0	76.0	0.0	No
S2	2425 2nd Avenue	PM	4694	5258	5258	75.5	76.0	76.0	0.0	No
S3	231 East 125th Street	PM	5063	7675	9159	77.6	79.4	80.2	0.8	No
S4	145 East 126th Street	PM	1920	2653	2653	70.2	71.6	71.6	0.0	No
S5	116 East 125th Street	AM	6289	8476	9319	76.0	77.3	77.7	0.4	No
S6	55 East 124th Street	PM	669	704	704	71.5	71.7	71.7	0.0	No
S7	35 East 125th Street	AM	6597	8492	9267	76.6	77.7	78.1	0.4	No
S8	9 East126th Street	AM	1596	1707	1707	68.9	69.2	69.2	0.0	No
S9	274 Lenox Avenue	PM	2848	3106	3157	71.5	71.9	72.0	0.1	No
S10	120 West 125th Street	AM	5954	7629	8318	77.2	78.3	78.7	0.4	No
S11	2075 Adam Clayton Powell Blvd	PM	2661	2898	2971	70.5	70.9	71.0	0.1	No
S12	243 West 124th St	MD	1333	1333	1333	69.5	69.5	69.5	0.0	No
S13	311 West 126th Street	PM	596	659	659	66.3	66.7	66.7	0.0	No
S14	145 Morningside Avenue	PM	846	1048	1054	70.3	71.2	71.2	0.0	No
S15	429 125th Street	MD	5349	6337	6526	71.7	72.4	72.5	0.1	No

1. For impact assessment, the highest measured hourly level for the entire day, AM Peak (7:00 am to 9:00 am), Midday Peak (12:00 pm to 2:00 pm) PM Peak (4:00 pm to 6:00 pm) and Saturday (12:00 pm to 2:00 pm), was used for each location to calculate change in noise level from calculated PCE's for the existing, the no-build and the build conditions.

Table 3.18-4, Required Attenuation Values To Achieve Acceptable Interior Noise Levels

	Marginally Acceptable	*Marginally Unacceptable*		*Clearly Unacceptable*		
Noise level with proposed action	$65< L_{10} \leq 70$	$70< L_{10} \leq 75$	$75< L_{10} \leq 80$	$80< L_{10} \leq 85$	$85< L_{10} \leq 90$	$90< L_{10} \leq 95$
Attenuation	25 dBA	30 dBA	35 dBA	40 dBA	45 dBA	50 dBA

Source: New York City Department of Environmental Protection

3.18.6 SENSITIVE RECEPTOR ASSESSMENT

The proposed action would introduce new sensitive receptors into an area with high existing ambient noise levels. As indicated in Table 3.18-1, the existing noise levels range from "Marginally Acceptable" to "Marginally Unacceptable" at the sites where residential, commercial or community facility use is part of the projected development.

The existing L_{10} noise levels at 14 of the 15 monitoring sites and the future noise levels at all of the 48 projected and potential development sites would exceed 70 dBA. These sites would be suitable for residential, commercial and community facility uses only by providing window-wall attenuation ranging from 30 dBA to 40 dBA for the exterior facade of the affected development in order to achieve a 45 dBA interior noise level (Table 3.18-4). An (E) designation for these sites would preclude the potential for significant adverse noise impacts. Window/wall attenuation requirements base on future Action noise levels are shown in Table 3.18-5 for the fifteen noise monitoring sites. To properly assess potential impacts on the development sites, the attenuation requirements predicted for the monitoring sites were used and applied as shown in Tables 3.18-6 and 3.18-7. The corresponding required (E) designations for the projected and potential development sites are described below and also shown in Tables 3.18-6 and 3.18-7. The closed window condition at these sites can be maintained only by providing an alternate means of ventilation for the interior spaces. Details of window insulation are the following:

- Sound attenuation of 30 dBA would be needed for sites where future noise levels would be between 70 and 75 dBA. This can be achieved through installing ¼ inch laminated single-glazed windows or double-glazed windows with 1/8 inch glass panes with ¼ inch air space between them mounted in a heavy frame.

- Sound attenuation of 35 dBA would be required for sites where future noise levels would be between 75 and 80 dBA. This can be achieved through installing double glazed windows on a heavy frame in masonry structures or windows consisting of laminated glass.

- Sound attenuation of 40 dBA would be required where future noise levels would be between 80 and 85 dBA. This requires the use of noise attenuation measures that typically exceed standard practice for new construction. Achieving the 40 dBA attenuation would require the placement of acoustically well-sealed 0.25” laminated storm sash 1.5” to 3” from single glazed window on wood or metal frame.

Table 3.18-5, Required Window Attenuation Values for Monitored sites S1 through S15*

Noise Site	L_{10} (No Action)[1]	Change in noise level due to change in Traffic PCEs	Build L_{10} Noise Levels	Required Window Attenuation dBA
		Proposed Action	Proposed Action	Proposed Action
S1	78.2	0.0	78.2	35
S2	78.7	0.0	78.7	35
S3	81.3	0.8	82.1	40
S4	74.9	0.0	74.9	30
S5	79.2	0.4	79.6	35
S6	75.6	0.0	75.6	35
S7	80.8	0.4	81.2	40
S8	73.1	0.0	73.1	30
S9	74.8	0.1	74.9	35 [2]
S10	81.1	0.4	81.5	40
S11	74.0	0.1	74.1	30
S12	72.6	0.0	72.6	30
S13	69.6	0.0	69.6	30 [2]
S14	72.1	0.0	72.1	30
S15	75.6	0.1	75.7	35

** The E designation associated with these build L_{10} noise levels would preclude the potential for adverse noise impacts.*
[1] As stated in the CEQR Technical Manual " L_{10} values can be calculated by adding the difference between the L_{10} and L_{eq} descriptors found to exist in the measurement program to the calculated no action L_{eq} noise level." For example, for Site 1 the difference between L_{10} and L_{eq} in the measurement program is 78.0.-75.8=2.2. Future calculated no-action L_{10} is 76.0 + 2.2 = 78.2
2 The required window attenuation for monitoring sites .9 and 13 were conservatively increased since the Build L10 noise levels were close to the next attenuation category.

For projected and potential development site locations including block and lot numbers and attenuation requirements, see Table 3.18-6 (Projected Development Sites) and 3.18-7 (Potential Development Sites).

Table 3.18-6, Required Attenuation Values for Projected Developmental Sites[1, 2, 3]

Dev. Site Number	Address		Block Number	Lot(s) Number	Build Max L10 (dBA)	Attenuation Required
	321 WEST 125 STREET	S10, S14	1952	19	81.5	35
	319 WEST 125 STREET	S10, S14	1952	21	81.5	35
1	317 WEST 125 STREET	S10, S14	1952	22	81.5	35
2	2329 FRED DOUGLASS BLVD	S10, S13	1952	29	81.5	30, 40 OSF
3	362 WEST 125 STREET	S10, S12	1951	7	81.5	30, 40 ONF
4	350 WEST 125 STREET	S10, S14	1951	51	81.5	35
5	324 WEST 125 STREET	S10, S14	1951	43	81.5	30, 40 ONF
6	2100 AC POWELL BLVD	S10, S11	1931	27	81.5	30, 40 OSF
	260 WEST 125 STREET	S10, S12	1930	55	81.5	30, 40 ONF
7	260 WEST 125 STREET	S10, S12	1930	55	81.5	30, 40 ONF
	256 WEST 125 STREET	S10, S12	1930	53	81.5	30, 40 ONF
	256 WEST 125 STREET	S10, S12	1930	53	81.5	30, 40 ONF
	252 WEST 125 STREET	S10, S12	1930	51	81.5	30, 40 ONF
	250 WEST 125 STREET	S10, S12	1930	50	81.5	30, 40 ONF
8	246 WEST 125 STREET	S10, S12	1930	49	81.5	30, 40 ONF
	226 WEST 125 STREET	S10, S12	1930	41	81.5	30, 40 ONF
	226 WEST 125 STREET	S10, S12	1930	41	81.5	30, 40 ONF
	222 WEST 125 STREET	S10, S12	1930	40	81.5	30, 40 ONF
	222 WEST 125 STREET	S10, S12	1930	40	81.5	30, 40 ONF
	208 WEST 125 STREET	S10, S12	1930	37	81.5	30, 40 ONF
9	208 WEST 125 STREET	S10, S12	1930	37	81.5	30, 40 ONF
	2105 AC POWELL BLVD	S8, S10, S11	1910	1	81.5	35
	2105 AC POWELL BLVD	S8, S10, S11	1910	1	81.5	35
10	125 WEST 125 STREET	S8, S10, S11	1910	7501	81.5	35
	158 WEST 125 STREET	S10, S11	1909	59	81.5	30, 40 ONF
11	2089 AC POWELL BLVD	S10, S11	1909	63	81.5	30, 40 ONF
	120 WEST 125 STREET	S10, S12	1909	44	81.5	30, 40 ONF
	124 WEST 125 STREET	S10, S12	1909	46	81.5	30, 40 ONF
12	124 WEST 125 STREET	S10, S12	1909	46	81.5	30, 40 ONF
13	111 WEST 124 STREET	S9, S10	1909	26	81.5	35, 40 ONF
	109 WEST 124 STREET	S9, S10	1909	27	81.5	35, 40 ONF
	107 WEST 124 STREET	S9, S10	1909	28	81.5	35, 40 ONF
	281 LENOX AVENUE	S9, S10	1909	29	81.5	35, 40 ONF
	283 LENOX AVENUE	S9, S10	1909	129	81.5	35, 40 ONF
	285 LENOX AVENUE	S9, S10	1909	30	81.5	35, 40 ONF
	287 LENOX AVENUE	S9, S10	1909	31	81.5	35, 40 ONF
	289 LENOX AVENUE	S9, S10	1909	32	81.5	35, 40 ONF
	291 LENOX AVENUE	S9, S10	1909	33	81.5	35, 40 ONF
	108 WEST 125 STREET	S9, S10	1909	38	81.5	35, 40 ONF

	110 WEST 125 STREET	S9, S10	1909	39	81.5	35, 40 ONF
	35 WEST 125 STREET	S7, S8	1723	17	81.2	30, 40 OSF
	33 WEST 125 STREET	S7, S8	1723	21	81.2	30, 40 OSF
	31 WEST 125 STREET	S7, S8	1723	22	81.2	30, 40 OSF
	29 WEST 125 STREET	S7, S8	1723	122	81.2	30, 40 OSF
14	38 WEST 126 STREET	S7, S8	1723	53	81.2	30, 40 OSF
	5 WEST 125 STREET	S7, S8	1723	31	81.2	30, 40 OSF
	16 WEST 126 STREET	S7, S8	1723	144	81.2	30, 40 OSF
15	18 WEST 126 STREET	S7, S8	1723	45	81.2	30, 40 OSF
	76 WEST 125 STREET	S6, S7	1722	168	81.2	35, 40 ONF
	74 WEST 125 STREET	S6, S7	1722	68	81.2	35, 40 ONF
	72 WEST 125 STREET	S6, S7	1722	67	81.2	35, 40 ONF
	70 WEST 125 STREET	S6, S7	1722	66	81.2	35, 40 ONF
	68 WEST 125 STREET	S6, S7	1722	65	81.2	35, 40 ONF
16	64 WEST 125 STREET	S6, S7	1722	63	81.2	35, 40 ONF
	62 WEST 125 STREET	S6, S7	1722	62	81.2	35, 40 ONF
	60 WEST 125 STREET	S6, S7	1722	61	81.2	35, 40 ONF
	58 WEST 125 STREET	S6, S7	1722	60	81.2	35, 40 ONF
	56 WEST 125 STREET	S6, S7	1722	59	81.2	35, 40 ONF
17	54 WEST 125 STREET	S6, S7	1722	58	81.2	35, 40 ONF
	69 EAST 125 STREET	S4, S7	1750	28	81.2	35, 40 OSF
	71 EAST 125 STREET	S4, S7	1750	29	81.2	35, 40 OSF
	75 EAST 125 STREET	S4, S7	1750	30	81.2	35, 40 OSF
18	58 EAST 126 STREET	S4, S7	1750	44	81.2	35, 40 OSF
	1824 PARK AVENUE	S7 & MN	1750	40	84.8	40
19	81 EAST 125 STREET	S7 & MN	1750	34	84.8	40
	60 EAST 125 STREET	S6, S7	1749	48	81.2	35, 40 ONF
20	58 EAST 125 STREET	S6, S7	1749	49	81.2	35, 40 ONF
	71 EAST 124 STREET	S6 & MN	1749	31	83.1	35
	1800 PARK AVENUE	S7 & MN	1749	33	84.8	35
	1804 PARK AVENUE	S7 & MN	1749	35	84.8	35
	1808 PARK AVENUE	S7 & MN	1749	40	84.8	35
	66 EAST 125 STREET	S7 & MN	1749	43	84.8	35
21	55 EAST 124 STREET	S6 & MN	1749	24	83.1	35
	127 EAST 125 STREET	S5, S9	1774	17	79.6	35, 40 OSF
22	132 EAST 126 STREET	S5, S9	1774	56	79.6	35, 40 OSF
	1815 PARK AVENUE	S5 & MN	1773	69	84.2	40
	1811 PARK AVENUE	S5, S6 & MN	1773	72	84.2	35, 40 ONF
	1807 PARK AVENUE	S5, S6 & MN	1773	4	84.2	35, 40 ONF
	1801 PARK AVENUE	S5, S6 & MN	1773	1	84.2	35, 40 ONF
	1801 PARK AVENUE	S5, S6 & MN	1773	1	84.2	35, 40 ONF
23	110 EAST 125 STREET	S5 & MN	1773	67	83.1	35, 40 ONF

	212 EAST 125 STREET	S1, S3	1789	45	82.1	35, 40 ONF
	214 EAST 125 STREET	S1, S3	1789	43	82.1	35, 40 ONF
	218 EAST 125 STREET	S1, S3	1789	42	82.1	35, 40 ONF
24	215 EAST 124 STREET	S1, S3	1789	9	82.1	35, 40 ONF
25	246 EAST 125 STREET	S1, S3	1789	30	82.1	40
	233 EAST 124 STREET	S1, S2	1789	16	78.7	34
	237 EAST 124 STREET	S1, S2	1789	18	78.7	34
	241 EAST 124 STREET	S1, S2	1789	19	78.7	34
	243 EAST 124 STREET	S1, S2	1789	20	78.7	34
	245 EAST 124 STREET	S1, S2	1789	21	78.7	34
	247 EAST 124 STREET	S1, S2	1789	121	78.7	34
	2423 2 AVENUE	S1, S2	1789	25	78.7	34
	2421 2 AVENUE	S1, S2	1789	24	78.7	34
26*	2419 2 AVENUE	S1, S2	1789	23	78.7	34
	2417 2 AVENUE	S1, S2	1789	22	78.7	34

[1] The representative monitoring sites are shown next to the address
[2] With respect to the "Sensitive Receptor Assessment", the worse case L_{10} noise level for the Metro north noise measurement program (86.0 dBA) was propagated outward based on the relationship between noise dissipation of a line source and distance. Affected sites included sites, 19, 21, 23, 42 and 43. For these sites, the impact of the propagated Metro North noise levels were included in the final maximum build noise level results.
[3] ONF – On North Façade of the development block, OSF – On South Façade of the development block, OSE – On East Façade of the development site, MN – Metro North Train
* Projected Development Site 26 is partially comprised of City-owned property under the jurisdiction of the Department of Housing Preservation and Development (HPD). As discussed in Chapter 1, "Project Description," the Department of City Planning (DCP), as lead agency, is conducting a coordinated review with HPD. With respect to required attenuation, when conducting its own reviews, HPD typically rounds up to the nearest decibel (Table 3R-4 in the CEQR Technical Manual suggests that attenuation levels be determined by conservatively rounding up to the nearest 5 decibels). In order to maintain a maximum interior(closed-window) noise environment of 45 dB(A) on Projected Development Site 26, the (E) designation would require the attenuation levels shown above.

Table 3.18-7, Required Attenuation Values for Potential Developmental Sites[1, 2, 3, 4]

Dev. Site Number	Address		Block Number	Lot(s) Number	Build Max L10 (dBA)	Attenuation Required
27	568 WEST 125 STREET	S15	1980	75	75.7	30
28	151-153 MORNINGSIDE AVE	S14	1952	61	72.1	30
	381 WEST 125 STREET	S10, S14	1952	101	81.5	30, 40 OSF
29	379 WEST 125 STREET	S10, S14	1952	2	81.5	30, 40 OSF
30	361 WEST 125 STREET	S10, S13	1952	9	81.5	30, 40 OSF
	313 WEST 125 STREET	S10, S13	1952	23	81.5	30, 40 OSF
	311 WEST 126 STREET	S10, S13	1952	41	81.5	30, 40 OSF
	309 WEST 125 STREET	S10, S13	1952	25	81.5	30, 40 OSF
	307 WEST 125 STREET	S10, S13	1952	27	81.5	30, 40 OSF
	305 WEST 125 STREET	S10, S13	1952	28	81.5	30, 40 OSF
	308 WEST 126 STREET	S10, S13	1952	38	81.5	30, 40 OSF
	306 WEST 126 STREET	S10, S13	1952	138	81.5	30, 40 OSF
31	304 WEST 126 STREET	S10, S13	1952	37	81.5	30, 40 OSF
	2342 FRED DOUGLASS BLVD	S13	1931	61	69.6	30
	260 WEST 126 STREET	S13	1931	56	69.6	30
	2340 FRED DOUGLASS BLVD	S13	1931	63	69.6	30
32	2338 FRED DOUGLASS BLVD	S13	1931	64	69.6	30
33	2330 FRED DOUGLASS BLVD	S10, S13	1931	1	81.5	30, 40 OSF
	2310 FRED DOUGLASS BLVD	S10, S14	1930	1	81.5	30, 40 ONF
34	2310 FRED DOUGLASS BLVD	S10, S14	1930	1	81.5	30, 40 ONF
	268 WEST 125 STREET	S10, S12	1930	59	81.5	30, 40 ONF
	264 WEST 125 STREET	S10, S12	1930	57	81.5	30, 40 ONF
35	264 WEST 125 STREET	S10, S12	1930	57	81.5	30, 40 ONF
	112 WEST 125 STREET	S10, S12	1909	40	81.5	30, 40 ONF
	114 WEST 125 STREET	S10, S12	1909	41	81.5	30, 40 ONF
	116 WEST 125 STREET	S10, S12	1909	42	81.5	30, 40 ONF
	117 WEST 124 STREET	S10, S12	1909	24	81.5	30, 40 ONF
	119 WEST 124 STREET	S10, S12	1909	25	81.5	30, 40 ONF
36	283 WEST 125 STREET	S10, S12	1909	140	81.5	30, 40 ONF
	300 LENOX AVENUE	S9, S10	1723	1	81.5	35, 40 OSF
37	308 LENOX AVENUE	S9, S10	1723	4	81.5	35, 40 OSF
38	2022 5 AVENUE	S9, S10	1723	33	81.5	35, 40 OSF

	2032 5 AVENUE	S9, S10	1723	37	81.5	35, 40 OSF
39	290 LENOX AVENUE	S9, S10	1722	69	81.5	35, 40 ONF
	52 WEST 125 STREET	S7	1722	57	81.2	40
	50 WEST 125 STREET	S7	1722	156	81.2	40
	48 WEST 125 STREET	S7	1722	56	81.2	40
	46 WEST 125 STREET	S7	1722	155	81.2	40
40	44 WEST 125 STREET	S7	1722	55	81.2	40
	~~32 WEST 125 STREET~~	~~S6, S7~~	~~1722~~	~~51~~	~~81.1~~	~~35, 40 ONF~~
~~41~~	~~32 WEST 125 STREET~~	~~S6, S7~~	~~1722~~	~~51~~	~~81.1~~	~~35, 40 ONF~~
42	102 EAST 126 STREET	S9 & MN	1774	68	82.8	35, 40 OEF
	108 EAST 126 STREET	S4, S5 & MN	1774	65	83.6	30, 40 OSF
	106 EAST 126 STREET	S4, S5 & MN	1774	66	83.6	30, 40 OSF
	104 EAST 126 STREET	S4, S5 & MN	1774	67	83.6	30, 40 OSF
	107 EAST 125 STREET	S4, S5 & MN	1774	5	79.7	30, 40 OSF
	109 EAST 125 STREET	S4, S5 & MN	1774	6	79.7	30, 40 OSF
	111 EAST 125 STREET	S4, S5 & MN	1774	7	79.7	30, 40 OSF
43	113 EAST 125 STREET	S4, S5 & MN	1774	8	79.7	30, 40 OSF
44	150-170 EAST 126 STREET	S4	1774	48	74.9	30
45	2306 3 AVENUE	S3, S9	1774	33	81.9	30, 35 OSF
	122 EAST 125 STREET	S5	1773	61	79.6	40
46	128 EAST 125 STREET	S5	1773	58	79.6	40
	129 EAST 124 STREET	S6	1773	15	75.6	35
	2050 LEXINGTON AVENUE	S6	1773	17	75.6	35
47	2054 LEXINGTON AVENUE	S6	1773	18	75.6	35
48	149 EAST 124 STREET	S3, S6	1773	20	82.1	35, 40 ONF
	228 EAST 125 STREET	S3	1789	36	82.1	40
	230 EAST 125 STREET	S3	1789	35	82.1	40
49	232 EAST 125 STREET	S3	1789	34	82.1	40

[1] The representative monitoring sites are shown next to the address
[2] With respect to the "Sensitive Receptor Assessment", the worse case L_{10} noise level for the Metro north noise measurement program (86.0 dBA) was propagated outward based on the relationship between noise dissipation of a line source and distance. Affected sites included sites, 19, 21, 23, 42 and 43. For these sites, the impact of the propagated Metro north noise levels were included in the final maximum build noise level results.
[3] ONF – On North Façade of the development block, OSF – On South Façade of the development block, OSE – On East Façade of the development site, MN – Metro North Train
[4] Site 41 has been remover as a potential site, due to a new proposal since the DEIS for the village Academies School (see Chapter 3.1).

The following sites require 40 dBA of noise attenuation in order to avoid the potential for significant adverse impacts related to noise. The proposed action includes (E) designations on the following properties:

PROJECTED DEVELOPMENT SITES		
Development Site	**Block**	**Lot(s)**
19	**1750**	**34, 40**
25	**1789**	**30**
POTENTIAL DEVELOPMENT SITES		
40	**1722**	**55, 56, 57, 155, 156**
46	**1773**	**61, 58**
49	**1789**	**34, 35, 36**

The text of the (E) designation for noise for the above properties is as follows:

In order to ensure an acceptable interior noise environment, future residential/commercial uses must provide a closed window condition with a minimum of 40 dBA window/wall attenuation on all façades in order to maintain an interior noise level of 45 dBA. To achieve 40 dBA of building attenuation, special design features that go beyond the normal double-glazed windows are necessary and may include using specially design windows (i.e., windows with small sizes, windows with air gaps, windows with thicker glazing, etc.), and additional building attenuation. In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning.

The following sites require 35 dBA of noise attenuation in order to avoid the potential for significant adverse impacts related to noise. The proposed action includes (E) designations on the following properties:

PROJECTED DEVELOPMENT SITES		
Development Site	**Block**	**Lot(s)**
1	**1952**	**19, 21, 22**
4	**1951**	**51**
10	**1910**	**1, 7501**
21	**1749**	**24, 31, 33, 35, 40, 43**

POTENTIAL DEVELOPMENT SITES		
47	1773	15, 17, 18

The text of the (E) designation for noise for the above properties is as follows:

> **In order to ensure an acceptable interior noise environment, future residential/commercial uses must provide a closed window condition with a minimum of 35 dB(A) window/wall attenuation in all façades in order to maintain an interior noise level of 45 dB(A). In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning or air conditioning sleeves containing air conditioners or HUD-approved fans.**

The following sites require 34 dBA of noise attenuation on specific façades in order to avoid the potential for significant adverse impacts related to noise. The proposed action includes (E) designations on the following properties:

Projected Development Site	Block	Lot(s)
26	1789	16, 18, 19, 20, 21, 22, 23, 24, 25, 121

The text of the (E) designation for noise for the above properties is as follows:
In order to ensure an acceptable interior noise environment, future residential/commercial uses must provide a closed window condition with a minimum of 34 dB(A) window/wall attenuation in all façades in order to maintain an interior noise level of 45 dB(A). In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning or air conditioning sleeves containing air conditioners or HUD-approved fans.

The following sites require 30 dBA of noise attenuation in order to avoid the potential for significant adverse impacts related to noise. The proposed action includes (E) designations on the following properties:

POTENTIAL DEVELOPMENT SITES		
Development Site	Block	Lot(s)
22	1774	17, 56
28	1952	61
27	1980	75
32	1931	56, 61, 63, 64
44	1774	48

The text of the (E) designation for noise for the above properties is as follows:

> **In order to ensure an acceptable interior noise environment, future residential/commercial uses must provide a closed window condition with a minimum of 30 dB(A) window/wall attenuation in all façades in order to maintain an interior noise level of 45 dB(A). In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning or air conditioning sleeves containing air conditioners or HUD-approved fans.**

The following sites require combination of 30 dBA and 35 dBA of noise attenuation on specific façades in order to avoid the potential for significant adverse impacts related to noise. The proposed action includes (E) designations on the following properties:

POTENTIAL DEVELOPMENT SITES		
45	1774	33

The text of the (E) designation for noise for the above properties is as follows:

In order to ensure an acceptable interior noise environment, future residential/commercial uses must provide a closed window condition with a minimum of 30 dBA and 35 dBA window/wall attenuation on some façades in order to maintain an interior noise level of 45 dBA. To achieve 35 dBA of building attenuation, special design features that go beyond the normal double-glazed windows are necessary and may include using specially design windows (i.e., windows with small sizes, windows with air gaps, windows with thicker glazing, etc.), and additional building attenuation. In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning.

The following sites require a combination of 30 dBA and 40 dBA of noise attenuation on specific façades in order to avoid the potential for significant adverse impacts related to noise. The proposed action includes (E) designations on the following properties:

PROJECTED DEVELOPMENT SITES		
Development Site	Block	Lot(s)
2	1952	29
3	1951	7
5	1951	43
6	1931	27
7	1930	55
8	1930	49, 50, 51, 53
9	1930	37, 40, 41
11	1909	59, 63
12	1909	44, 46
14	1723	17, 21, 22, 53 122
15	1723	31, 45, 144
POTENTIAL DEVELOPMENT SITES		
29	1952	2, 101
30	1952	9
31	1952	23, 25, 27, 28, 37, 38, 41, 138
33	1931	1
34	1930	1
35	1930	57, 59
36	1909	24, 25, 40, 41, 42, 140
43	1774	68, 65, 66, 67, 5, 6, 7, 8

The text of the (E) designation for noise for the above properties is as follows:
In order to ensure an acceptable interior noise environment, future residential/commercial uses must provide a closed window condition with a minimum of 30 dBA and 40 dBA window/wall attenuation on some façades in order to maintain an interior noise level of 45 dBA. To achieve 40 dBA of building attenuation, special design features that go beyond the normal double-glazed windows are necessary and may include using specially design windows (i.e., windows with small sizes, windows with air gaps, windows with thicker glazing, etc.), and additional building attenuation. In order to maintain a closed-window

condition, an alternate means of ventilation must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning."

The following sites require combination of 35 dBA and 40 dBA of noise attenuation on specific façades in order to avoid the potential for significant adverse impacts related to noise. The proposed action includes (E) designations on the following properties:

PROJECTED DEVELOPMENT SITES		
Development Site	**Block**	**Lot(s)**
13	1909	26, 27, 28, 29, 30, 31, 32, 38, 39, 129, 33
16	1722	63, 65, 66, 67, 68, 168
17	1722	58, 59, 60, 61, 62
18	1750	28, 29, 30, 44
20	1749	48, 49
23	1773	1, 69, 72, 4, 67
22	1774	17, 56
24	1789	9, 42, 43, 45
POTENTIAL DEVELOPMENT SITES		
37	1723	1, 4
38	1723	33, 37
39	1722	69
~~41~~**	~~1722~~	~~51~~
42	1774	68
48	1773	20

**Site 41 has been removed as a potential development site, due to a new proposal since the DEIS for the Village Academies School (see Chapter 3.1, "Land Use, Zoning, and Public Policy").

The text of the (E) designation for noise for the above properties is as follows:

In order to ensure an acceptable interior noise environment, future residential/commercial uses must provide a closed window condition with a minimum of 35 dBA and 40 dBA window/wall attenuation on some façades in order to maintain an interior noise level of 45 dBA. To achieve 40 dBA of building attenuation, special design features that go beyond the normal double-glazed windows are necessary and may include using specially design windows (i.e., windows with small sizes, windows with air gaps, windows with thicker

glazing, etc.), and additional building attenuation. In order to maintain a closed-window condition, an alternate means of ventilation must also be provided. Alternate means of ventilation includes, but is not limited to, central air conditioning.

With the attenuation measures specified above, the proposed rezoning would not result in any significant adverse noise impacts, and would meet CEQR guidelines.

CONCLUSION

The proposed action would not result in significant adverse impacts related to noise. The proposed action would generate new residential, commercial and community facility uses in an area that is already characterized by medium to high density residential and commercial development. As discussed above, as part of the proposed action, (E) designations would be placed on the zoning map for all of the projected and potential development sites to avoid the potential for significant adverse noise impacts. Residential, commercial and community facility development on lots mapped with an (E) designation would be required to provide sufficient noise attenuation to maintain interior noise levels of 45 dBA or lower, and the proposed action would not result in significant adverse noise impacts.

3.17 AIR QUALITY

INTRODUCTION

The proposed action would not result in significant adverse impacts related to mobile or stationary source emissions. With respect to HVAC emissions, the proposed action would include (E) designations for air quality, which would restrict the placement of a building's vent stack and/or restrict the type of fuel used for HVAC systems.

As discussed in Chapter 3.1, "Project Description," the net increment the proposed action is expected to generate is approximately 2,328 dwelling units (DUs), 208,586 square feet (sf) of retail space, 436,015 sf of office/commercial space, and, 11,672 sf of hotel space on 26 projected development sites. In addition, DCP has identified 22 potential development sites in the rezoning area. If development does not occur on the projected development sites, the same overall amount of development could occur instead on some or all of the potential development sites. Although considered possible sites for future development based on the soft site criteria described above, these sites are considered less likely to be developed over the ten year analysis period. Site conditions, location, and market demand are among the factors contributing to the more limited likelihood for redevelopment of potential development sites.

Air quality issues associated with the proposed action relate to:

- Potential for increases and/or changes in vehicular travel associated with the action-generated development to result in significant mobile source air quality impacts;
- Potential for the emissions from the heating systems of the action-generated developments to significantly impact existing land uses and/or other action-generated developments;
- Potential of existing commercial, institutional or large-scale residential developments to impact action-generated residential/commercial uses on projected and potential development sites;
- Potential for action-generated residential/commercial uses on projected and potential development sites to be adversely affected by air toxic emissions generated by existing nearby industrial and commercial uses (including the 126th Street and Amsterdam Avenue MTA bus depots).

Air quality analyses were conducted, following the procedures outlined in the 2001 *CEQR Technical Manual*, to determine whether the proposed action would result in violations of ambient air quality standards or health-related guideline values. The methodologies and procedures utilized in these analyses along with corresponding results tables are described below.

Pollutants Of Concern

Criteria Pollutants

The following air pollutants have been identified by the U.S. Environmental Protection Agency (USEPA) as being of concern nationwide: carbon monoxide (CO), nitrogen oxides (NO_X), photochemical oxidants, particulate matter, sulfur dioxide (SO_2), and lead (Pb). In New York City, ambient concentrations of CO, and photochemical oxidants are predominantly influenced by motor vehicle activity; NO_X are emitted from both mobile and stationary sources; emissions of SO_2 are associated mainly with stationary sources; and emissions of particulate matter are associated with stationary sources, and to a lesser extent, diesel-fueled mobile sources (heavy trucks and buses). Lead emissions, which historically were principally influenced by motor vehicle activity, have been substantially reduced due to the elimination of lead from gasoline.

Carbon Monoxide

Carbon monoxide is a colorless, odorless, and toxic gas that results primarily from the incomplete combustion of fossil fuels. Particularly sensitive to its affects are infants and elderly persons, as well as other individuals who may suffer from respiratory diseases. In New York, more than eighty percent of all CO emissions are the result of motor vehicle exhaust. Roadways that experience high vehicular volumes, low travel speeds and traffic congestion, conditions often are usually associated with high CO concentrations. The implementation of the proposed project could exacerbate traffic conditions within the already heavily congested 125th street corridor. As a result CO is a pollutant of concern for this project.

Nitrogen Oxides and Photochemical Oxidants

Nitrogen dioxide is formed from the burning of fossil fuels and is considered a highly reactive gas that is also linked to the production of acid rain. Nitrogen dioxide and photochemical oxidants such as ozone (O_2) are linked in that the production of NO_2 is a precursor to the formation of O_2. Because the chemical reactions that form O_2 occur slowly and ordinarily take place far downwind from the site of actual pollutant emission, the effects of the pollutants involved are usually analyzed on a regional level. New York County is designated as a moderate non-attainment zone for the 8-hour standard; however, since the projected and potential developments would not significantly affect the amounts of these pollutants generated within the region, an analysis of these pollutants is usually not warranted. However, because nitrogen oxides could be emitted from heating systems associated with the proposed residential developments, NO_2 is a pollutant of concern.

Particulate Matter

Inhalable particulate matter is a respiratory irritant and is of most concern when classified as being less than 10 microns in diameter, or PM_{10}. Particulate matter is primarily generated by stationary sources, such as industrial facilities and power plants, however, with respect to the proposed project could also be produced by the combustion of diesel fuel used in some buses and trucks as well as residential HVAC systems using oil fuel. It is also derived from mechanical breakdown of coarse particulate matter, e.g., from building demolition or roadway surface wear as well as other construction-related activities.

The USEPA has also promulgated standards for PM less than 2.5 microns in diameter ($PM_{2.5}$). While $PM_{2.5}$ and PM_{10} both emanate from similar sources, $PM_{2.5}$ of "fine particulates are considered the most damaging to human health because they penetrate and remain in the deepest passages of the lungs." In addition to health effects, it has been shown that fine particles are the major cause of visibility impairment within major urban landscapes. At the present time New York City is recognized as a non-attainment area for this pollutant. To assist in the prediction of potential impacts, the New York State Department of Environmental Conservation (NYSDEC) and New York City Department of Environmental Protection (NYCDEP) have developed recently updated interim guidelines (July 9, 2007) for the screening and assessment of potential project-related $PM_{2.5}$ emissions. The mobile source screening portion of the guidelines requires that a calculation of the HDD screening threshold be conducted for the particular project build year. For the Proposed Action, the results of the calculation indicated that 95 heavy duty diesel (HDD) vehicles (trucks and buses or their emissions equivalent in autos) at an intersection during a peak hour would have the potential to cause adverse air quality impacts from $PM_{2.5}$, and require a detailed analysis. As the proposed project could generate HDD's, $PM_{2.5}$ and PM_{10} are pollutants of particular concern.

Sulfur Oxides

Oxides of sulfur (SO_2) are respiratory irritants associated with the combustion of sulfur-containing fuels (such as heating oil and coal). SO_2 is a precursor to acid rain and to $PM_{2.5}$, both of which create damage to individual health and the environment. This pollutant is typically associated with large industrial operations but can also result from much smaller sources. In urban areas, especially in the winter, smaller stationary sources such as HVAC systems contribute to elevated SO_2 levels. However, all NYSDEC sulfur dioxide monitoring sites have remained in compliance with the New York State/Federal annual mean standard for over twenty consecutive years. As the proposed heating systems of anticipated new mixed-use residential and commercial developments would potentially use oil fuel, SO_2 is a pollutant of concern.

Lead

Lead emissions are principally associated with industrial sources and motor vehicles using gasoline containing lead additives. As the availability of leaded gasoline has decreased, motor vehicle-related lead emissions have decreased resulting in a significant decline of concentrations of lead. Atmospheric lead concentrations in New York City are well below national standards.

Lead concentrations are expected to continually decrease; and as a result lead is not a pollutant of concern for the proposed project.

Air Toxic Pollutants

In addition to criteria pollutants, small quantities of a wide range of the non-criteria air pollutants (known as air toxic pollutants), which could be emitted from nearby industrial and commercial facilities, are also of concern. These pollutants can be grouped into two categories: carcinogenic air pollutants, and non-carcinogenic air pollutants. These two groups include hundreds of pollutants, ranging from high to low toxicity. No federal standards have been promulgated for toxic air pollutants. However, USEPA and the NYSDEC have issued guidelines that establish acceptable ambient levels for these pollutants based on human exposure criteria.

In summary, the air pollutants identified as being of concern are considered as follows:

- CO is considered as the pollutant of concern for the mobile source analysis because of the additions and/or changes in local vehicular traffic that are anticipated as a result of the proposed action;

- NO_2 and SO_2 are the pollutants of concern for the air quality analysis of emissions from the heating systems of project-related developments; and

- Air toxic emissions from existing industrial/manufacturing land uses are considered to determine the potential for significant impacts on projected and potential development sites.

Based on future traffic projections, the proposed action would not have a significant effect on the number of heavy duty and/or diesel fueled vehicles in the study area. As a result, $PM_{2.5}$ and PM_{10} were not considered for the mobile source analysis. A screening assessment is provided below.

Air Quality Standards And Guidelines

Air Quality Standards

National and New York State ambient air quality standards (NAAQS) are pollutant concentrations for each of the criteria pollutants specified by EPA that have been developed primarily to protect human health. The secondary goal is to protect the nation's welfare and account for the effect of air pollution on soil, water, vegetation and other aspects of general welfare. Time frames, based on how these pollutants adversely affect health, have also been established for these pollutants. These standards, together with their health-related averaging periods, are presented in Table 3.17-1.

Table 3.17-1, Ambient Air Quality Standards

Pollutant	Standard Value		Standard Type
Carbon Monoxide (CO)			
8-hour Average[1]	9 ppm	(10 $\mu g/m^3$)	Primary
1-hour Average[1]	35 ppm	(40 $\mu g/m^3$)	Primary
Nitrogen Dioxide (NO_2)			
Annual Arithmetic Mean	.053 ppm	(100 $\mu g/m^3$)	Primary & Secondary
Ozone (O_3)			
1-hour Average[1,6]	.12 ppm	(235 $\mu g/m^3$)	Primary & Secondary
8-hour Average[5]	.08 ppm	(235 $\mu g/m^3$)	Primary & Secondary
Lead (PB)			
Quarterly Average	1.5 $\mu g/m^3$		Primary & Secondary
Particulate (PM_{10})			
Annual Arithmetic Mean	(Revoked)[2]		Primary & Secondary
24-hour Average[1]	(150 $\mu g/m^3$)		Primary & Secondary
Particulate ($PM_{2.5}$)			
Annual Arithmetic Mean[3]	(15 $\mu g/m^3$)		Primary & Secondary
24-hour Average[4]	(35 $\mu g/m^3$)		Primary & Secondary
Sulfur Dioxide (SO_2)			
Annual Arithmetic Mean	.03 ppm	(80 $\mu g/m^3$)	Primary
24-hour Average[1]	.14 ppm	(365 $\mu g/m^3$)	Primary
3-hour Average[1]	.50 ppm	(1300 $\mu g/m^3$)	Secondary

1 - Not to be exceeded more than once per year
2 - As of December 17, 2006, the EPA revoked the annual PM_{10} standard
3 - 3 year average of annual mean within an area must not exceed 15 $\mu g/m^3$
4 - 3 year average of 98th percentile of 24-hour concentrations at each monitor within an area must not exceed 35 $\mu g/m^3$
5 - 3 year average of the 4th highest daily maximum 8-hour average ozone concentrations, measured at each monitor within an area over each year, must not exceed 0.08 ppm.
6 – As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone non-attainment Early Action Compact (EAC) Areas.

Significant Impact Thresholds

In addition to the Federal and State standards, under New York City's Environmental Quality Review (CEQR) guidelines, incremental impact criteria, known as "*de minimis*" criteria, have been established to measure the impact significance of estimated increments.

CO Thresholds

Significant CO increments are characterized as:

- An increase of 0.5 ppm or more for the 8-hour period, when baseline concentrations are above 8.0 ppm; or
- An increase of one-half the difference between the baseline and the standard concentration (9 ppm) for the 8-hour period when baseline concentrations are below 8 ppm.

Project-related impacts less than these values are not considered to be significant.

Non-Criteria Air Toxics Pollutant Thresholds

In order to evaluate short-term and annual impacts of non-carcinogenic toxic air pollutants, the NYSDEC has established short-term guideline concentrations (SGCs) and annual guideline concentrations (AGCs) for exposure limits. These are maximum allowable one-hour and annual guideline concentrations, respectively, that are considered acceptable concentrations below which there should be no adverse effects on the health of the general public.

When cumulative impacts of multiple air toxics from multiple sources could pose a potential health risk to proposed development, a cumulative impact analysis for industrial sources would be performed. Potential cumulative impacts are determined based on the USEPA's Hazard Index Approach for non-carcinogenic compounds and using the USEPA's Unit Risk Factors for carcinogenic compounds. These methods are based on equations that use USEPA health risk information (established for individual compounds with known health effects) to determine the level of health risk posed by an expected ambient concentration of that compound at a potentially sensitive receptor. The derived values of health risk are additive and can be used to determine the total risk posed by multiple air contaminants. For carcinogens, the public health risk would be based on calculations of the incremental risk associated with each toxic pollutant. These incremental values would then be summed to arrive at the total risk. If the total risk is predicted to be less than or equal to one in one million (1×10^{-6}), the carcinogenic risk is considered negligible. For non-carcinogens, the public health risk would be based on estimates for inhalation of non-carcinogenic pollutants (i.e. the Hazard Index). Once the hazard index of each compound is established, they are summed together. If the total hazard index is less than or equal to one, then the non-carcinogenic risk is considered negligible.

The following equations are used to calculate incremental risk for carcinogenic pollutants and the hazard index for non-carcinogenic pollutants:

- Incremental Risk = C x URF

  Where:
  C = annual average ambient air concentration of the compound in µg/m3
  URF = compound-specific inhalation unit risk factor in (µg/m3)-1

- Hazard Index = C / RfC

  Where:
  C = annual average ambient air concentration of compound in µg/m3
  RfC = compound-specific inhalation reference concentration in µg/m3

EXISTING POLLUTANT LEVELS AND REGULATORY SETTING

Monitored Data

Representative monitored ambient air quality data for the area are shown in Table 3.17-2. These data were compiled by the NYSDEC ~~for 2005 &~~ 2006, the latest calendar years for which data are currently available. Monitored levels for pollutants that are considered for this analysis (i.e., SO_2, NO_2, and PM_{10}) do not exceed National and State ambient air quality standards. Monitored values indicate that current $PM_{2.5}$ annual levels exceed the NAAQS.

Table 3.17-2, Representative Ambient Air Quality Data (~~2005~~/ 2006)

Pollutant	Monitor	Averaging Time	Value	NAAQS
CO	Brooklyn Transit (Traffic Site Monitor)	8-hour	5.9 ppm	9 ppm
		1-hour	2.5 ppm	
	Botanical Gardens (Bronx) (Background Site Monitor)	8-hour	1.9 ppm	9 ppm
		1-hour	2.6 ppm	35 ppm
NO_2	IS 52 (Bronx)	Annual	.026 ppm	0.053 ppm (100 µg/m3)
Ozone	IS 52 (Bronx)	8-hour	0.072	0.080 ppm (157 µg/m3)
		1-hour	0.114	0.12 ppm
PM_{10}	No Data Available	Annual (revoked)	-	50 µg/m3
		24-hour	-	150 µg/m3
$PM_{2.5}$	JHS 45 (Manhattan)	Annual	13.4 µg/m3	15 µg/m3
		24-hour	37.0 µg/m3	35 µg/m3
SO_2	IS 52 (Bronx)	3-hour	.069 ppm	0.50 ppm (1300 µg/m3)
		24-hour	.036 ppm	0.14 ppm (365 µg/m3)
		Annual	.009 ppm	0.03 ppm (80 µg/m3)

Note: Values are the highest pollutant levels recorded during the latest available calendar years. Source: NYSDEC 2006 Data.

Regulatory Setting

Attainment Status / State Implementation Plan (SIP)

The Clean Air Act (CAA), as amended in 1990, defines non-attainment areas as geographic regions that have not meet one or more of the NAAQS. When an area within a state is designated as non-attainment by the USEPA, the state is required to develop and implement a State Implementation Plan (SIP), which would describes how it will meet the NAAQS under deadlines established by the CAA. New York City has been designated as non-attainment area for ozone and $PM_{2.5}$ but as an attainment area for CO. Violations of the CO standard have not been recorded at the NYSDEC monitoring sites for several years. As part of its ongoing effort to maintain its attainment designation for CO, New York State has committed to the implementation of area-wide and site-specific control measures to continue to reduce CO levels.

On February 13, 2004, New York State formally recommended that the USEPA designate New York City (NYC) as non-attainment for $PM_{2.5}$; USEPA made their final non-attainment designation for $PM_{2.5}$ on December 17, 2004. On September 8, 2005, the United States Environmental Protection Agency (USEPA) proposed specific requirements that state and local governments have to meet as they implement the national ambient air quality standards for $PM_{2.5}$. State and local governments have three years from the date of the USEPA designation to develop implementation plans to meet the NAAQS. State plans are due in April 2008. $PM_{2.5}$ attainment designations would be effective by April 2010, $PM_{2.5}$ SIPs would be due by April 2013, and would be designed to meet the $PM_{2.5}$ standards by April 2015. On September 21, 2006 the USEPA tightened the 24-hour fine particle standard from 65 micrograms per cubic meter (µg/m3) to 35 µg/m3, but retained the current annual fine particle standard at 15 µg/m3. In addition, effective September 17, 2006 the USEPA has revoked the current annual PM_{10} standard based on a lack of evidence that links health problems to long-term exposure to coarse particle pollution.

Ozone SIP revisions have been submitted to the USEPA over the past several years. A November 1992 NYSDEC submission to USEPA provided SIP revisions which addressed the minimum air quality control requirements that were established by the CAA. In November 1993, a revision was submitted which documented how a 15% reduction in ozone precursors would be achieved by the end of 1996. Subsequent SIP revisions took into consideration the need to incorporate alternative procedures in order to reach an ozone attainment status by 2007. Phase I of this plan calls for a 9% rate of progress for the period 1997 through 1999. Phase II calls for future per annum rates of progress for the years 2002, 2005 and 2007 to be at 3%. On April 15, 2004 USEPA officially designated the five NYC counties as moderate non-attainment for the new 8-hour ozone standard (effective June 15, 2004). USEPA revoked the 1-hour standard on June 15, 2005, so that New York State can focus attention an attaining the stricter 8-hour standard. However, the very specific control measures for the 1-hour standard included in the SIP will be required to stay in place until the 8-hour standard is attained. A new SIP for ozone was to be adopted by the state no later than June 15, 2007, with a target attainment deadline of June 15, 2010. However, on June 20, 2007, USEPA proposed to strengthen the national ambient air quality standards for ground-level ozone. The proposed revisions reflect new scientific evidence about ozone and its effects on people and public welfare. The USEPA will issue final standards by March 12, 2008. Based on that date, USEPA estimates the following implementation schedule:

- By June 2009: States make recommendations for areas to be designated attainment and nonattainment.

- By June 2010: USEPA makes final designations of attainment and nonattainment areas. Those designations would become effective 60 days after publication in the Federal Register.
- 2013: State Implementation Plans, outlining how states will reduce pollution to meet the standards, are due to USEPA (three years after designations).
- 2013 to 2030: States are required to meet the standard, with deadlines depending on the severity of the problem.

3.17.1 MOBILE SOURCE ANALYSIS

Carbon Monoxide

Selection of Intersection Analysis Sites

A microscale modeling analysis was conducted to estimate CO levels at the most heavily congested intersections (i.e., analysis sites) in the study area. These intersections are also anticipated to be those which would be most affected by the Proposed Action. The following scenarios were analyzed: existing conditions and future conditions (2017), with and without the proposed action. In order to select analysis sites, data related to traffic volumes, levels of service and vehicular speeds at the major signalized intersections were evaluated with and without the proposed action. Selection of analysis sites was based on screening procedures described in the 2001 *CEQR Technical Manual.* The procedure utilizes total traffic volumes at intersections, operating levels of service, changes associated with speeds, and project-generated trips from the traffic analysis to make a final determination on the analysis sites which will be studied in detail. Intersections selected for analysis are shown in Table 3.17-3 and on Figure 3.17-1.

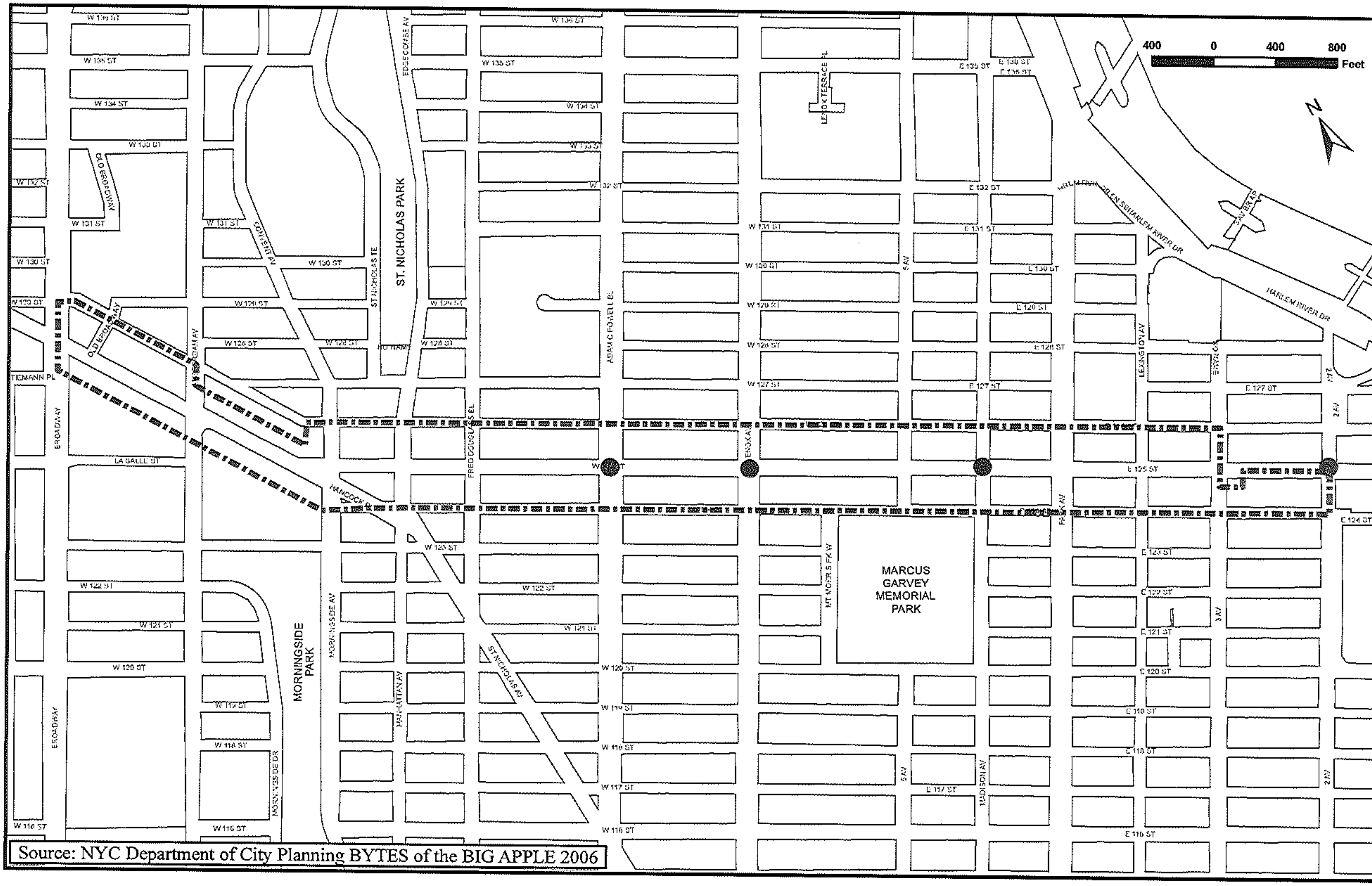
Table 3.17-3, Microscale Intersection Analysis Sites

Site Number	*Intersection*
1	East 125th Street & 2nd Avenue
2	East 125th Street & Madison Avenue
3	East 125th Street & Lenox Avenue
4	East 125th Street & Adam Clayton Powell Boulevard

Receptors

The exact locations at which pollutant concentrations are estimated are known as "receptors." Following guidelines established by the USEPA, receptors are typically located where the maximum concentration is likely to occur and where the general public is likely to have access.

For this analysis, receptors were distributed along sidewalks near the intersection selected for analysis and surrounding each analysis site.



Legend

- Air Quality Analysis Location
- Proposed Rezoning Area

Figure 3.17-1- Air Quality Intersections

125th Street Corridor Rezoning and Related Actions EIS

NYC Department of City Planning

Traffic Data

Traffic data for the air quality analysis were derived from traffic counts and other information developed as part of the traffic study analysis. Traffic periods considered in the analysis were the same periods selected for the traffic analysis. They consisted of the AM, MD and PM weekday peak as well as the PM weekend peak. These are the periods when the maximum changes in pollutant concentrations are expected based on overall traffic volumes and anticipated changes in traffic patterns due to the proposed action. Future proposed action traffic data utilized in the mobile source air quality analyses were based on unmitigated traffic conditions. This represents a conservative approach since traffic mitigation is usually employed to improve traffic flow at an intersection (i.e. by decreasing traffic delays or improving the Level of Service). Improvements in an intersections LOS will typically result in improvements to traffic-related air quality conditions at that intersection.

The *2000 Highway Capacity Manual* and HCS 2000 software were used to develop the traffic data necessary for the air quality analysis. The vehicle classification was determined through field data collection. Existing vehicle speeds were obtained from field measurements for the area, and adjusted to estimate future free flow speeds.

Vehicle Classification Data

Vehicle classification percentages required to determine composite emission factors were based on traffic survey data for the following categories: light duty gasoline vehicles (LDGVs), sport utility vehicles (SUVs), medallion taxis, light-duty trucks, heavy-duty trucks, and buses. Where appropriate, the six collected vehicle classification categories were expanded into eight categories. The eight expanded categories were based on NYSDEC's downstate registration data contained in the MOBILE CO emissions model for each appropriate analysis year. Light duty gasoline trucks were divided into two sub-groups (LDGT12, and LDGT34). Heavy-duty trucks were divided into heavy duty gas vehicles (HDGVs) and heavy-duty diesel vehicles (HDDVs). All buses were analyzed as heavy-duty diesel vehicles (HDDVs).

Vehicular Emissions

CO emission factors were estimated using the USEPA MOBILE6 mobile emission factor algorithm model released by the USEPA on January 29, 2002. This version includes the effects of the new vehicle standards, and covers vehicle turnover. MOBILE6.2 (the most current version), which includes emission factors for particulate matter, was released May 2004 and is used in this analysis.

The following assumptions were applied in using MOBILE6.2:

- NYSDEC input files with engine operating start and distribution parameters and vehicle miles traveled (VMT) for New York County were used to estimate baseline conditions;

- 2006 New York State registration and diesel sales fraction data;
- 100 percent hot-stabilized LDGV emission factors were used for medallion taxis
- All project-generated trips were assumed to consist of 15% in (hot start) and 85% out (cold start) trips.
- SUVs were assumed to be LDGTs that have the same engine operating parameters as automobiles;
- A 24-hour average temperature distribution was used.

Dispersion Analysis

Mobile source dispersion models are the basic analytical tools used to estimate pollutant concentrations from the emissions generated by motor vehicles as expected under given conditions of traffic, roadway geometry, and meteorology. CAL3QHC Version 2 is a line-source dispersion model that predicts pollutant concentrations near congested intersection and heavily traveled roadways. CAL3QHC input variables include free flow and calculated idle emission factors, roadway geometries, traffic volumes, site characteristics, background pollutant concentrations, signal timing, and meteorological conditions. CAL3QHC predicts inert pollutant concentrations, averaged over a one-hour period near roadways. This model was used to predict concentrations at affected study-area intersections.

CAL3QHC predicts peak one-hour pollutant concentrations using assumed meteorology and peak-period traffic conditions. Different emission rates occur when vehicles are stopped (idling), accelerating, decelerating, and moving at different average speeds. CAL3QHC simplifies these different emission rates into the following two components:

- Emissions when vehicles are stopped (idling) during the red phase of a signalized intersection.
- Emissions when vehicles are in motion during the green phase of a signalized intersection.

The analyses followed USEPA's Intersection Modeling Guidelines (EPA-454/R-92-005) for CO modeling methodology and receptor placement. All major roadway segments (links) within approximately 1,000 feet from each analysis site (i.e., congested intersection) were considered. A mixing height of 1,000 meters and a surface roughness factor of 321 centimeters were included in all calculations.

A conservative analysis, which assumes that peak period vehicular emissions, traffic volumes, and intersection operating parameters occur every hour of each analysis year, was conducted. The use of peak hour baseline and project-generated traffic conditions would also result in conservative predictions of pollutant levels and project impacts.

Background Values

To properly represent the total impact of the proposed action in the analysis, it is necessary to consider representative background levels for each of the analyzed pollutants. The background level is the component of the total concentration not accounted for through the microscale modeling analysis. Applicable background concentrations were added to the modeling results to obtain total pollutant concentrations at each receptor site for each analysis year. Background concentrations were based either on monitored values collected by the NYSDEC or values obtained from NYCDEP. The CO background values were provided by NYCDEP using the latest NYSDEC procedures based on the most recent ambient monitoring data and future decreases in vehicular emissions. $PM_{2.5}$, NO_2 and SO_2 background values were also obtained from NYCDEP. These values were added to the modeling results as appropriate to obtain total pollutant concentrations at each receptor site for each analysis year. The background values used in the air quality analyses are provided in Table 3.17-4.

Table 3.17-4 Background Concentrations

Pollutant	*Averaging Time*	*Value*
CO	8-hour	2.0 ppm
NO_2	Annual	60 µg/m3
PM_{10}	24-hour	91 µg/m3
SO_2	3-hour	233 µg/m3
	24-hour	136 µg/m3
	Annual	34 µg/m3

*CO values are representative of 2007 data. NO2 and SO2 values are based on data collected for the years 2001 – 2005. PM10 values are based on data collected for the years 2002 – 2004. The monitoring station for NO2 and SO2 and PM10 was located at IS 52 in the Bronx.

Existing Conditions

The results of the mobile source air quality modeling analysis under existing (2006) conditions are provided in Table 3.17-5. The values shown are the maximum CO concentrations estimated near each analysis site under the time frames that correspond to the NAAQS.

Table 3.17-5 Existing Conditions – Maximum 8-Hour CO Levels (2006)

Site #	*Analysis Site*	*8-hr CO Level (ppm)*	*Maximum Time Period*
1	East 125th Street & 2nd Avenue	3.5	SAT
2	East 125th Street & Madison Avenue	3.2	SAT
3	East 125th Street & Lenox Avenue	3.3	SAT
4	East 125th Street & AC Powell Boulevard	3.4	SAT

Notes: 1. Maximum results of all time periods analyzed.
2. All values include appropriate background concentration.
3. 8-hour CO background concentration = 2.0 ppm
Time Periods: AM peak period (7:45-8:45 AM); Midday peak period (12-1PM); PM peak period (5-6 PM)
SAT – PM weekend peak period (1-2 PM)

The results are summarized as follows:

- Carbon monoxide levels do not exceed the 8-hour CO standard of 9 ppm. The highest estimated concentration (4.4 ppm) occurs near the intersection of East 125th street and Second Avenue (Analysis Site #1) under the PM peak period.

Future Without the Proposed Action

A summary of the results of the mobile source air quality modeling analysis for the future without the proposed action in 2017 are provided in Table 3.17-6. The values shown are the maximum CO concentrations estimated near each analysis site under the time frames that correspond to the NAAQS.

Table 3.17-6 Future Without the Proposed Action – Maximum 8-Hour CO Levels (2017)

Site #	*Analysis Site*	*8-hr CO Level (ppm)*	*Maximum Time Period*
1	East 125th Street & 2nd Avenue	~~3.5~~ 3.1	SAT ~~PM~~
2	East 125th Street & Madison Avenue	~~3.1~~ 2.8	SAT ~~PM~~
3	East 125th Street & Lenox Avenue	~~3.1~~ 2.9	SAT ~~PM~~
4	East 125th Street & AC Powell Boulevard	3.1	SAT ~~PM~~

Notes: 1. Maximum results of all time periods analyzed.
2. All values include appropriate background concentration.
3. 8-hour CO background concentration = 2.0 ppm
Time Periods: AM peak period (7:45-8:45 AM); Midday peak period (12-1PM); PM peak period (5-6 PM)
SAT – PM weekend peak period (1-2 PM)

The results are summarized as follows:

- CO levels would not exceed the 8-hour standard at any of the analysis sites. The highest estimated concentration (3.6~~5~~ ppm) would occur near the intersection of East 125th Street and

Second Avenue (Analysis Site #1) under the PM peak period.

These results assume that the future year CO emission rates would be affected by decreases in future year emission factors due to increasing stringent emission control requirements and increases in traffic volumes due to anticipated increases in travel demand.

Future With the Proposed Action

A summary of the results of the mobile source air quality modeling analysis for the Future with the Proposed Action in 2017 is provided in Table 3.17-7. The values shown are the maximum CO concentrations increments estimated near each analysis site with the proposed action.

Table 3.17-7, 2017 Future With the Proposed Action – Maximum 8-Hour CO Levels

Site #	*Analysis Site*	*8-hr CO Level (ppm)*	*Maximum Time Period*
1	East 125th Street & 2nd Avenue	3.2	SAT
2	East 125th Street & Madison Avenue	3.054	SAT
3	East 125th Street & Lenox Avenue	3.1	SAT
4	East 125th Street & AC Powell Boulevard	3.3	SAT

Notes: 1. Maximum results of all time periods analyzed.
2. All values include appropriate background concentration.
3. 8-hour CO background concentration = 2.0 ppm
Time Periods: AM peak period (7:45-8:45 AM); Midday peak period (12-1PM);PM peak period (5-6 PM)
SAT – PM weekend peak period (1-2 PM)

The results of this analysis are summarized as follows:

- CO levels would not exceed the 8-hour standard at any of the analysis sites. The highest estimated 8-hour concentration (3.5 ppm) would occur near the intersection of East 125th Street and Second Avenue (Analysis Site #1) under the PM peak period.

  The highest project-generated CO increment would occur at the intersection of East 125th Street and ~~Adam Clayton Powell Boulevard~~ Lenox Avenue during the ~~PM~~ SAT peak period (increase of 0.2 ppm). The NYCDEP CO *de minimis* values would not be exceeded at this site or any other analysis site, indicating that the proposed action does not have the potential to cause CO impacts that are considered to be significant.

Parking Facilities Analysis

Pollutant concentrations could be affected near new parking facilities that could be built as part of the Proposed Action. To estimate the potential impacts from the emissions of these facilities, the two largest proposed underground parking garages that were located near the intersection which would accommodate the most project-generated traffic were selected for detailed analysis.

The largest facility would be a 258-space parking garage located at projected development site 9 along 125th Street between Frederick Douglass Boulevard and Adam Clayton Powell Boulevard. The second largest facility would be a 231-space parking garage located at projected development site 13 along 125th Street between Adam Clayton Powell Boulevard and Malcolm X Boulevard.

Because both garages would be used almost exclusively by gasoline-powered automobiles and not diesel-fueled trucks, CO was the only pollutant considered for this analysis. PM_{10} and $PM_{2.5}$ concentrations would not be materially affected by emissions from these facilities.

CO concentrations near the facility were estimated following the *CEQR Technical Manual* guidelines for a mechanically ventilated, enclosed garage. Pollutant concentrations were estimated at receptors (representative of a near and far sidewalk locations) located at 5 and 95 feet from the exhaust vents, with the assumed height of the vent a minimum of 10 feet above street level. An additional elevated receptor located above the vent on the near side of the street, was studied to determine potential impacts on residents at the development sites. The study analyzed one exhaust vent for each garage and the vent location was assumed to be located on the 125th Street side of each parking garage. These are conservative assumptions since 1) more than 1 vent would dilute pollutant emissions at a specific location, 2) 125th Street side would experience more traffic volume than 126th Street, and 3) contributions from emissions generated by 125th Street traffic under peak hour Build conditions could be added to these estimated concentrations to estimate the cumulative impacts of the garage and the corresponding street contribution.

This analysis was conducted for the 2017 analysis year, when this facility is anticipated to be in operation and for the PM peak period, when estimated garage emissions would be greatest because all of the exiting vehicles would be operating in the higher-polluting, cold-start mode.

The resulting maximum total 8-hour CO concentration (i.e., including background levels and street traffic contributions) predicted for any of the receptor sites are not estimated to cause or exacerbate the NAAQS of 9.0 ppm.

Table 3.17-8, 125th Street Rezone Garage Analysis Results*

	Near Receptor - South Side of 125th Street	Far Receptor– North Side of 125th Street	Elevated Near Receptor - South Side of 125th Street
Garage Site #	8-hr CO Impact (ppm)	8-hr CO Impact (ppm)	8-hr CO Impact (ppm)
9	5.9	3.7	6.4
13	6.2	3.8	6.8

* Results include contribution from on street traffic.

Particulate Matter

Project traffic data indicate the proposed project would induce a small number (less than nine heavy duty trucks per intersection) of heavy duty vehicles. A percentage of these heavy duty vehicles (approximately 30% based on MOBILE6.2 – registration data for the 2017 Build year) would actually be HDD vehicles. An additional, contribution of $PM_{2.5}$ would also result from automobile exhaust. To account for this, the NYCDEP has a procedure which determines the automobile equivalent of $PM_{2.5}$ emissions to HDD vehicle $PM_{2.5}$ emissions was used. For the proposed project, the procedure involves using the ratio of 2017 MOBILE6.2 Light Duty Gas Vehicle's (LDGV) emissions to 2017 MOBILE6.2 HDD vehicle emissions. The resulting emissions ratio would be approximately 4 to 1 (i.e., it would take approximately 4 autos to equal the $PM_{2.5}$ emissions equivalent of 1 HDD vehicle). Since the maximum number of induced autos at any of the studied intersections would be ~~299~~ 331, the equivalent number of HDD vehicle would be ~~67~~ 74.

When this result is combined with the actual number of induced HDD vehicles, the total number of equivalent project-generated HDD vehicles would not approach the 95 HDDV screening limit calculated for $PM_{2.5}$ and thus, combined with the fact that here are very few project induced trucks, both $PM_{2.5}$ and PM_{10} from mobile sources are not pollutants of concern for this project.

3.17.2 ANALYSIS OF PROJECT-GENERATED HEATING SYSTEM EMISSIONS

Introduction

The primary issues with regard to fuel combustion sources associated with HVAC systems include (1) the impact of HVAC systems from proposed (i.e., projected and potential) development sites on existing buildings; (2) the impact of HVAC systems from projected and potential development sites on other projected and potential development sites; and (3) the impact of existing commercial, institutional, or large-scale residential developments on projected and potential development sites.

With regard to item one, since some projected and potential developments are shorter than existing nearby buildings (and thus emissions from a projected development site could potentially enter open windows or vent locations of an existing building), an analysis of the potential impacts of the HVAC emissions of the projected and potential development sites on existing buildings was conducted using the *2001 CEQR Technical Manual* procedures. The potential air quality impacts associated with item two above was addressed using screening analysis and/or detailed modeling procedures, as discussed below.

With regard to item three, a field examination determined that several of the existing buildings along the project corridor could potentially impact projected and potential developments. The results of an air quality analysis conducted to evaluate the potential impacts of these sources on projected and potential development sites are presented below.

In addition to estimating potential impacts from individual HVAC systems, the potential impacts from the combined emissions of multiple project-related HVAC sources with similar stack heights that are located near each other were also analyzed to determine the potential impact from the combined effects of the HVAC emissions on nearby proposed/potential development sites. Sites analyzed for potential cumulative impacts are shown in Figure 3.17-2. The analysis was performed in the same manner described for the individual HVAC sites except that after the emissions generated by the individual buildings within each cluster were calculated (based on floor area), a screening-level analysis was conducted using a single representative stack located in the approximate geographic center of each cluster as the emission source and estimated pollutant concentrations on nearby projected and potential development sites.

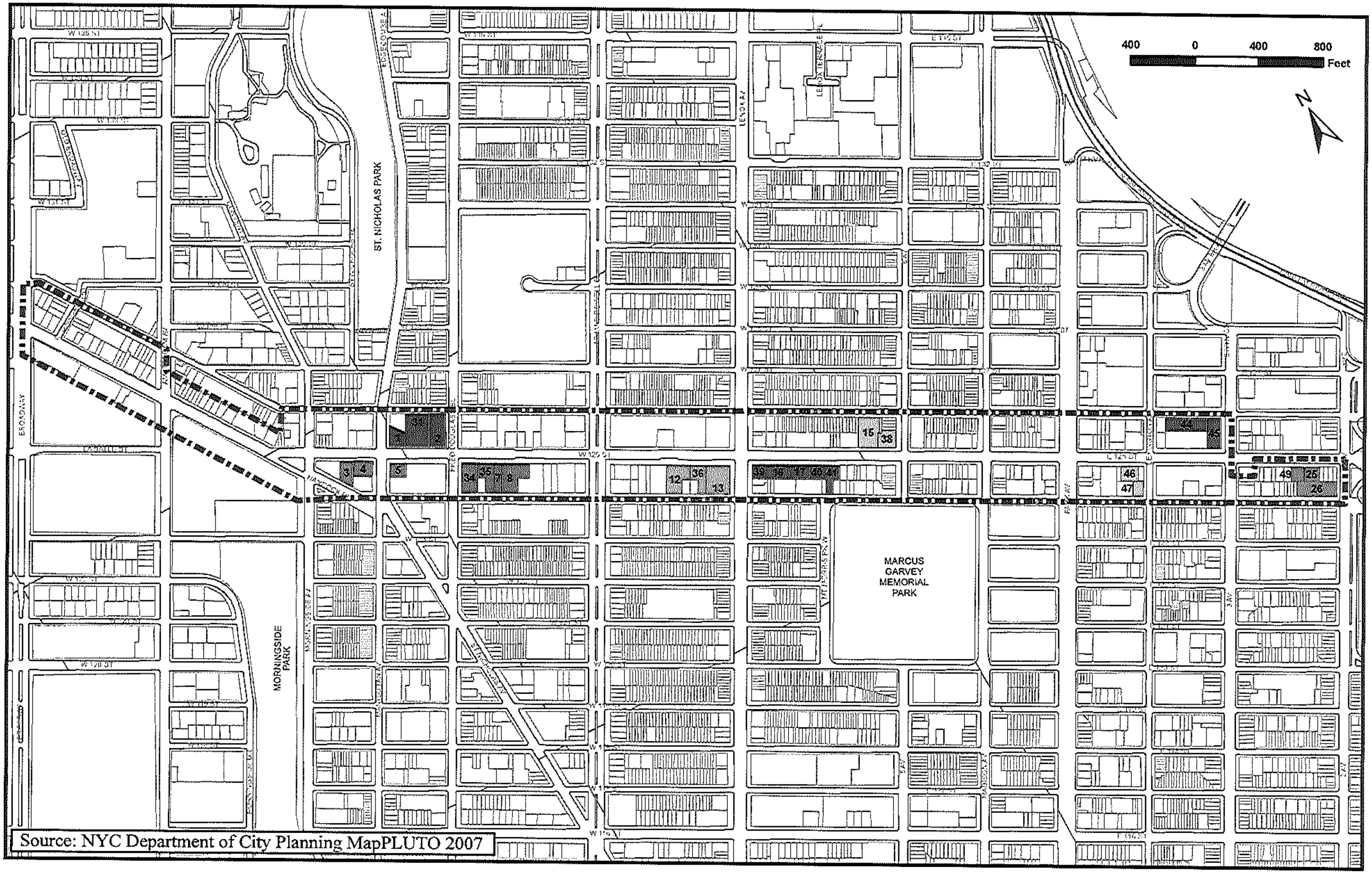
Analyses assumed that all projected and potential development sites under each scenario would be built, thereby maximizing potential HVAC system emissions.

Methodology

Emissions from the heating (and hot water) systems of existing and projected and potential development sites may affect air quality levels at other nearby buildings. Potential impacts would be a function of fuel type, stack height, size of development, and location of the emission sources relative to the nearby buildings. Fuel uses may include oil or natural gas for space heating and hot water, and natural gas for cooking. Since the fuel types that would supply heat and hot water to the new developments have not been determined, analyses were conducted conservatively assuming that Nos. 2,or 4 fuel oil or natural gas would be used.

Each projected and potential development site was evaluated and all nearby projected or potential residential developments of similar or greater height were considered as potential sensitive receptor sites. If the distance from a projected and potential development to the nearest building of similar or greater height would be less than the threshold distance provided in the *2001 CEQR Technical Manual*, there is a potential for significant air quality impact, and a detailed dispersion modeling analysis was conducted. Otherwise, the source passes the screening analysis, and no further analysis is required.

The maximum projected and potential development floor area of each site under each development scenario was used as input for the screening analysis. The average size of each new dwelling unit was assumed to be 900 square feet. It was assumed that all stacks would be located 3 feet above roof height (as per the *2001 CEQR Technical Manual*). If a source did not pass the CEQR screen, more detailed atmospheric dispersion analyses using USEPA's AERMOD model were conducted.



Legend

Proposed Rezoning Area

Cluster Analysis Sites

- Cluster 1 (1,31,2)
- Cluster 2 (3,4,5)
- Cluster 3 (34,35,7,8)
- Cluster 4 (12,33,36)
- Cluster 5 (16,17,39,40,41)
- Cluster 6 (15,38)
- Cluster 7 (46,47)
- Cluster 8 (44,45)
- Cluster 9 (25,26,49)

Figure 3.17-2 - Potential Cumulative Impact Sites

125th Street Corridor Rezoning and Related Actions EIS

NYC Department of City Planning

Screening-Level Analysis

An analysis was conducted to determine whether any of the projected and potential development sites would have the potential to significantly impact air quality levels at any of the other nearby projected and potential development sites (i.e., project-on-project impacts). The *2001 CEQR Technical Manual* provides a nomographic procedure that was used to determine the threshold distance between projected and potential development site heated by oil or natural gas and nearby projected and potential development site of similar or greater heights, based on the square footage and height of the building (provided that the buildings are at least 30 feet apart) for a potential impact to occur.

The following procedures were conducted:

- Figures 3Q-5 through 3Q-10 of the 2001 *CEQR Technical Manual Appendix* were used as a first screening to determine potential for significant SO_2 (i.e., the critical pollutant for facilities burning fuel oil) and NO_x (i.e., the critical pollutant for facilities burning natural gas) impacts.
- The estimated maximum size of each building was plotted on the nomograph against the distance to the potentially affected nearby taller building.
- Using the nomograph, the threshold distance at which a potentially significant impact is likely to occur was estimated for each fuel type and compared to the distance of the affected building.
- If the distance between buildings was greater than the threshold distance indicated on the nomograph, no potentially significant impact is anticipated, and no detailed analysis was conducted.
- If it is determined that for certain fuel types, the distance between buildings was less than the threshold distance indicated on the nomograph, a potentially significant impact is possible, and a more detailed analysis was provided.
- The more detailed analysis involved the use of table 3Q-3 from the 2001 *CEQR Technical Manual Appendix* to determine potential for significant SO_2 and PM_{10} (i.e., the critical pollutants for facilities burning fuel oil) as well as NO_x (i.e., the critical pollutant for facilities burning natural gas) impacts. This approach assumes a minimum distance between the exhaust vent and adjoining buildings of 30 feet. It used calculated emission rates and a conservative building height parameter to predict pollutant concentrations.
- If the predicted concentration was less than the NAAQS, significant impacts would be unlikely and no detailed dispersion modeling analysis was conducted.
- If the predicted concentration was greater than the NAAQS, a potentially significant impact is possible, and a detailed dispersion modeling analysis was conducted.

Detailed Analysis

Detailed dispersion modeling analyses using USEPA's AERMOD model were conducted for those projected and potential development sites that failed CEQR screening analysis or if the distance between the vent stack and the proposed buildings is less than 30 feet (adjacent properties). AERMOD is a versatile model capable of predicting pollutant concentrations from continuous point, area, and volume sources. AERMOD uses enhanced plume and wake dispersion algorithms that are capable of estimating pollutant concentrations in a building's cavity and wake regions. The AERMOD model was used to estimate pollutant concentrations with downwash effects on plume dispersion incorporated.

Three pollutants emitted from fuel oil and/or natural gas combustion -- SO_2, NO_x, and PM_{10} -- were considered. Short-term (3hr & 24 hr) and long-term (i.e., annual average) concentrations of SO_2, NO_x, and PM_{10} were estimated.

The following dispersion modeling options and assumptions were applied:

- Emissions would be released through a single stack located at the edge of building closed to the nearest taller building; and
- A conservative set of default values (stack exhaust temperature of $293^{O}K$, velocity of 0.001 m/s and a stack diameter of 0.0 m) were used (unless otherwise indicated), as recommended by the *2001 CEQR Technical Manual.*

Emission Rates

Emission rates were estimated as follows:

- A fuel consumption rate for each proposed or projected residential / commercial building was estimated using fuel consumption tables found in the 2001 *CEQR Technical Manual.* These factors were then multiplied by the square footage of the projected and potential development sites to estimate total gallons of fuel consumed annually.
- When available, daily values were divided by 24 to obtain hourly values for use in the short-term dispersion analysis, and
- Average annual pollutant emission rates were estimated, as recommended in 2001 *CEQR Technical Manual*, by dividing the total amount of pollution estimated to be emitted in a year by the number of hours in one year (8,760 hours).

Emission factors were obtained from USEPA's "Compilation of Air Pollutant Emission Factors" (AP-42), assuming fuel oil Nos. 2 and 4, with sulfur contents of 0.2 percent, would be used to heat the new buildings. It was conservatively assumed that all emissions of NO_X released from the stack would be in form of NO_2 at the receptor sites.

Coordinate System and Receptors

A GIS coordinate system was utilized that included the location of each stack on the roof of an affected building and nearby elevated receptors. Because highest impacts would occur along the level of the plume centerline at approximately the height of the stack, elevated receptors were placed at varying elevations. It was assumed that all nearby taller buildings would have operable windows at these levels and were therefore considered as potential sensitive receptor sites.

Meteorology

The latest five years of meteorological data from La Guardia Airport was used for the years 2000 through 2004.

Background Values

Background concentrations (i.e., pollutant levels from other sources in the study area) for the pollutants of concern were obtained from the NYCDEP and based on the latest monitoring data collected by the NYSDEC. These values, which are provided in Table 3.17-4 above, were added to estimate project impacts, and the resulting total concentrations were compared with appropriate NAAQS.

Stationary Source Analysis

Project-on-Project Impacts

A total of forty-eight ~~forty-nine~~ (~~49~~ 48) projected and potential development sites were considered for this analysis. These developments are anticipated to range from 18 to 264 dwelling units, with lot sizes ranging from approximately 5,000 to 60,000 square feet, and total floor area ranging from approximately 20,184 to 602,520 square feet.

An analysis was conducted to determine whether any of the projected and potential development sites would have the potential to significantly impact air quality levels at any of the other nearby projected and potential development sites (i.e., project-on-project impacts). Table 3.17-8 provides a list of the projected and potential development sites, and the results of the screening analysis.

Screening analysis results from Table 3.17-8 indicate that

- No. 4 Oil
  Of the ~~49~~ 48 projected and potential development sites associated with this scenario, thirteen sites passed, six sites failed and thirty sites require a minimum distance to pass the screening using the CEQR Technical Manual nomographs as indicated in Table 3.17-8.

- No. 2 Oil
  Of the ~~49~~ 48 projected and potential development sites associated with this scenario, thirteen sites passed, five sites failed and thirty-one sites require a minimum distance to pass the

screening using the CEQR Technical Manual nomographs as indicated in Table 3.17-8.

- Natural Gas

Of the ~~49~~ 48 projected and potential development sites associated with this scenario, thirteen sites passed, one site failed and thirty-five sites require a minimum distance to pass the screening using the CEQR Technical Manual nomographs as indicated in Table 3.17-8.

For those sites which were unable to pass the initial screening using fuel oil, a more detailed assessment using the *CEQR Technical Manual* industrial source screening process was used for No. 2 and No 4 fuel oil as indicated in CEQR Technical Manual Appendices 7 and 8. The results of the assessment indicated that sites 7, 35, 36, 40 and ~~49~~ 48 would fail and thus would have to be analyzed in detail for natural gas. Site 17 also failed the industrial source assessment for No. 4 fuel but passed the CEQR nomograph screening for No. 2 fuel oil (The E designation for site 17 using No. 2 fuel oil is described below and referenced in Table 3.17-10).

Detail Analysis

As a result, sites 7, 35, 36, 40 and 49 were studied in detail using the USEPA's AERMOD model, utilizing the standard CEQR Technical Manual parameters assumptions for stationary source analysis with the AERMOD model (stack exit velocity of 0.001 m/s and a stack diameter of 0.0 m). The results of this analysis indicated that when using natural gas, emissions from the development sites would not result in air quality impacts to neighboring developments sites. E designations restricting the location of the exhaust vent are recommended. The results are shown in Table 3.17-9.

Table 3.17-9, Air Quality Impacts: Summary of Maximum Predicted NO_2 Concentrations

Site #	Averaging Period	Background Concentration (µg/m3)	Maximum Predicted Concentration (µg/m3)	Maximum Predicted Total Concentration (µg/m3)	NAAQS (µg/m3)
7	Annual	60	5.6	65.6	100
17	Annual	60	17.1	77.1	100
35	Annual	60	17.7	77.7	100
36	Annual	60	17.9	77.9	100
40	Annual	60	18.7	78.7	100
49	Annual	60	3.9	63.9	100

The result of this analysis is that the proposed build scenario, with its (E) designation, would cause no violations of the NAAQS, and would have no significant adverse environmental impacts on air quality at all development sites.

Table 3.17-10, Results of HVAC Source Impact Analysis for Projected and Potential Sites Under the Reasonable Worst Case Development Scenario[6]

HVAC Source ID	CEQR Technical Manual Screening Results for No. 4 Fuel Oil – Minimum Required Distance (feet) From Edge of Roof [1]	CEQR Technical Manual Screening Results for No. 2 Fuel Oil – Minimum Required Distance (feet) From Edge of Roof [2]	CEQR Technical Manual Screening Results for Natural Gas – Minimum Required Distance (feet) From Edge of Roof [3]	CEQR Technical Manual Industrial Source Analysis Results for No. 4 Fuel Oil – Minimum Required Distance (feet) From Edge of Roof [4]	CEQR Technical Manual Industrial Source Analysis Results for No. 2 Fuel Oil – Minimum Required Distance (feet) From Edge of Roof [4]	Detailed AERMOD Results for Natural Gas – Minimum Required Distance (feet) From Edge of Roof [5]
1	54	43	33	NA	NA	NA
2	84	65	54	NA	NA	NA
3	70	55	40	NA	NA	NA
4	55	43	32	NA	NA	NA
5	Pass	Pass	Pass	-	-	-
6	Pass	Pass	Pass	-	-	-
7	Fail	Fail	Fail	Fail	Fail	11
8	100	82	65	NA	NA	NA
9	Pass	Pass	Pass	-	-	-
10	156	130	~~104~~ 59	NA	NA	NA
11	Pass	Pass	Pass	-	-	-
12	95	78	62	NA	NA	NA
13	117	93	70	NA	NA	NA
14	Pass	Pass	Pass	-	-	-
15	88	71	52	NA	NA	NA
16	72	59	48	NA	NA	NA
17	Fail	53	46	Fail	NA	27
18	53	45	32	NA	NA	NA
19	76	56	47	NA	NA	NA
20	39	30	28	NA	NA	NA
21	149	122	~~99~~ 56	NA	NA	NA
22	Pass	Pass	Pass	-	-	-
23	Pass	Pass	Pass	-	-	-
24	Pass	Pass	Pass	-	-	-
25	62	54	39	NA	NA	NA
26	95	79	58	NA	NA	NA

27	Pass	Pass	Pass	-	-	-
28	Pass	Pass	Pass	-	-	-
29	Pass	Pass	Pass	-	-	-
30	Pass	Pass	Pass	-	-	-
31	113	91	70	NA	NA	NA
32	93	79	56	NA	NA	NA
33	79	63	47	NA	NA	NA
34	70	56	46	NA	NA	NA
35	Fail	Fail	47	Fail	Fail	13
36	Fail	Fail	48	Fail	Fail	16
37	Pass	Pass	Pass	-	-	-
38	62	49	39	NA	NA	NA
39	62	46	35	NA	NA	NA
40	Fail	Fail	33	Fail	Fail	20
~~41~~	~~66~~	~~53~~	~~46~~	~~NA~~	~~NA~~	~~NA~~
42	65	50	40	NA	NA	NA
43	83	66	51	NA	NA	NA
44	93	66	56	NA	NA	NA
45	71	59	47	NA	NA	NA
46	65	50	40	NA	NA	NA
47	50	43	28	NA	NA	NA
48	165	133	~~93~~ 65	NA	NA	NA
49	Fail	Fail	30	Fail	Fail	26

1) For sites that pass the CEQR screening for No. 4 fuel oil, the minimum distance for which the source would pass the CEQR Technical Manual screening nomograph procedures was provided. The following (E) designation would be placed on these development sites: Any new development on the property must use No. 4 fuel oil and locate the HVAC stack no closer to the edge of roof than the distance indicated.
2) For sites that pass the CEQR Technical Manual screening for No. 2 fuel oil, the minimum distance for which the source would pass the CEQR Technical Manual screening nomograph procedures was provided. The following (E) designation would be placed on these development sites: Any new development on the property must use No. 2 fuel oil and locate the HVAC stack no closer to the edge of roof than the distance indicated.
3) For sites that pass the CEQR Technical Manual screening for natural gas, the minimum distance for which the source would pass the CEQR Technical Manual screening nomograph procedures was provided. The following (E) designation would be placed on these development sites: Any new development on the property must use natural gas and locate the HVAC stack no closer to the edge of roof than the distance indicated.
4) For sites that failed the CEQR Technical Manual screening procedures for No. 4 and No. 2 fuel oil, a CEQR Technical Manual Industrial Source screen was performed.
5) For sites that failed the CEQR Technical Manual Industrial Source screen for No. 4 and No. 2 fuel oil, a detailed AERMOD analysis was performed for natural gas. For sites that pass the detailed AERMOD analysis for natural gas, the minimum distance for which the source would pass was provided. The following (E) designation would be placed on these development sites: Any new development on the property must use natural gas and locate the HVAC stack no closer to the edge of roof than the distance indicated.
6) Site 41 has been remover as a potential site, due to a new proposal since the DEIS for the village Academies School (see Chapter 3.1).

To avoid the potential for significant adverse air quality impacts related to HVAC emissions, an (E) designation for air quality would be incorporated into the rezoning proposal for each of the following properties:

Block 1952; Lots 19, 21, 22 (Site 1)

Block 1952; Lot 29 (Site 2)
Block 1951; Lot 7 (Site 3)
Block 1951; Lot 51 (Site 4)
Block 1930; Lot 55 (Site 7)
Block 1930; Lots 49, 50, 51, 53 (Site 8)
Block 1910; Lots 1, 7501 (Site 10)
Block 1909; Lots 44, 46 (Site 12)
Block 1909; Lots 26, 27, 28, 29, 30, 31, 32, 38, 39, 129 (Site 13)
Block 1723; Lots 31, 45, 144 (Site 15)
Block 1722; Lots 63, 65, 66, 67, 68, 168 (Site 16)
Block 1722; Lots 58, 59, 60, 61, 62 (Site 17)
Block 1750; Lots 28, 29, 30, 44 (Site 18)
Block 1750; Lots 40, 34 (Site 19)
Block 1749; Lots 48, 49 (Site 20)
Block 1749; Lots 24, 31, 33, 35, 40, 43 (Site 21)
Block 1789; Lot 30 (Site 25)
Block 1789; Lots 16, 18, 19, 20, 21, 22, 23, 24, 25, 121 (Site 26)
Block 1952; Lots 23, 25, 27, 28, 37, 38, 41, 138 (Site 31)
Block 1931; Lots 56, 61, 63, 64 (Site 32)
Block 1931; Lot 1 (Site 33)
Block 1930; Lot 1 (Site 34)
Block 1930; Lots 59, 57 (Site 35)
Block 1909; Lots 24, 25, 40, 41, 42, 140 (Site 36)
Block 1723; Lots 33, 37 (Site 38)
Block 1722; Lots 69, 168 (Site 39)
Block 1722; Lots 55, 56, 57, 155, 156 (Site 40)
Block 1722; Lot 51 (Site 41)
Block 1774; Lot 68 (Site 42)
Block 1774; Lots 5, 6, 7, 8, 65, 66, 67 (Site 43)
Block 1774; Lot 48 (Site 44)
Block 1774; Lot 33 (Site 45)
Block 1773; Lots 58, 61 (Site 46)
Block 1773; Lots 15, 17, 18 (Site 47)
Block 1773; Lot 20 (Site 48)
Block 1789; Lots 34, 35, 36 (Site 49)

The text for the (E) designations is as follows:

Block 1952, Lots 19, 21, 22 (Projected Development Site 1)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 54 and 43 feet for Oil No. 4 and Oil No. 2 from the lot lines, or use Natural Gas as the type

of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1952, Lot 29 (Projected Development Site 2)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 84 and 65 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1951, Lot 7 (Potential Development Site 3)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 70 and 55 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1951, Lot 51 (Projected Development Site 4)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 55 and 43 feet for Oil No. 4 and No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1930, Lot 55 (Projected Development Site 7)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning systems (HVAC) use Natural Gas as the type of fuel for space heating and hot water, to avoid any potential significant adverse air quality impacts.

Block 1930, Lots 49, 50, 51, 53 (Potential Development Site 8)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 100 and 82 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1910, Lots 1, 7501 (Projected Development Site 10)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 156, 130 and 59 feet for Oil No. 4, Oil No.2 and Natural Gas from the lot lines as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

<u>Block 1909, Lots 44, 46 (Projected Development Site 12)</u>
<u>Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 95 and 78 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.</u>

<u>Block 1909, Lots 26, 27, 28, 29, 30, 31, 32, 38, 39, 129 (Potential Development Site 13)</u>
<u>Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 117 and 93 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.</u>

<u>Block 1723, Lots 31, 45, 144 (Projected Development Site 15)</u>
<u>Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 88 and 71 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.</u>

<u>Block 1722, Lots 63, 65, 66, 67, 68, 168 (Projected Development Site 16)</u>
<u>Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 72 and 59 feet for Oil No. 4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.</u>

<u>Block 1722, Lots 58, 59, 60, 61, 62 (Potential Development Site 17)</u>
<u>Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 53 feet for Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.</u>

<u>Block 1750, Lots 28, 29, 30, 44 (Projected Development Site 18)</u>
<u>Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 53 and 45 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.</u>

Block 1750, Lots 40, 34 (Projected Development Site 19)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 76 and 56 feet for Oil No. 4 and No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1749, Lots 48, 49 (Projected Development Site 20)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 39 and 30 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1749, Lots 24, 31, 33, 35, 40, 43 (Projected Development Site 21)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 149, 122 and 56 feet for Oil No.4, Oil No. 2 and Natural Gas from the lot lines as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1789, Lot 30 (Projected Development Site 25)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 62 and 54 feet for Oil No. 4 and No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1789, Lots 16, 18, 19, 20, 21, 22, 23, 24, 25, 121 (Projected Development Site 26)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 95 and 79 feet for Oil No. 4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1952, Lots 23, 25, 27, 28, 37, 38, 41, 138 (Potential Development Site 31)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 113 and 91 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1931, Lots 56, 61, 63, 64 (Potential Development Site 32)

Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 93 and 79 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1931, Lot 1 (Potential Development Site 33)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 79 and 63 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1930, Lot 1 (Potential Development Site 34)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 70 and 56 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1930, Lots 59, 57 (Potential Development Site 35)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning systems (HVAC) use Natural Gas as the type of fuel for space heating and hot water, to avoid any potential significant adverse air quality impacts.

Block 1909; Lots 24, 25, 40, 41, 42, 140 (Potential Development Site 36)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning systems (HVAC) use Natural Gas as the type of fuel for space heating and hot water, to avoid any potential significant adverse air quality impacts.

Block 1723, Lots 33, 37 (Potential Development Site 38)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 62 and 49 feet for Oil No.4 and oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1722, Lots 69, 168 (Potential Development Site 39)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 62 and 46 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of

fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1722, Lots 55, 56, 57, 155, 156 (Potential Development Site 40)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning systems (HVAC) use Natural Gas as the type of fuel for space heating and hot water, to avoid any potential significant adverse air quality impacts.

~~Block 1722, Lot 51 (Potential Development Site 41)~~
~~**Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 66 and 53 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.**~~

Block 1774, Lot 68 (Potential Development Site 42)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 65 and 50 feet for Oil No. 4 and No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1774, Lots 5, 6, 7, 8, 65, 66, 67 (Potential Development Site 43)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 83 and 66 for Oil No 4 and No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1774, Lot 48 (Potential Development Site 44)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 93 and 66 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1774, Lot 33 (Potential Development Site 45)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 71 and 59 feet for Oil No. 4 and No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1773, Lots 58, 61 (Potential Development Site 46)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 65 and 50 feet for Oil No. 4 and Oil No.2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1773, Lots 15, 17, 18 (Potential Development Site 47)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 50 and 43 feet for Oil No.4 and Oil No. 2 from the lot lines or use Natural Gas as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1773, Lot 20 (Potential Development Site 48)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning stack(s) are located at least 165, 133 and 65 feet for Oil No. 4, Oil No. 2 and Natural Gas from the lot lines as the type of fuel for space heating and hot water (HVAC) systems, to avoid any potential significant adverse air quality impacts.

Block 1789, Lots 34, 35, 36 (Potential Development Site 49)
Any new residential and/or commercial development on the above-referenced properties must ensure that the heating, ventilating and air conditioning systems (HVAC) use Natural Gas as the type of fuel for space heating and hot water, to avoid any potential significant adverse air quality impacts.

With the placement of the (E) designations on the above blocks and lots, no impacts related to stationary source air quality would be expected.

Cumulative Impacts from HVAC Sources

Many of the projected development sites are within close proximity to one another and therefore their HVAC emissions could have a cumulative effect on other nearby individual projected development sites. As a result, nine projected development site clusters (i.e. projected development sites in close proximity to one another and having similar heights) were identified. These clusters, described below and shown in Figure 3.17-2, were evaluated to determine the potential impact from the combined effects of the HVAC emissions from buildings on nearby proposed and potential development sites.

- Cluster #1: development sites 1, 2 & 31 – comprising total floor area of 419,126 square feet with a stack height of approximately 120 feet;

- Cluster #2: development sites 3, 4 and 5 – comprising a total floor area of 206,743 square feet with a stack height of approximately 120 feet;
- Cluster #3: development sites 7, 8, 34 and 35 – comprising a total floor area of 501,255 square feet with a stack height of approximately 160 feet;
- Cluster #4: development sites 12, 13 and 36 – comprising a total floor area of 543,641 square feet with a stack height of approximately 160 feet;
- Cluster #5: development sites 16, 17, 39, 40 and 41 – comprising a total floor area of 460,132 square feet with a stack height of approximately 160 feet;
- Cluster #6: development sites 15 and 38 – comprising a total floor area of 153,024 square feet with a stack height of approximately 80 feet;
- Cluster #7: development sites 46 and 47 – comprising a total floor area of 124,389 square feet with a stack height of approximately 120 feet;
- Cluster #8: development sites 44 and 45 – comprising a total floor area of 259,414 square feet with a stack height of approximately 120 feet;
- Cluster #9: development sites 25, 26 and 49 – comprising a total floor area of 301,998 square feet with a stack height of approximately 120 feet;

Using the CEQR nomograph screening procedure (assuming that the stack for the cluster was located in its approximate center) the results of the analysis indicated that there would be no potential air quality impacts of combined emissions from these HVAC clusters, using No. 4 fuel oil.

<u>Impacts from Proposed HVAC Sources on Existing Buildings</u>

With respect to the impact the proposed action would have on existing buildings, there are only three projected development sites that would be shorter than the nearby existing buildings. These are potential development site 32 which could affect the 14 story Saint Nicholas Houses, projected development site 24 which could affect the 35-story Taino Towers and projected development site 26 which could affect both the 35-story Taino Towers and 16-story Wagner Houses. Using the CEQR nomograph procedure it was determined that none of the proposed buildings would impact the nearby taller existing buildings. Therefore, impacts on existing buildings from proposed buildings are unlikely to occur.

<u>Potentially Significant Existing Emission Sources</u>

An examination of existing buildings located within 400 feet of any of the proposed development sites identified the following potentially significant HVAC combustion sources in the study area: the 14-story Saint Nicholas Houses in the proximity to the potential development site 32, the 35-story Taino Towers building complex in the proximity of projected development sites 24 and 26, and the 16-story Wagner Houses building complex in the proximity to the project development site 26.

A screening-level analysis was conducted using the CEQR nomographic procedure to evaluate the potential impacts from these existing large combustion sources on the affected development sites. The result of this analysis is that emissions from existing large combustion sources would not significantly impact any of the projected and potential development sites.

An additional field examination confirmed that there was no large industrial emission source (e.g., power plant, co-generation facility, etc) located within 1,000 feet of any of the projected and potential development sites.

MTA Bus Depots - 126th Street / Second Avenue & 128th Street / Amsterdam Avenue

Project field surveys identified two MTA bus depots located at 126th Street / Second Avenue & 128th Street / Amsterdam Avenue. Based on emissions data obtained from the MTA, a detailed analysis using USEPA's AERMOD was conducted to determine the potential impact that the two bus depots could have on the proposed developments. According to the MTA, pollutant emissions would result from bus exhaust within the depot and space heating. No spray booths or other painting activities were indicated by the MTA at these sites. Natural gas is used for the space heating and the overwhelming majority of buses would be using diesel fuel. Consequently, a detailed analysis was conducted for PM_{10} (resulting from bus exhaust) and NO_2 (resulting from space heating) for each of the garages. MTA estimates of yearly pollutant emissions for NO_2 and PM_{10} would be 13,238 and 703 lbs, respectively. Emissions from both depots would be similar. The results of the modeling analysis indicate that there would be no exceedances of the NAAQS for NO_2 or PM_{10} at any of the proposed development sites from those sources. Therefore, there would be no significant adverse impact from the pollutant emissions of the two MTA bus depots.

3.17.3 ANALYSIS OF AIR TOXICS

Introduction

This section addresses potential impacts from existing toxic emission sources on the future residential development sites along the 125th Street corridor. These emissions are of concern because a large portion of the proposed action would include the development of residential uses. As a result, emissions of toxic pollutants from the operation of these existing facilities may result in pollutant concentrations that could affect the action's projected and potential residential/commercial uses.

The following procedures were used to estimate the potential air quality impacts of these toxic emissions:

- To ensure that the air toxics analysis included existing sources with the most potential to affect the proposed action, an analysis zone within approximately 1000 feet of all of the projected and potential residential / commercial sites was selected;

- Air permits for all facilities within the analysis zone were acquired from the NYSDEC, NYCDEP or USEPA Envirofacts databases. A review of these permits along with a separate field review of potential existing sites not included in any database was conducted; and
- Dispersion analyses were conducted to determine the potential of the toxic emissions released from the permitted emission sources to adversely affect the new residential / commercial areas.

Permit Information

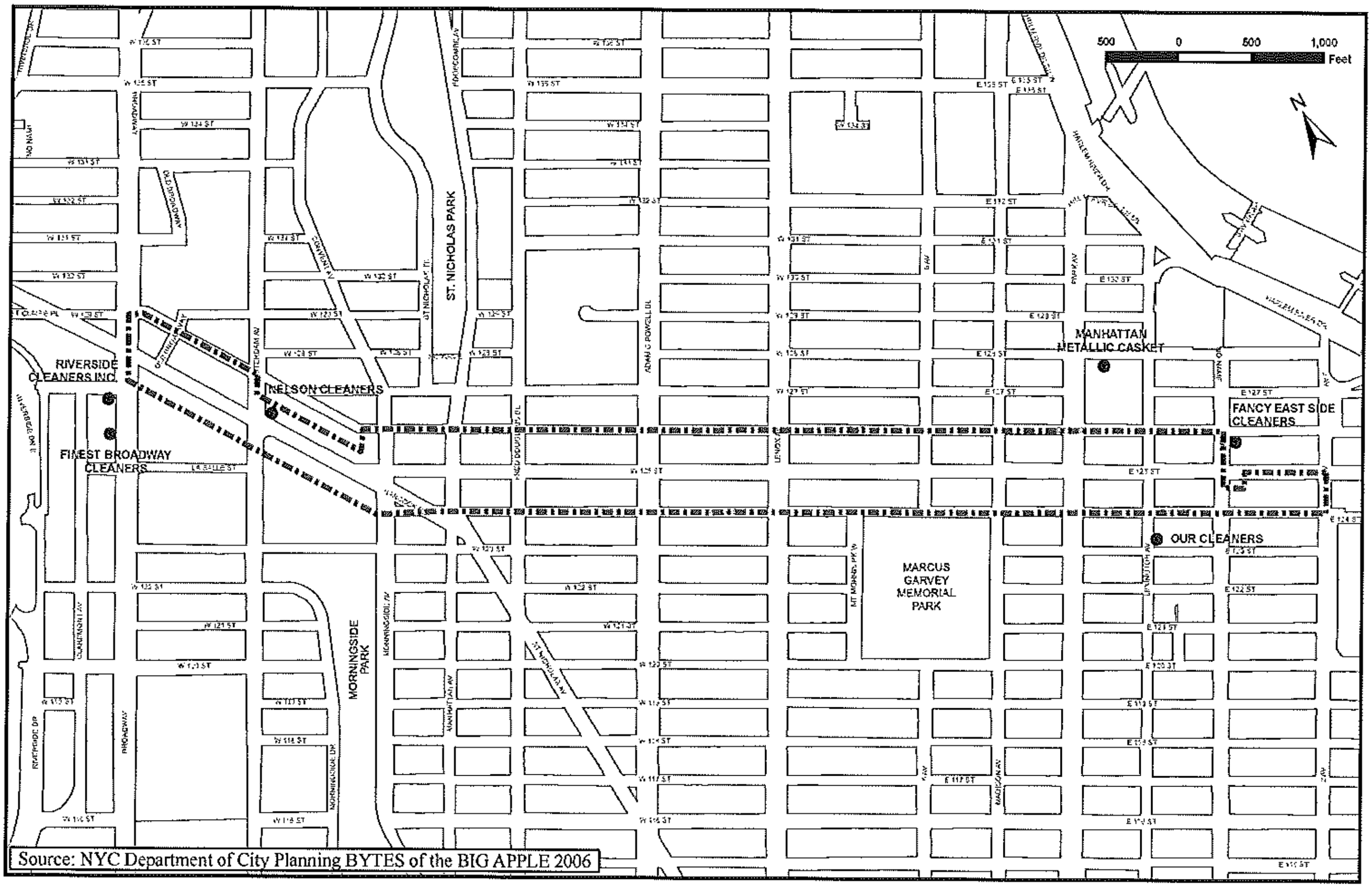
Information on emission data for the manufacturing and industrial facilities with air toxics within the study area were developed as follows:

- NYSDEC's Air Guide-1 (AG-1), which includes a database with information on all facilities in the state that have an air quality permit (as of 1996), was searched to identify facilities located within the area that had received state air quality permits.
- The NYCDEP Bureau of Environmental Compliance's (BEC) files of current air quality permits for all facilities operating within the air toxics study area were examined.

The information on the NYCDEP permits (e.g., pollutant emission rates and stack parameters) is considered to be the most current and comprehensive, and served as the primary basis of data for this analysis. The following information was obtained from these permits"

- A total of 14 locations in and around the 125th Street corridor were identified as potential emission sources.
- Eight facilities were for operations that were canceled, had ceased operations, or are no longer engaged in operations that would require a permit. These facilities were omitted from further consideration.
- The six (6) remaining facilities, which consist of one industrial site (Manhattan Metallic Casket) and five dry cleaning operations emit three different toxic pollutants (tetrachloroethylene, particulates and toluene.) Of these pollutants, only tetrachloroethylene is identified by the USEPA as a carcinogen.

Figure 3.17-3 provides the locations of the six facilities considered in the detailed analysis.



Legend

Air Toxic Facility Location

Proposed Rezoning Area

Figure 3.17-3 - Air Toxic Facilities

125th Street Corridor Rezoning and Related Actions EIS

NYC Department of City Planning

Analysis

A dispersion modeling analysis was conducted to determine whether the currently operating permitted facilities within the air toxics study area would have the potential to adversely affect the sensitive analysis sites. USEPA's conservative screening model SCREEN3 was used to predict NYSDEC Annual Guideline Concentrations (AGC) and Short-term Guideline Concentrations (SGC) resulting from operations at the Manhattan Metallic Casket Company. To predict concentrations of the remaining five dry cleaning facilities, USEPA's AERMOD was utilized.

Results

The result of the air toxic analysis is that no exceedance of an NYSDEC SGC or an AGC acceptable limit was predicted at any of the proposed development sites, and that the total hazard index impact of the non-carcinogenic air toxics pollutants emitted from all of sources combined is 7.48×10^{-2}, which is well below the level of 1.0 that is considered by USEPA to be significant. In addition, the one carcinogen emitted by the identified facilities, tetrachloroethylene would result in a cancer threshold risk of 9.15×10^{-7} which is below the USEPA acceptable risk value of one in one million (i.e., 1.0×10^{-6}).

CONCLUSION

The result of the air quality analysis is that the proposed action would not cause or exacerbate an exceedance of an air quality standard nor cause the exceedance of a significant impact criterion. This conclusion assumes that an (E) designation for HVAC systems would be placed on thirty-six projected and potential development sites with the specified requirements detailed above, which would preclude the potential for significant adverse air quality impacts. As such, the proposed action would not cause significant adverse air quality impacts.

Analysis

A dispersion modeling analysis was conducted to determine whether the currently operating permitted facilities within the air toxics study area would have the potential to adversely affect the sensitive analysis sites. USEPA's conservative screening model SCREEN3 was used to predict NYSDEC Annual Guideline Concentrations (AGC) and Short-term Guideline Concentrations (SGC) resulting from operations at the Manhattan Metallic Casket Company. To predict concentrations of the remaining five dry cleaning facilities, USEPA's AERMOD was utilized.

Results

The result of the air toxic analysis is that no exceedance of an NYSDEC SGC or an AGC acceptable limit was predicted at any of the proposed development sites, and that the total hazard index impact of the non-carcinogenic air toxics pollutants emitted from all of sources combined is 7.48×10^{-2}, which is well below the level of 1.0 that is considered by USEPA to be significant. In addition, the one carcinogen emitted by the identified facilities, tetrachloroethylene would result in a cancer threshold risk of 9.15×10^{-7} which is below the USEPA acceptable risk value of one in one million (i.e., 1.0×10^{-6}).

CONCLUSION

The result of the air quality analysis is that the proposed action would not cause or exacerbate an exceedance of an air quality standard nor cause the exceedance of a significant impact criterion. This conclusion assumes that an (E) designation for HVAC systems would be placed on thirty-six projected and potential development sites with the specified requirements detailed above, which would preclude the potential for significant adverse air quality impacts. As such, the proposed action would not cause significant adverse air quality impacts.

APPENDIX C

HVAC System Specifications

TRANE

Odyssey™

Split System 5-20 Tons

Light Commercial
TTA / TTH / TWE
Series 50 Hz

ODYSSEY - Light Commercial
Split System Cooling Units

A new standard for the air conditioning industry, Trane sets new appearance and new standard for Serviceability... Installability... Reliability... and Flexibility for all applications in split system air conditioning.

Design for You
Trane consulted its customers during the split system design phase to bring a product to the market place which would meet job needs every time.

Quality and Reliability
- Scroll compressors are available from 5 to 20 tons with excellent reliability and high efficiency.
- All units are 100 percent run tested prior to leaving the production line.

Manifolding Scroll Compressors Option
(TTA150-240RD)
- The key to this system is an oil equalized line connecting the two compressors. In addition, the discharge lines are simple manifolded togethers.
- Efficiency and proven Technology. A manifolded set of compressors is more efficient at part load than the compressors with independent circuits.
- Manifolded to be single circuit provides cost and time saving with fully refrigerant charge.

System Performance Matrix

Outdoor Unit	Indoor Unit	Evaporator cfm	Total Capacity MBH	Power Input kw
TTK060KD	TTH060BD	2,000	60	6.20
TTA075RD	TTH075BD	2,500	75	8.52
TTA100RD	TTH100BD	3,400	100	11.76
TTA120RD	TWE120AD	4,000	120	12.84
TTA150RD	TWE180BD	5,000	160	17.87
TTA200RD	TWE240BD	6,650	200	24.17
TTA240RD	TWE240BD	8,000	240	26.33

Notes : 1. Matched system ratings are ARI 360. Full load rating is at 95°F, entering condensing air temperature and 80/67 FDB/FWB entering air handler coil.
2. Indoor fan power accounts for ARI 360 required external static pressure and losser associated with air filter, casing and wet evaporator coil pressure.

Maximum Efficiency
- Lower noise operation and higher efficiency with the new generation higher EER Scroll Compressor.
- 64% fewer parts than a comparable capacity reciprocating compressor.
- Single rotating assembly minimizes the friction and mechanical losses.
- Smooth operation, similar to a centrifugal compressor, give low torque variation and extend motor life, and minimal vibration reducing wear.
- Solid mount with no internal suspension to be worn out.
- Integral inlet dirt separator removes contaminants.
- Rolling element bearings for higher efficiency reduced friction. No suction or discharge valves for improved efficiency compared to a reciprocating compressor.

Flexibility
Trane Split System offers single and dual compressors allowing the right equipment to be matched to the job application and save on operating cost.

Convertibility
Trane air handler can easily be converted for vertical or horizontal airflow in free blow and ducted applications.

Installation
- Compact design makes smaller footprint in the market so we can save the area cost.
- Installation is simplified through fully factory packaged assembled indoor and outdoor units. Ready to run when they arrive at the jobsites.

Ease of Service
Reduction of service time and cost through
- Single side access on condenser.
- Multiple removable panels on air handlers.
- Colored and numbered wiring.
- Service valves.
- Dual circuits allow for comfort cooling even during service time. (TTA150-240)

Trane Split System Units
- A reputation for quality and reliability.
- Improvements in efficiency, flexibility and installation.

Designed With Your Needs In Mind

Product Line

Indoor Units						
Model	TTH060	TTH075	TTH100	TWE120	TWE180	TWE240
Single Circuit	x	x	x	x		
Dual Circuits					x	x

Outdoor Units							
Model	TTK060	TTA075	TTA100	TTA120	TTA150	TTA200	TTA240
Single Compressor	x	x	x	x			
Dual Circuits					x	x	x

General Data-Air Handler Units

INDOOR UNIT MODEL		TTH060BD	TTH075BD	TTH100BD	TWE120AD	TWE180BD	TWE240BD
POWER CONS-V/ph/Hz		380-415/3/50					
INDOOR COIL-TYPE		SLIT FIN	SLIT FIN	SLIT FIN	PLATE FIN	PLATE FIN	PLATE FIN
Row/FPI		3/15	3/15	3/15	3/12	3/12	3/12
Face Area	(sq.ft.)	4.22	5.06	6.67	11.2	16.3	21.6
Tube Size	in	3/8	3/8	3/8	3/8	3/8	3/8
Refrigerant Control		CAP.TUBE	EXPANSION VALVE	EXPANSION VALVE	EXPANSION VALVE	EXPANSION VALVE	EXPANSION VALVE
Drain Conn. Size	in	STEEL PIPE 1" MPT.	STEEL PIPE 1" MPT.	STEEL PIPE 1" MPT.	3/4 PVC PIPE-FEMALE	1 PVC PIPE-FEMALE	1 PVC PIPE-FEMALE
No. of Refrigerant Circuit		1	1	1	1	2	2
INDOOR FAN-TYPE		Centrifugal Type, Belt-Adjustable Drive					
Dia x Width	in	10x10	10x10	10x8	15x15	15x15	15x15
No. Used		1	1	2	1	2	2
Nominal	cfm	2,000	2,500	3,400	4,000	6,000	8,000
No. Motors	hp	1-3/4	1-1	1-2	1-2	1-3	1-5
Motors Speed	rpm.	1,400	1,450	1,450	1,450	1,450	1,450
Volts/Ph/Hz.		380-415/3/50					
F.L.Amps-L.R.	A	1.4-5.2	1.8-10.0	3.3-19.0	3.3-19.0	4.8-28.0	7.5-50.0
FILTER-TYPE		Aluminium/Washable Filter					
(No.)-Size x Thk.	mm	(2)-520x440x25	(2)-600x440x25	(3)-520x440x25	(4)-406x635x25	(4)-727x528x25	(4)-815x572x25
Ref. Line Connection		Braze	Braze	Braze	Braze	Braze	Braze
Suction Line Size (each)	in	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8
Liquid Line Size (each)	in	3/8	1/2	1/2	1/2	1/2	1/2
DIMENSIONS (HxWxD)							
Crated	mm	673x1,410x970	673x1,410x970	673x1,778x970	1,651x1,702x724	1,867x2,108x794	1,943x2,413x858
Uncrated	mm	520x1,312x841	520x1,312x841	521x1,680x841	1,523x1,613x635	1,751x2,019x702	1,824x2,350x773
Net Weight	kg	86.7	91.3	135.4	190	313	372

General Data - Condensing Units

		TTK060KD	TTA075RD	TTA100RD	TTA120RD	TTA150RD	TTA200RD	TTA240RD
Electrical Data								
Main Power supply	V/ph/Hz	380-415/3/50						
Min.Brch.Cir.Ampacity	A	13.4	22.45	25.82	26.87	40.8	46.84	48.84
Compressor								
Number		1	1	1	1	2	2	2
Type		Hermetic Scroll						
Rated Amps (each)	A	10.0	16.4	19.2	19.6	16.4	19.2	19.6
Locked rotor Amps (each)	A	74	95	125	125	95	125	125
Motor RPM	rpm	2,900	2,900	2,900	2,900	2,900	2,900	2,900
System Data								
Refrigerant circuit		1	1	1	1	2	2	2
Suction line	in	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 3/8	1 3/8
Liquid line	in	3/8	1/2	1/2	1/2	1/2	1/2	1/2
Outdoor Coil								
Type		Louver fin	Slit fin	Slit fin	Slit fin	Slit fin	Slit fin	Slit fin
Tube size	in	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Face Area	(sq.ft.)	11.7	15.1	20.0	25.0	30.2	40.0	42.5
Rows	#	2	2	2	2	2	2	2
Fins per inch (fpf)	#	21(252)	16(192)	16(192)	16(192)	16(192)	16(192)	16(192)
Outdoor Fan								
Type		Propeller						
Number		2	1	1	1	2	2	2
Diameter	ft	18	28	28	28	28	28	28
Drive type		Direct						
Air flow	cfm	2,700	4,900	5,800	6,800	9,800	11,600	13,600
Motors Number		2	1	1	1	2	2	2
Motor HP (each)	hp	1/15	3/4	3/4	3/4	3/4	3/4	3/4
Rated Amps (each)	A	0.45	1.95	1.82	2.37	1.95	1.82	2.37
Locked rotor Amps (each)	A	0.95	2.33	3.07	7.46	2.33	3.07	7.46
Motor RPM	rpm	930	700	800	950	700	800	950
R-22 Refrigerant Charge		Holding Charge						
DIMENSIONS (HxWxD)								
Crated	mm	1,371x1,131x450	1,190x1,194x1,042	1,190x1,194x1,042	1,190x1,397x1,143	1,190x2,312x1,118	1,190x2,312x1,118	1,190x2,312x1,118
Uncrated	mm	1,254x988x350	1,050x1,060x950	1,050x1,060x950	1,050x1,260x1,050	1,050x2,200x1,050	1,050x2,200x1,050	1,050x2,200x1,050
Net Weight	kg	94	157	177	221	368	408	424

Feature and Benefits

TTK060KD

TTA075-120RD

TTA150-240RD

TTH060-100BD

TWE120-240BD

TTA Condensing Units

Features	Benefits
• Powder paint finish.	• Full covering of all edges and a uniform paint finish for a smooth, attractive and durable cabinet exterior.
• Innovative cabinet design.	• The most attractive light commercial condensing unit available.
• Refrigerant accessories as standard.	• Each unit ships standard with the service valves, hi-low pressure controls, liquid line filter drier.
• Single and dual compressors	• Optimized operation and reduced service time.
Optional	
• Copper fin / Blue fin.	• Designed to provide corrosion protection on sea coast application.
• Manifolding single circuit (for TTA150-240RD).	• More efficiency at part load.

TTH/TWE Air Handler Units

Features	Benefits
• 500 mm in height (TTH060-100).	• Designed to fit easily into tight ceiling spaces.
• Excellent drain pan.	• Specially designed drain pan with a deep pitch to catch and drain water safely away.
• Belt drive.	• Fully adjustable airflow for application versatility and ease of servicing.
• Factory installed mounting channel (TTH060-100).	• Supports the unit from below, and saves time and money for the installer.
• Quiet operation.	• Well-insulated cabinet with wide forward curved fans provide quiet operation.
• Convertible for horizontal or vertical configuration (TWE120-240).	• Maximum application flexibility without the extra inventory of dedicated models.
• Thermal expansion valve.	• For maximum application flexibility and performance, capacity modulation provides improved comfort and backup in the event of a malfunction with one circuit.
Optional	
• Discharge Plenum.	• Designed for free blow application.
• Return air grille (for TWE model only).	
• High static motor.	• For high static pressure applications.

TRANE®

Trane Thailand
7th Floor, Ploenchit Center Building
2 Sukhumvit Road, Klongtoey
Bangkok 10110

Amair Limited
35 Mu 8, Poochaosamingprai Road
Samrong Tai, Samutprakarn 10130

http://www.trane.com
An American Standard Company

Literature Order Number:	SSA5-SLB001-EN 1101
Supersedes:	SSA5-SLB001-EN 0401
Stocking Location:	Bangkok, Thailand

AIR CONDITIONING
130-12 90TH AVENUE RICHMOND HILL, NEW YORK 11418
(718) 441-7200 FAX (718) 849-0370

H.V.A.C. SUBMITTAL

****

PROJECT: NEW RETAIL CENTER
301 WEST 125TH STREET
NEW YORK, NEW YORK

****

CONTRACTOR: H & H BUILDERS

****

ENGINEER: SRA ARCHITECTURE & ENGINEERING

TAG: AIR HANDLING & CONDENSING UNITS
DATE: 08.05.2011
SUBMISSION #: 1 OF 1
REVISION #: 0

Submittal

Prepared For:
Engineer: S R A Architecture and Engineering

Date: *August 04, 2011*

Customer P.O. Number:
Customer Project Number:

Sold To:
Admiral Air Conditioning
130-12 90th Avenue
RICHMOND HILL, NY 11418

Job Number:
Job Name:
301 W 125th St

Trane U.S. Inc. is pleased to provide the enclosed submittal for your review and approval.

Product Summary

Qty	Product
4	Packaged Gas/Electric Rooftop Units
5	Indoor Gas Heating Products
12	Split System Air Conditioning Units (Large)

The attached information describes the equipment we propose to furnish for this project, and is submitted for your approval.

Tim Lomax
Trane
45-18 Court Square
Long Island City, NY 11101-4347
Phone: (718) 269-3600
Cell:
Fax: (718) 269-3601

Table Of Contents

Tag Data - Split System Air Conditioning Units (Large) (Qty: 12)

Item	Tag(s)	Qty	Description	Model Number
C1	AHU/CU-1	11	6 - 20 Ton Unitary Split Systems	TTA240E300--TWE240E300
C2	AHU/CU-2	1	6 - 20 Ton Unitary Split Systems	TTA120D300--TWE120D300

Product Data - Split System Air Conditioning Units (Large)

Item: C1 Qty: 11 Tag(s): AHU/CU-1

TTA Air Condensing Outdoor Unit
20 Ton Nominal Cooling Capacity R410A
Dual Compressors - R410A
208-230 Volt 3 Phase 60 Hertz
Low Ambient On/Off (Fld)
2nd-5th Year Replacement Compressor Warranty

TWE Air Handler Unit
20 Ton Nominal Cooling Capacity R-410A
Dual Circuit - R410A
208-230 Volt 3 Phase 60 Hertz

Item: C2 Qty: 1 Tag(s): AHU/CU-2

TTA Air Condensing Outdoor Unit
10 Ton Nominal Cooling Capacity R410
Single Compressor - R410A
208-230 Volt 3 Phase 60 Hertz
Low Ambient On/Off (Fld)

TWE Air Handler Unit
10 Ton Nominal Cooling Capacity
Single Refrigerant Circuit - R410
208-230 Volt 3 Phase 60 Hertz

Not Including: Disconnects and Thermostats

Performance Data - Split System Air Conditioning Units (Large)

Tags	AHU/CU-1	AHU/CU-2
Airflow (cfm)	8000	4000
External Static Pressure (in H2O)	0.500	0.500
Supply fan power (bhp)	3.09	1.73
Indoor motor RPM (rpm)	826	745
Cooling EDB (F)	80.00	80.00
Cooling EWB (F)	67.00	67.00
Cooling LDB (F)	59.89	59.60
Cooling LWB (F)	57.25	58.23
Total capacity (MBh)	257.37	116.69
Sensible capacity (MBh)	188.41	94.96
Ambient (F)	95.00	95.00
EER @ AHRI (with air handler) (EER)	10.0	11.2
EER @ AHRI (cond. unit only) (EER)	10.0	11.2

Mechanical Specifications - Split System Air Conditioning Units (Large)
Item: C1, C2 Qty: 12 Tag(s): AHU/CU-1, AHU/CU-2

General - TTA
Weatherproofed Steel Mounting/Lifting Rails
Hermetic Scroll Compressors
Plate Fin Condenser Coils
Fans and Motors
Standard Operating Range 50-125F (Min. 0°F with Low Ambient Accy)
Nitrogen Holding Charge
Certified and Rated in Accordance with AHRI and DOE Standards
Certified to UL 1995

Casing - TTA
Zinc Coated, Heavy Gauge, Galvanized Steel
Weather Resistant Baked Enamel Finish
Meets 672 hr Salt Spray Test
Removable Single Side Maintenance Access Panels
Lifting Handles in Maintenance Access Panels
Unit Base Provisions for Forklift and/or Crane Lifting

Refrigeration System - - TTA
Dual Compressor (TTA120E, TTA150E, TTA180E, TTA240E)
Two (2) Separate and Independent Refrigerant Circuits
Each Refrigeration Circuit Equipped with Integral Subcooling Circuit.
Two (2) Direct Drive Hermetic Scroll Compressor with Centrifugal Oil Pump Providing Lubrication To Moving Parts
Suction Gas-Cooled Motors w/ ± 10% Voltage Utilization Range of Unit Nameplate Voltage
Crankcase Heaters
Internal Temperature and Current Sensitive Motor Overloads
Factory Installed Liquid Line Filter Driers
Phase Loss/Reverse Rotation Monitor
Liquid Line Service Valves (with gauge port)
Suction Line Service Valves (with gauge port)
No Compressor Suction and/or Discharge Valves (Reduced Vibration/Sound)
External High Pressure Cutout Devices
External Low Pressure Cutout Devices
Evaporator Defrost Control
Loss of Charge Protection (Discharge Line Thermostats)

Refrigeration System - - TTA
Single Compressor (TTA073D, TTA090D, TTA120D)
Single Refrigeration Circuit with Integral Subcooling Circuit.
Single Direct Drive Hermetic Scroll Compressor with Centrifugal Oil Pump Providing Lubrication To Moving Parts
Suction Gas-Cooled Motor w/ ± 10% Voltage Utilization Range of Unit Nameplate Voltage
Crankcase Heater
Internal Temperature and Current Sensitive Motor Overloads
No Compressor Suction and/or Discharge Valves (Reduced Vibration/Sound)
Factory Installed Liquid Line Filter Drier
Phase Loss/Reverse Rotation Monitor
Liquid Line Service Valve (with gauge port)
Suction Line Service Valve (with gauge port)
External High Pressure Cutout Device
External Low Pressure Cutout Device
Evaporator Defrost Control
Loss of Charge Protection (Discharge Line Thermostat)

Condenser Coil - TTA
3/8" Internally Enhanced Copper Tube Mechanically Bonded to Lanced Aluminum Plate Fins
Factory Pressure and Leak Tested to 660 psig.
Perforated Steel Hailguards Available (Factory Installed Option or Field Installed Accessory)

Condenser Fan - TTA
26" or 28" Propeller Fan(s)

Direct Drive
Statically and Dynamically Balanced

Condenser Motor(s) - TTA
Permanently Lubricated Totally Enclosed or Open Construction
Built-In Current and Thermal Overloads
Ball or Sleeve Bearing Type

Controls - TTA
Choice of Electro-mechanical or Microprocessor
Completely Internally Wired
Numbered and Colored Wires
Contactor Pressure Lugs or Terminal Block
Unit External Mounting Location for Disconnect Device
Single Point Power Entry

Controls: Electro-Mechanical - TTA
24V Control Circuit
Control Transformer
Thermostat Compatible
Anti-Short Cycle Timer

Low Ambient (Fan ON/OFF) - TTA
Provides Unit Cooling Operation to Outdoor Ambient of 0°F
Low Cost Solution
Liquid Line Temperature Controls Condenser Fan Operation
1 Kit Per Condenser Fan Required

General - TWE
Completely Factory Assembled
Convertible for Horizontal or Vertical Configuration
Convertible for Cooling Only or Heat Pump Application
Convertible for Left or Right External Connections (Refrigerant and/or Electrical)
Convertible for Front or Bottom Air Return
Nitrogen Holding Charge
Certified and Rated in Accordance with AHRI and DOE Standards
Certified to UL 1995 for Indoor Blower Coil Units

Casing - TWE
Zinc Coated, Heavy Gauge, Galvanized Steel
Weather Resistant Baked Enamel Finish
Access Panels with Captive Screws
Completely Insulated with Foil Faced, Cleanable, Fire Retardant, Permanent, Odorless Glass Fiber Material
Captured or Sealed Insulation Edges
Electrical Connection Bushings or Plugs
Refrigerant Connection Bushings or Plugs
Withstand Elevated Internal Static Pressure

Refrigeration System - TWE
Single or Dual Circuit
Distributor(s)
Thermal Expansion Valves (TXVs)

Evaporator Coil - TWE
3/8" Internally Enhanced Copper Tube Mechanically Bonded to Lanced Aluminum Plate Fins
Factory Pressure and Leak Tested to 449 psig.
Draw-Through Airflow
Dual Circuits Are Interlaced/Intertwined
Double Sloped, Removable, Cleanable, Composite Drain Pan
Four Drain Pan Positions

Indoor Fan - TWE
Double Inlet, Double Width, Forward Curved, Centrifugal Type Fan

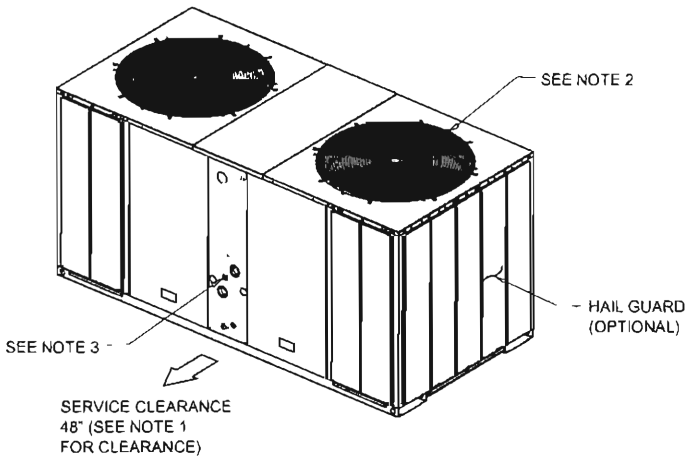
Dual Fans On 12.5-20T Air Handlers
Adjustable Belt Drive
Permanently Lubricated Bearings

Indoor Motor - TWE
Adjustable Motor Sheaves
Thermal Overload Protection
Permanently Lubricated Bearings
Meet Energy Policy of 1992 (EPACT)
Optional Over Sized Motors for High Static Applications

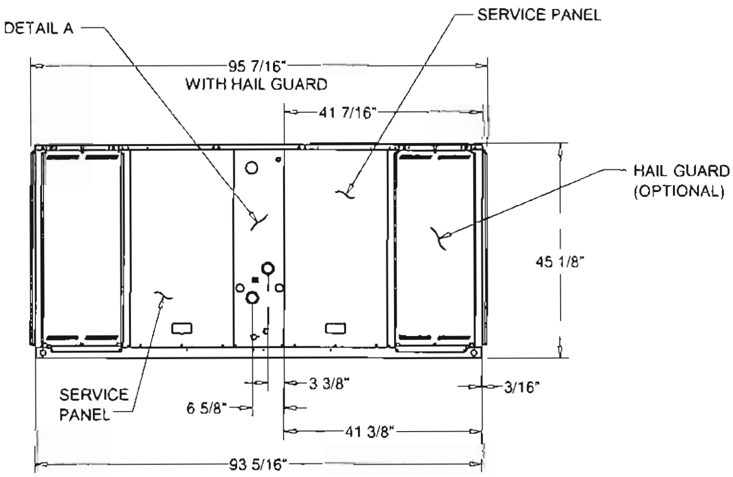
Controls - TWE
Completely Internally Wired
Numbered and Colored Wires
Magnetic Indoor Fan Contactor
Low Voltage Terminal Strip
Single Point Power Entry
Evaporator Defrost Control

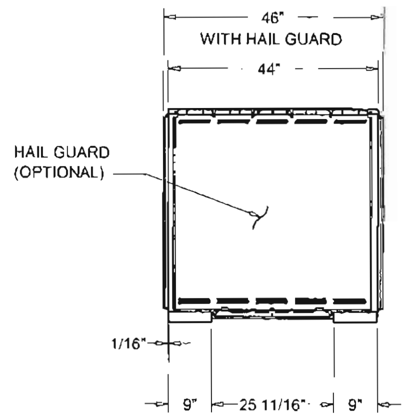
Filters - TWE
Access From Side Coil Panels
Filters Slide on Rack
One Inch (1"), Throw-Away Filters on 5-10 Ton Units
Filter Rack Convertible to Two Inch (2") Capability on 5-10 Ton Units
Two Inch (2"), Throw-Away Filters on 12.5-20 Ton Units

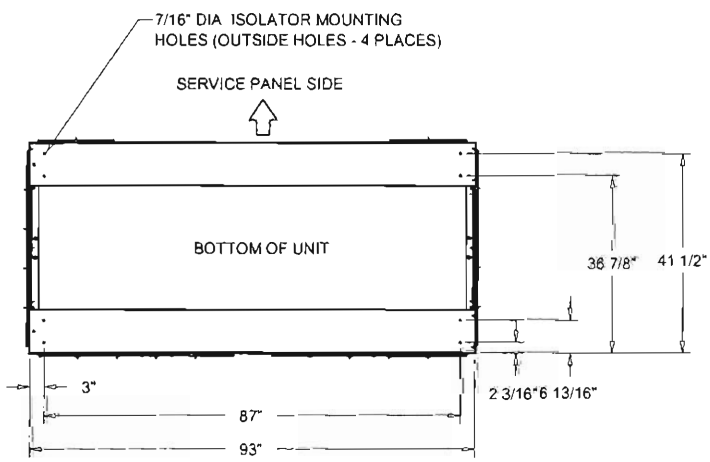
Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C1 Qty: 11 Tag(s): AHU/CU-1

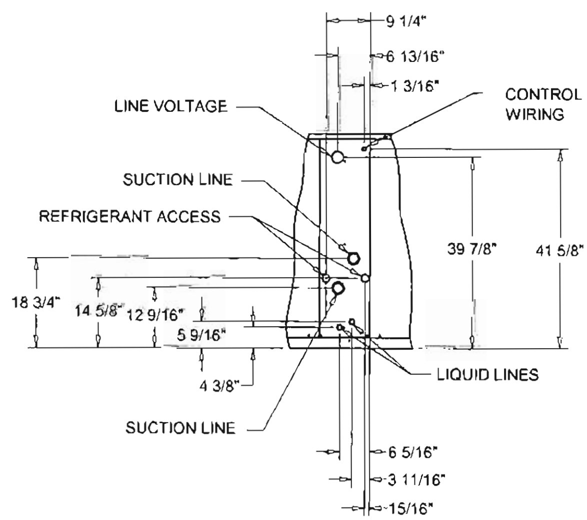


NOTES:
1. MINIMUM CLEARANCE FOR PROPER OPERATION IS 36" FROM WALLS, SHRUBBERY, PRIVACY FENCES ETC. MINIMUM CLEARANCE BETWEEN ADJACENT UNITS IS 72". RECOMMENDED SERVICE CLEARANCE 48"
2. TOP DISCHARGE AREA SHOULD BE UNRESTRICTED FOR 100" MINIMUM. UNIT SHOULD BE PLACED SO ROOF RUN-OFF WATER DOES NOT POUR DIRECTLY ON UNIT
3. OUTDOOR AIR TEMPERATURE SENSOR OPENING (DO NOT BLOCK OPENING)









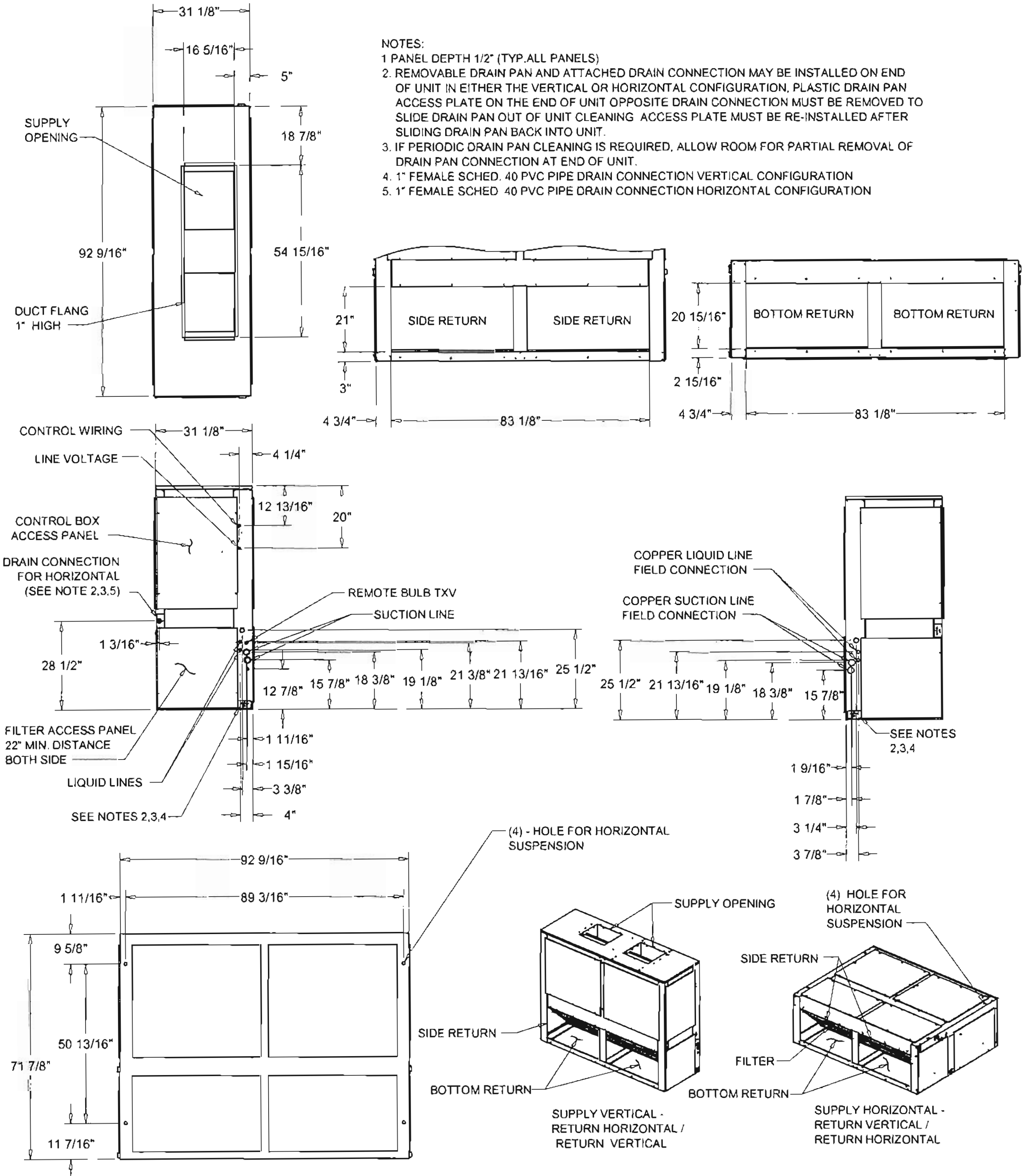
FRONT DETAIL A

DIMENSIONAL DETAIL

20 TON COOLING CONDENSER (DUAL COMPRESSOR)

DIMENSIONAL DRAWING

Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C1 Qty: 11 Tag(s): AHU/CU-1



20 TON AIR HANDLER (DUAL CIRCUIT)
DIMENSIONAL DRAWING

Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C1 Qty: 11 Tag(s): AHU/CU-1

'ELECTRICAL DATA CONDENSER

'ELECTRICAL DATA		COMPRESSOR MOTOR		CONDENSER FAN MOTOR	
Model:	TTA240E3	No..	'2	No..	'2
Unit Operating Voltage.	187 - 253	Volts:	208-230	Volts.	208-230
Minimum Circuit Ampacity.	98 0	Phase:	3	Phase	1
Maximun Fuse Size:	110 0	Amp-RLA:	39.1	Amp-FLA	5.0
Maximun Circuit Breaker	110 0	Amp-LRA:	267.0	Amp-LRA:	14.4

GENERAL DATA CONDENSER

COOLING PERFORMANCE (1)(2)(3)(4)(5)	
Matched Air Handler:	263,000
Condensing Unit Only.	270,000
ARI Net Cooling Capacity	254,000
Matched Air Handler:	10 0
Condensing Unit Only:	12 1
System Integrated Part Load Value	11 2
Condensing Unit Only IPLV:	15.9
System KW	25.40
Condensing Unit KW:	22.32
IEER:	10.9

COMPRESSOR	
Number:	'2
Motors/HP (each)	15.0
Motor RPM:	3500
No. Compressor / Tons:	2/10.1

SYSTEM DATA (7)	
No. Refrigerant Circuits:	'2
Suction Line (in) OD:	1 3/8"
Liquid Line (in.) OD	1/2"

OUTDOOR COIL	
Tube Size (in.) OD	'3/8"
Face Area (sq ft)	52 5/8"
Rows/FPI	2/18

OUTDOOR FAN	
No Used/Diameter (in.).	'2 / 28"
Drive Type/No. Speeds.	DIRECT / 1
CFM.	19,500
No. Motors/HP.	2 / 1
Motor RPM:	1,100

REFRIGERANT CHARGE (Fld Supplied) (7)(8)	
TYPE:	R-410A
(Circuits #1):	21.9 lb
(Circuits #2):	21.9 lb

NOTES:

1. Cooling performance is rated at 95 F ambient, 80 F entering dry bulb, 67 F entering wet bulb. Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Ratings shown are tested and certified in accordance with AHRI
2. Standard 340/360 or 365 certification program.
3. Condensing Unit Only Gross Cooling Capacity rate at 45 F saturated suction temperature and at 95 F ambient.
4. ARI Net Cooling Capacity is calculated with matched blower coil and 25 ft. of OD interconnecting tubing. EER is rated at AHRI conditions and in accordance with DOE test procedures.
5. Integrated Part Load Value is based on AHRI Standard 340/360 or 365 Units are rated at 80 F ambient, 80 F entering dry bulb, and 67 F entering wet bulb at AHRI rated CFM.
6. Sound Rating shown is tested in accordance with AHRI Standard 270.
7. Refer to refrigerant piping program for line sizing and line length.
8. Refrigerant (operating) charge is for condensing unit (all circuits) with matching blower coils and 25 ft of interconnecting refrigerant lines. All units are shipped with a small nitrogen holding charge only.

Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C1 Qty: 11 Tag(s): AHU/CU-1

AIR HANDLER ELECTRICAL DATA CONDENSER

ELECTRICAL DATA

Model.	TWE240
Unit Operating Voltage:	187-253
Minimum Circuit Ampacity:	18.1 - 17.9
Maximun Fuse Size:	25.0 - 25.0
Maximun Circuit Breaker:	25 0 - 25.0

EVAPORATOR FAN MOTOR

No.:	1
Volts:	208-230
Phase.	3
Motor HP.	5.0
Amp-FLA:	14.5 - 14 3
Amp-LRA	98 0 - 98.0

GENERAL DATA

SYSTEM DATA

No. Refrigerant Circuits	2
Suction Line (in.) OD	1 3/8"
Liquid Line (in.) OD	5/8"

INDOOR COIL - TYPE

Tude Size:	3/8"
Face Area:	21 11/16"
Row/FPI	3 / 14
Refrigerant Control	EXPANSION VALVE
Drain Connection Size	1" PVC

INDOOR FAN

Type	CENTRIFUGAL
No. Used/Diameter x Width	2 / 15"X15"
Drive Type/No. Speed:	BELT / ADJUSTABLE
CFM	8000
No. Motor:	1
Motor HP - Standard/Oversized:	3 0/ 5.0 / 7.5
Motor RPM.	1750 / 3470
Motor Frame Size	184T

FILTER

Type:	THROWAWAY
Furnished:	YES
No Size Recommended	(4) 16"X25"X2" (4) 16"X20"X2"

HEATER DATA

ELECTRICAL DATA

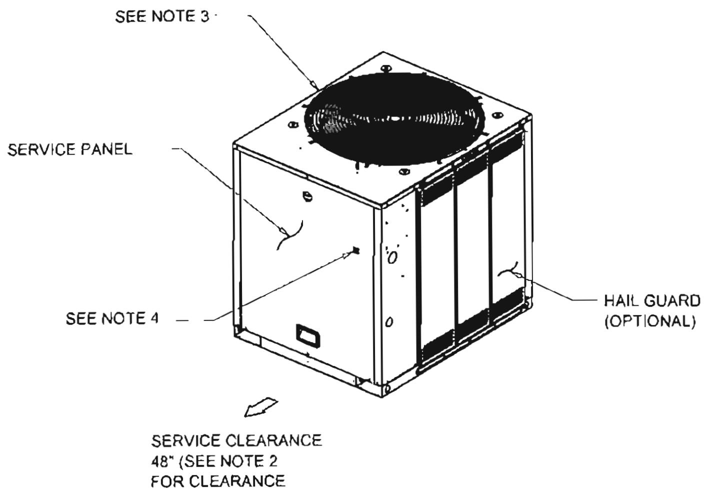
Heat Rating (kW):
Control Stages
Power Supply:
Minimum Circuit Ampacity
Maximun Fuse Size:
Maximun Circuit Breaker

Notes:
1 KW ratings are at. 208/240V for 208-230V air handlers
480V for 460V air handlers
600V for 575V air handlers
For other than rated voltage, capacity = ($\frac{\text{Voltage}}{\text{Rated Voltage}}$) x 2 Rated Capacity
2. Any power supply and circuits must be wired and protected in accordance with local electrical codes.
3. The HACR circuit breaker is for U.S A. installations only.
4 With motor field converted to 460V.

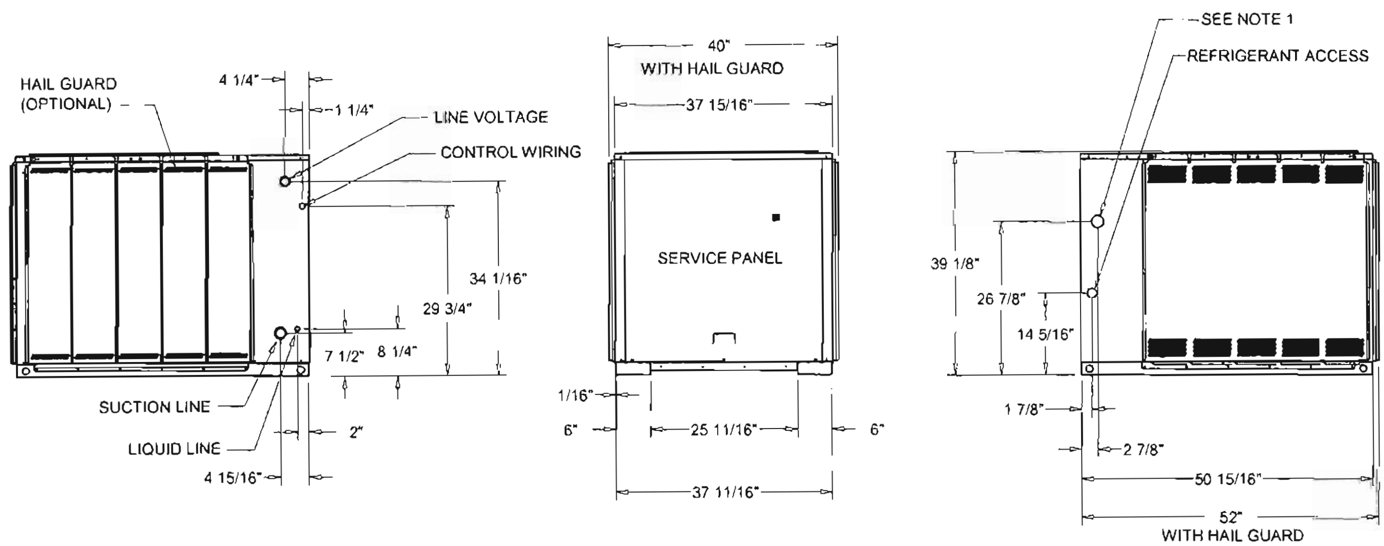
NOTES.

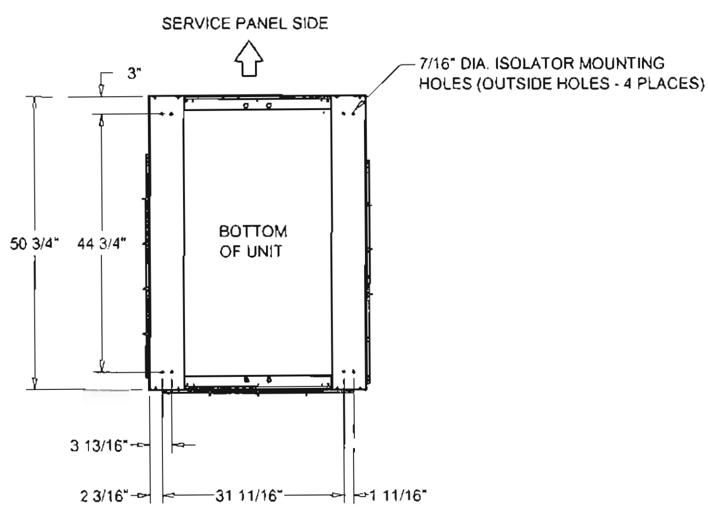
1. Cooling performance is rated at 95 F ambient, 80 F entering dry bulb, 67 F entering wet bulb.
2 Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Ratings shown are tested and certified in accordance with AHRI Standard 340/360 or 365 certification program.
3 Condensing Unit Only Gross Cooling Capacity rate at 45 F saturated suction temperature and at 95 F ambient.
4. AHRI Net Cooling Capacity is calculated with matched blower coil and 25 ft. of OD interconnecting tubing EER is rated at AHRI conditions and in accordance with DOE test procedures.
5. Integrated Part Load Value is based on AHRI Standard 340/360 or 365. Units are rated at 80 F ambient, 80 F entering dry bulb, and 67 F entering wet bulb at AHRI rated CFM.
6 Sound Rating shown is tested in accordance with AHRI Standard 270.
7. Refer to refrigerant piping program for line sizing and line length.
8. Refrigerant (operating) charge is for condensing unit (all circuits) with matching blower coils and 25 ft of interconnecting refrigerant lines. All units are shipped with a small nitrogen holding charge only

Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C2 Qty: 1 Tag(s): AHU/CU-2



NOTES:
1. ACCESS OPENING IS FOR FIELD INSTALLED BAYLOAM ACCESSORY
2. MINIMUM CLEARANCE FOR PROPER OPERATION IS 36" FROM WALLS, SHRUBBERY, PRIVACY FENCES ETC. MINIMUM CLEARANCE BETWEEN ADJACENT UNITS IS 72" RECOMMENDED SERVICE CLEARANCE 48"
3. TOP DISCHARGE AREA SHOULD BE UNRESTRICTED FOR 100" MINIMUM. UNIT SHOULD BE PLACED SO ROOF RUN-OFF WATER DOES NOT POUR DIRECTLY ON UNIT
4. OUTDOOR AIR TEMPERATURE SENSOR OPENING (DO NOT BLOCK OPENING)



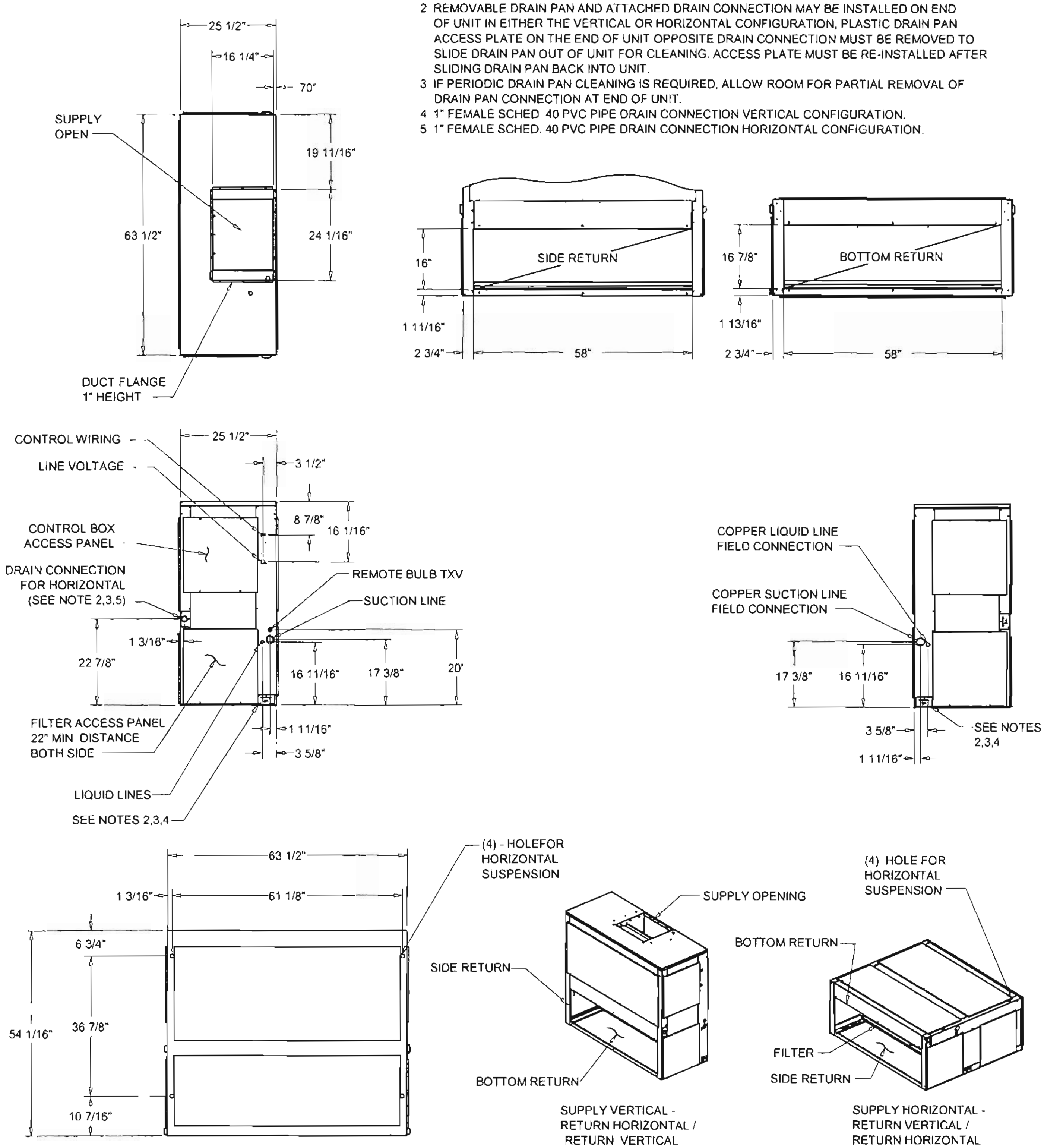


10 TON COOLING CONDENSER (SINGLE COMPRESSOR)

DIMENSIONAL DRAWING

Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C2 Qty: 1 Tag(s): AHU/CU-2

NOTES:
1 PANEL DEPTH 1/2" (TYP.ALL PANELS)
2 REMOVABLE DRAIN PAN AND ATTACHED DRAIN CONNECTION MAY BE INSTALLED ON END OF UNIT IN EITHER THE VERTICAL OR HORIZONTAL CONFIGURATION, PLASTIC DRAIN PAN ACCESS PLATE ON THE END OF UNIT OPPOSITE DRAIN CONNECTION MUST BE REMOVED TO SLIDE DRAIN PAN OUT OF UNIT FOR CLEANING. ACCESS PLATE MUST BE RE-INSTALLED AFTER SLIDING DRAIN PAN BACK INTO UNIT.
3 IF PERIODIC DRAIN PAN CLEANING IS REQUIRED, ALLOW ROOM FOR PARTIAL REMOVAL OF DRAIN PAN CONNECTION AT END OF UNIT.
4 1" FEMALE SCHED 40 PVC PIPE DRAIN CONNECTION VERTICAL CONFIGURATION.
5 1" FEMALE SCHED. 40 PVC PIPE DRAIN CONNECTION HORIZONTAL CONFIGURATION.



10 TON AIR HANDLER (SINGLE CIRCUIT)

DIMENSIONAL DRAWING

Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C2 Qty: 1 Tag(s): AHU/CU-2

ELECTRICAL DATA CONDENSER

ELECTRICAL DATA		COMPRESSOR MOTOR		CONDENSER FAN MOTOR	
Model:	TTA120D3	No	1	No	1
Unit Operating Voltage:	187 - 253	Volts:	208-230	Volts:	208-230
Minimum Circuit Ampacity	42.6	Phase:	3	Phase:	1
Maximun Fuse Size:	60.0	Amp-RLA:	30.1	Amp-FLA.	5.0
Maximun Circuit Breaker	60 0	Amp-LRA:	225 0	Amp-LRA:	14.4

GENERAL DATA CONDENSER

COOLING PERFORMANCE (1)(2)(3)(4)(5)		COMPRESSOR	
Matched Air Handler.	124,000	Number	1
Condensing Unit Only.	112,000	Motors/HP (each):	8 5
ARI Net Cooling Capacity	120,000	Motor RPM.	3500
Matched Air Handler.	11.2	No Compressor / Tons:	1/8.6
Condensing Unit Only:	12.2	**SYSTEM DATA (7)**	
System Integrated Part Load Value	N/A	No. Refrigerant Circuits:	1
Condensing Unit Only IPLV	N/A	Suction Line (in.) OD	1 3/8"
System KW	10.72	Liquid Line (in.) OD	1/2"
Condensing Unit KW:	9.18		
IEER	12.2		

OUTDOOR COIL		OUTDOOR FAN	
Tube Size (in) OD	3/8"	No Used/Diameter (in.):	1 / 28"
Face Area (sq. ft)	24"	Drive Type/No. Speeds	DIRECT / 1
Rows/FPI	2/18	CFM.	9,600
		No. Motors/HP:	1 / 1
		Motor RPM	1,100

REFRIGERANT CHARGE (Fld Supplied) (7)(8)	
TYPE:	R-410A
(Circuits #1):	22.5 lb
(Circuits #2):	N/A

NOTES

1. Cooling performance is rated at 95 F ambient, 80 F entering dry bulb, 67 F entering wet bulb Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Ratings shown are tested and certified in accordance with AHRI
2. Standard 340/360 or 365 certification program.
3. Condensing Unit Only Gross Cooling Capacity rate at 45 F saturated suction temperature and at 95 F ambient.
4. ARI Net Cooling Capacity is calculated with matched blower coil and 25 ft. of OD interconnecting tubing. EER is rated at AHRI conditions and in accordance with DOE test procedures.
5. Integrated Part Load Value is based on AHRI Standard 340/360 or 365 Units are rated at 80 F ambient, 80 F entering dry bulb, and 67 F entering wet bulb at AHRI rated CFM.
6. Sound Rating shown is tested in accordance with AHRI Standard 270
7. Refer to refrigerant piping program for line sizing and line length.
8. Refrigerant (operating) charge is for condensing unit (all circuits) with matching blower coils and 25 ft. of interconnecting refrigerant lines. All units are shipped with a small nitrogen holding charge only.

Unit Dimensions - Split System Air Conditioning Units (Large)
Item: C2 Qty: 1 Tag(s): AHU/CU-2

AIR HANDLER ELECTRICAL DATA CONDENSER

ELECTRICAL DATA		EVAPORATOR FAN MOTOR	
Model.	TWE120	No..	1
Unit Operating Voltage	187-253	Volts:	208-230
Minimum Circuit Ampacity:	7.8 7.3	Phase.	3
Maximun Fuse Size:	15.0 - 15 0	Motor HP.	2.0
Maximun Circuit Breaker:	15.0 - 15 0	Amp-FLA:	6.2 - 5.8
		Amp-LRA	33.9 - 33 9

GENERAL DATA

SYSTEM DATA		INDOOR COIL - TYPE	
No Refrigerant Circuits	1	Tude Size:	3/8"
Suction Line (in.) OD	1 3/8"	Face Area.	11 3/16"
Liquid Line (in.) OD	1/2"	Row/FPI	4 / 14
		Refrigerant Control	EXPANSION VALVE
		Drain Connection Size	1" PVC

INDOOR FAN		FILTER	
Type.	CENTRIFUGAL	Type.	THROWAWAY
No. Used/Diameter x Width	1 / 15"X15"	Furnished:	YES
Drive Type/No Speed	BELT/ADJUSTABLE	No Size Recommended	(4) 16"X25"X1"
CFM:	4000		
No. Motor	1		
Motor HP - Standard/Oversized	2.0 / 3.0		
Motor RPM:	1725		
Motor Frame Size:	56Z		

HEATER DATA

ELECTRICAL DATA

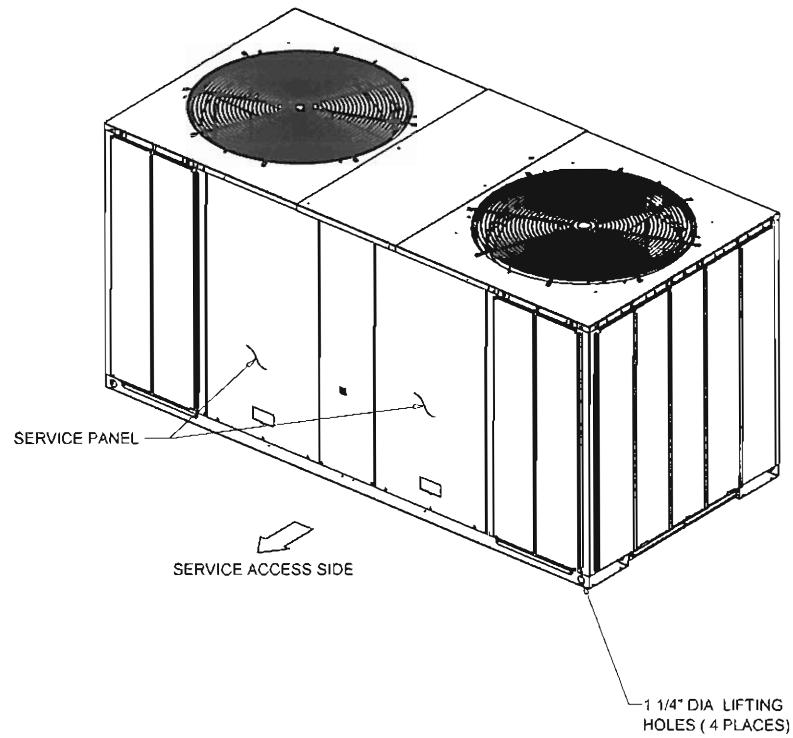
Heat Rating (kW):
Control Stages:
Power Supply:
Minimum Circuit Ampacity:
Maximun Fuse Size:
Maximun Circuit Breaker

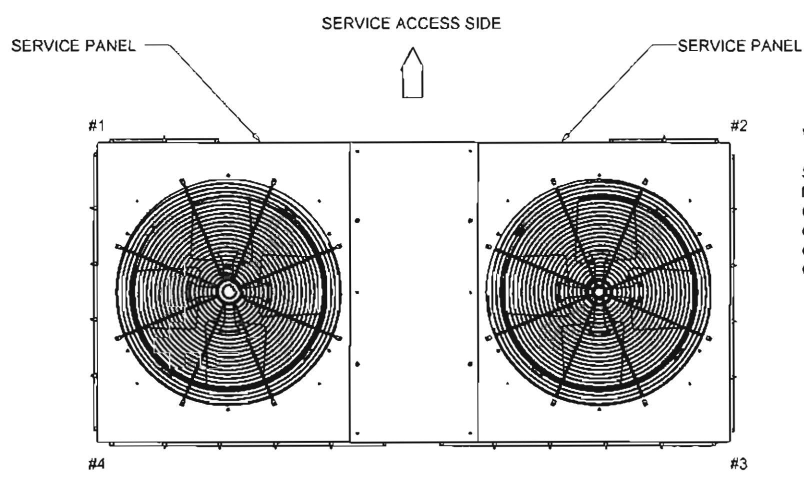
Notes:
1. KW ratings are at. 208/240V for 208-230V air handlers
   480V for 460V air handlers
   600V for 575V air handlers
   For other than rated voltage, capacity = $\left(\frac{\text{Voltage}}{\text{Rated Voltage}}\right)^2$ x Rated Capacity
2. Any power supply and circuits must be wired and protected in accordance with local electrical codes.
3. The HACR circuit breaker is for U S.A. installations only
4. With motor field converted to 460V

NOTES:

1. Cooling performance is rated at 95 F ambient, 80 F entering dry bulb, 67 F entering wet bulb.
2. Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Ratings shown are tested and certified in accordance with AHRI Standard 340/360 or 365 certification program.
3. Condensing Unit Only Gross Cooling Capacity rate at 45 F saturated suction temperature and at 95 F ambient.
4. AHRI Net Cooling Capacity is calculated with matched blower coil and 25 ft. of OD interconnecting tubing EER is rated at AHRI conditions and in accordance with DOE test procedures.
5. Integrated Part Load Value is based on AHRI Standard 340/360 or 365. Units are rated at 80 F ambient, 80 F entering dry bulb, and 67 F entering wet bulb at AHRI rated CFM
6. Sound Rating shown is tested in accordance with AHRI Standard 270
7. Refer to refrigerant piping program for line sizing and line length.
8. Refrigerant (operating) charge is for condensing unit (all circuits) with matching blower coils and 25 ft. of interconnecting refrigerant lines. All units are shipped with a small nitrogen holding charge only.

Weight, Clearance & Rigging Diagram - Split System Air Conditioning Units (Large)
Item: C1 Qty: 11 Tag(s): AHU/CU-1





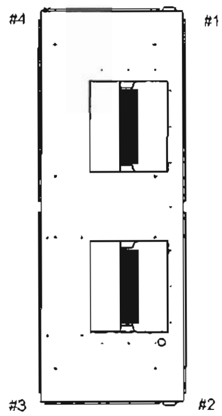
WEIGHTS AND CORNER WEIGHTS

Shipping:	970.0 lb
Net	837.0 lb
Corner 1	262.0 lb
Corner 2.	240.0 lb
Corner 3:	164 0 lb
Corner 4:	171 in3

WEIGHTS AND LOAD POINT LOCATION FOR CONDENSOR

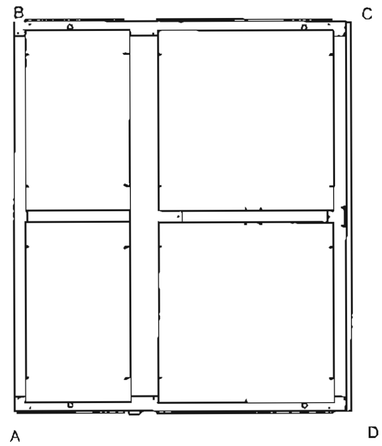
WEIGHT AND RIGGING

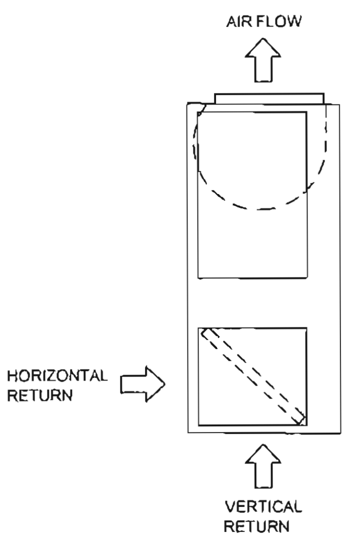
Weight, Clearance & Rigging Diagram - Split System Air Conditioning Units (Large)
Item: C1 Qty: 11 Tag(s): AHU/CU-1



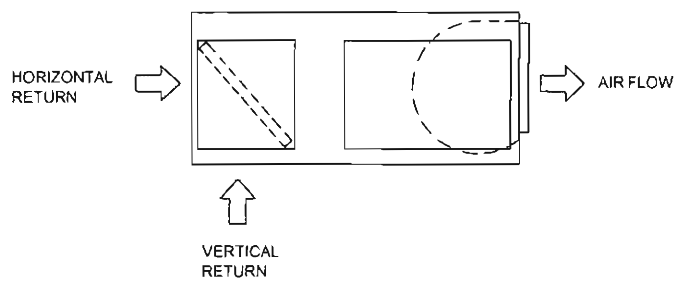
WEIGHTS AND CORNER WEIGHTS

Shipping:	891 0 lb
Net	818.0 lb
VERTICAL	
Corner 1:	258.0 lb
Corner 2:	168.0 lb
Corner 3:	161 0 lb
Corner 4:	231 0 lb
HORIZOTNAL	256.0 lb
Corner A:	181.0 lb
Corner B	146.0 lb
Corner C:	235.0 lb
Corner D.	





VERTICAL APPLICATION

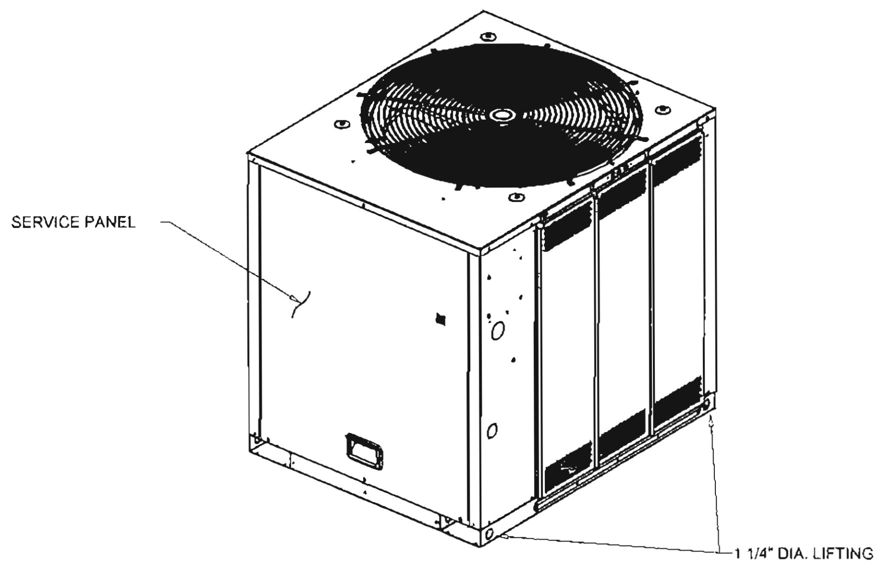


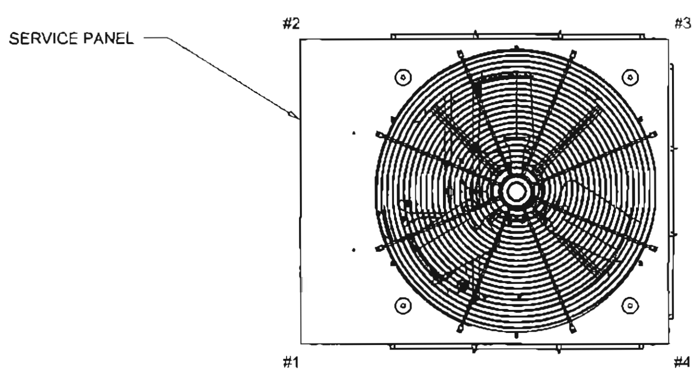
HORIZONTAL APPLICATION

WEIGHTS AND LOAD POINT LOCATION FOR CONDENSOR

WEIGHT AND RIGGING

Weight, Clearance & Rigging Diagram - Split System Air Conditioning Units (Large)
Item: C2 Qty: 1 Tag(s): AHU/CU-2





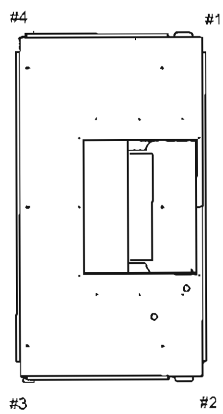
WEIGHTS AND CORNER WEIGHTS

Shipping:	467.0 lb
Net	395.0 lb
Corner 1.	133.0 lb
Corner 2:	103.0 lb
Corner 3:	70.0 lb
Corner 4	89.0 lb

WEIGHTS AND LOAD POINT LOCATION

WEIGHT AND RIGGING

Weight, Clearance & Rigging Diagram - Split System Air Conditioning Units (Large)
Item: C2 Qty: 1 Tag(s): AHU/CU-2

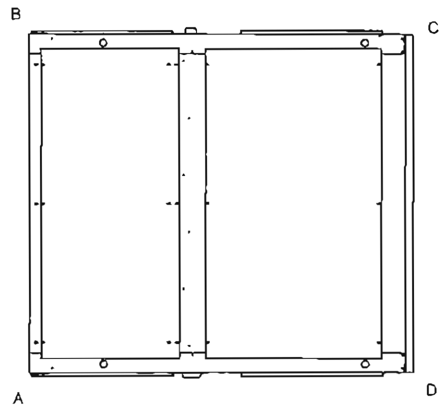


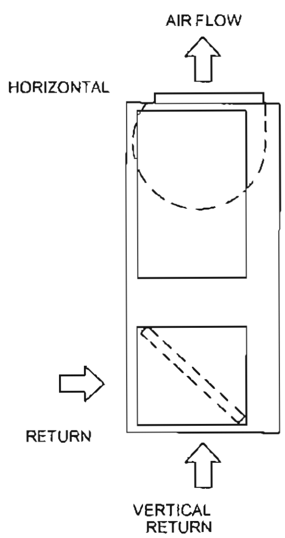
WEIGHTS AND CORNER WEIGHTS

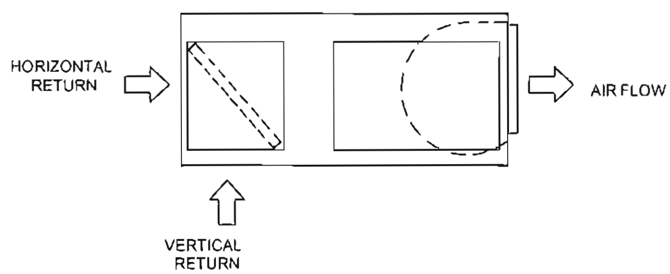
Shipping: 429 0 lb
Net 393 0 lb

VERTICAL 77.0 lb
Corner 1 121.0 lb
Corner 2 110.0 lb
Corner 3: 85 0 lb
Corner 4.

HORIZOTNAL 79.0 lb
Corner A: 118.0 lb
Corner B: 77.0 lb
Corner C: 119.0 lb
Corner D:



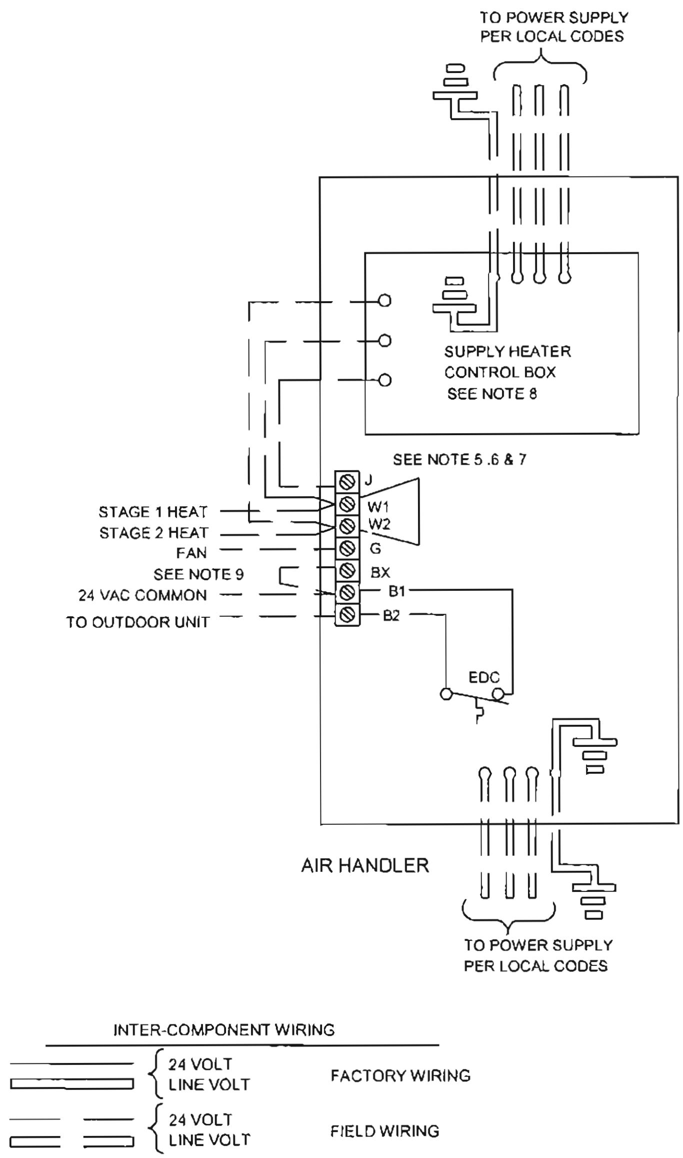




WEIGHTS AND LOAD POINT LOCATION FOR CONDENSOR

WEIGHT AND RIGGING

Field Wiring - Split System Air Conditioning Units (Large)
Item: C1 Qty: 11 Tag(s): AHU/CU-1



NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE
3. LOW VOLTAGE WIRING TO BE 18 A.W.G MINIMUM CONDUCTOR.
4. USE COPPER CONDUCTORS ONLY.
5. IF TWO STAGE ELECTRIC HEATERS AND THERMOSTAT ARE USED, REMOVE JUMPER BETWEEN W1 AND W2 .
6. FOR SINGLE STAGE ELECTRIC HEATER, OMIT WIRE BETWEEN W2 AND THERMOSTAT AND W2 AND ELECTRIC HEATER.
7. FOR COOLING ONLY. OMIT WIRES BETWEEN W1,W2 AND THERMOSTAT AND OMIT ELECTRIC HEATER.
8. WHEN ELECTRIC HEATER ACCESSORY IS USED SINGLE POINT POWER ENTRY OR DUAL POINT POWER ENTRY IS FIELD OPTIONAL. SINGLE POINT POWER ENTRY OPTION IS THROUGH ELECTRIC HEATER ONLY
9. WHEN ELECTRIC HEATER ACCESSORY IS USED, A FIELD SUPPLIED JUMPER MUST BE PLACED BETWEEN "B1" AND "BX" ON THE THE INDOOR SECTION LOW VOLTAGE TERMINAL BOARD.

Field Installed Options - Part/Order Number Summary
This is a report to help you locate field installed options that arrive at the jobsite. This report provides part or order numbers for each field installed option, and references it to a specific product tag. It is NOT intended as a bill of material for the job.

Product Family - Packaged Gas/Electric Rooftop Units

Item	Tag(s)	Qty	Description	Model Number
A1	RTU-1 to 4	4	12 1/2 -25 Ton Packaged Unitary Gas/Elec	YCD240F3H

Field Installed Option Description	Part/Ordering Number
0-100% Economizer, dry bulb control	BAYECON090A
Programmable Sensor with Night Setback and System Function Lights	BAYSENS119A

Product Family - Split System Air Conditioning Units (Large)

Item	Tag(s)	Qty	Description	Model Number
C1	AHU/CU-1	11	6 - 20 Ton Unitary Split Systems	TTA240E300--TWE240E300
C2	AHU/CU-2	1	6 - 20 Ton Unitary Split Systems	TTA120D300--TWE120D300

Field Installed Option Description	Part/Ordering Number
Low Ambient Control if no Hot Gas Bypass or Reliatel	BAYLOAMU02B

Admiral AIR CONDITIONING
130-12 90TH AVENUE RICHMOND HILL, NEW YORK 11418
(718) 441-7200 FAX (718) 849-0370

H.V.A.C. SUBMITTAL

****

PROJECT: NEW RETAIL CENTER
301 WEST 125TH STREET
NEW YORK, NEW YORK

****

CONTRACTOR: H & H BUILDERS

****

ENGINEER: SRA ARCHITECTURE & ENGINEERING

TAG: DUCT FURNACE (DF-1, DF-2)
DATE: 08.05.2011
SUBMISSION #: 1 OF 1
REVISION #: 0

Submittal

Prepared For:
Engineer: S R A Architecture and Engineering

Date: *August 04, 2011*

Customer P.O. Number:
Customer Project Number:

Sold To:
Admiral Air Conditioning
130-12 90th Avenue
RICHMOND HILL, NY 11418

Job Number:
Job Name:
301 W 125th St

Trane U.S. Inc. is pleased to provide the enclosed submittal for your review and approval.

Product Summary

Qty	**Product**
4	Packaged Gas/Electric Rooftop Units
5	Indoor Gas Heating Products
12	Split System Air Conditioning Units (Large)

The attached information describes the equipment we propose to furnish for this project, and is submitted for your approval.

Tim Lomax
Trane
45-18 Court Square
Long Island City, NY 11101-4347
Phone: (718) 269-3600
Cell:
Fax: (718) 269-3601

Table Of Contents

Tag Data - Indoor Gas Heating Products (Qty: 5)

Item	Tag(s)	Qty	Description	Model Number
B1	DF-1	4	Indoor Gas Heating Products	GLND030EDG
B2	DF-2	1	Indoor Gas Heating Products	GLND015EDG

Product Data - Indoor Gas Heating Products

All Units

High efficiency indoor gas duct furnace
Natural gas
460/60/3 main power supply
Single stage gas control, intermittent pilot
Seventh design
Aluminized steel heat exchanger
Open Drip Proof (ODP)
2nd - 10th Year Warranty - Heat Exchanger

Item: B1 Qty: 4 Tag(s): DF-1

300 MBH input/240 MBH output

Item: B2 Qty: 1 Tag(s): DF-2

150 MBH input/120 MBH output

Not Including: Disconnects and Thermostats

Mechanical Specifications - Indoor Gas Heating Products
Item: B1, B2 Qty: 5 Tag(s): DF-1, DF-2

General - Centrifugal Fan/Duct Furnace
Unit is completely factory assembled, piped, wired, and test fired. Unit is A.G.A. Certified, and conforms with the latest ANSI Standards for safe and efficient performance. Unit is provided with four point suspension hangers.

Casing - Duct Furnace
Casing is die-formed, 20 gauge [1.0 mm] galvanized steel and finished in baked enamel. The bottom panel is easily removed to provide service access to the burners, pilot and orifices. The pilot is also accessible through a side panel access plate. The high limit switch is accessible through a side panel access.

Heat Exchanger - Aluminized Steel
Heat Exchanger construction consists of seam welded 20 gauge [1.0 mm] aluminized steel tubes and 18 gauge [1.3 mm] aluminized steel headers.

Draft Diverter - Aluminum
Draft diverter construction is corrosion resistant aluminized steel.

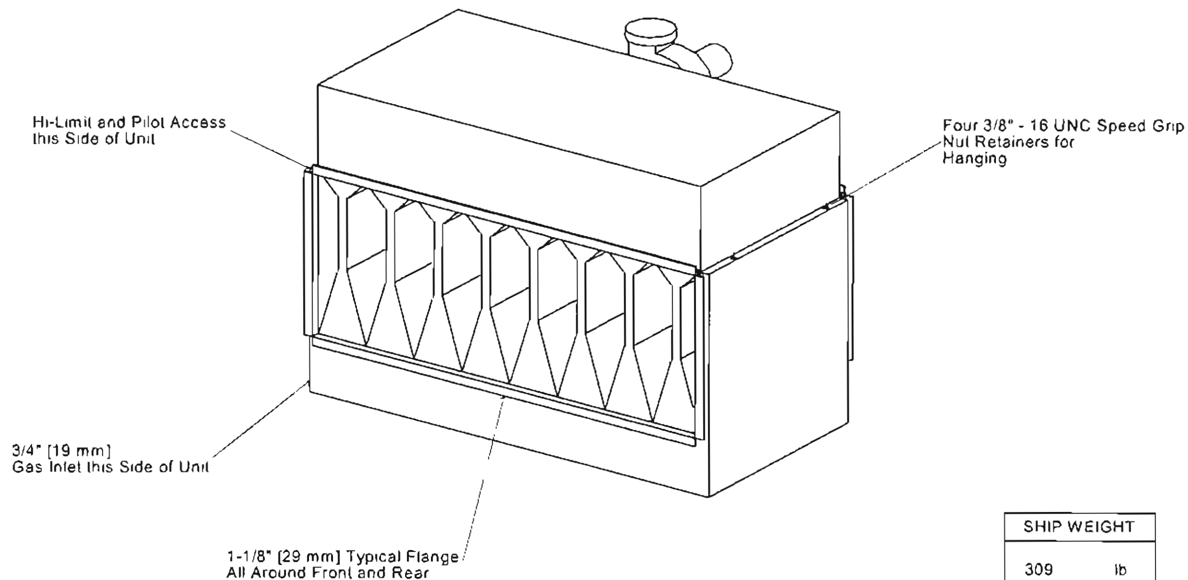
Flue Vent Fan
Flue vent fan provides power venting. Provided factory assembled to a sealed flue collection chamber. A combustion air pressure switch is provided as standard to verify proper powered vent flow prior to allowing the gas valve to operate.

Motor - 460 volt
Motor is 460 volt, 60 hertz, three phase, open drip-proof with built-in thermal overload protection.

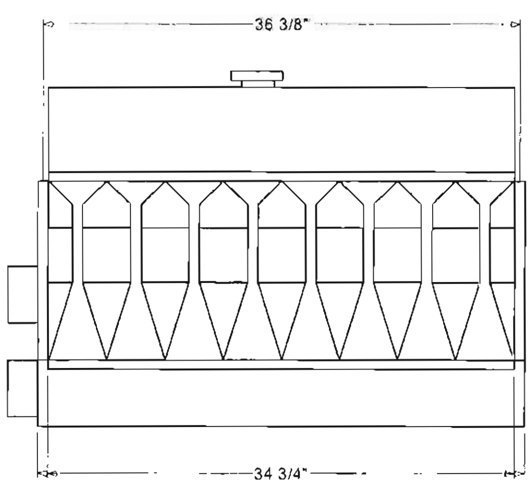
Control - Hi-Eff Duct Furnace
A factory installed junction box is provided for all power connections. Unit is provided with a 24-volt combination single-stage redundant gas valve, consisting of a combination pilot solenoid valve, automatic electric gas valve, pilot filter, pressure regulator, pilot adjustment and manual shutoff. A flue vent fan relay and combustion air proving switch is also provided. Equipment includes spark-ignited intermittent pilot system with electronic flame supervision. A 24-volt control transformer and high limit and are provided.

Single Stage Gas Valve
Equipment includes spark-ignited intermittent pilot system with electronic flame supervision.

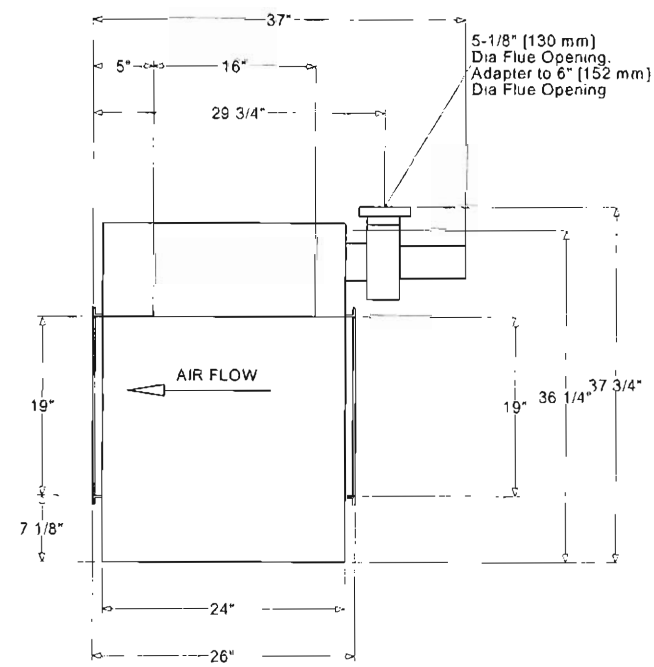
Unit Dimensions - Indoor Gas Heating Products
Item: B1 Qty: 4 Tag(s): DF-1



SHIP WEIGHT	
309	lb

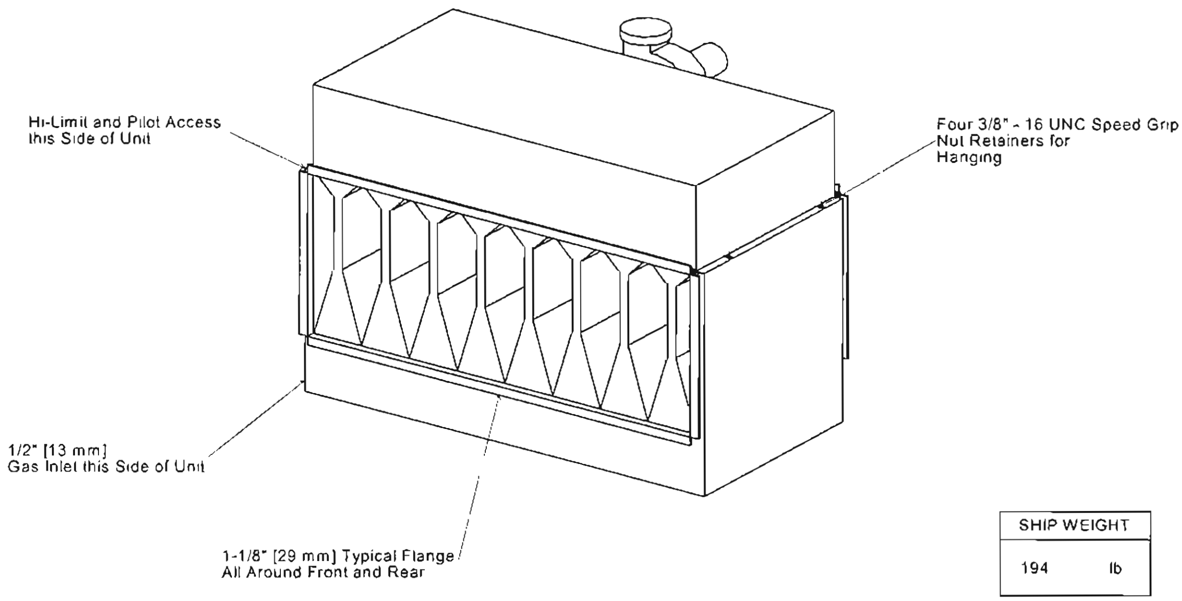


FRONT VIEW

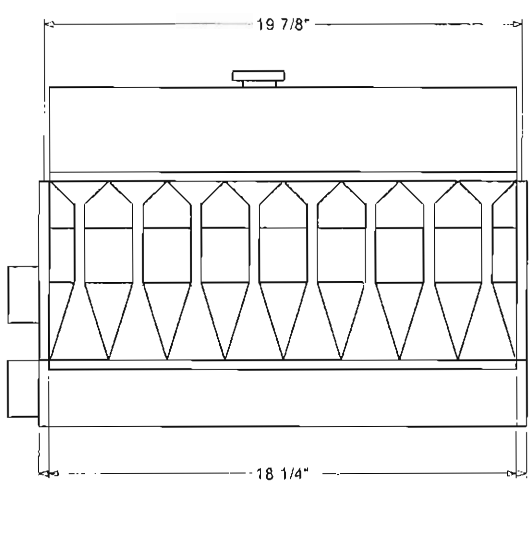


RIGHT VIEW

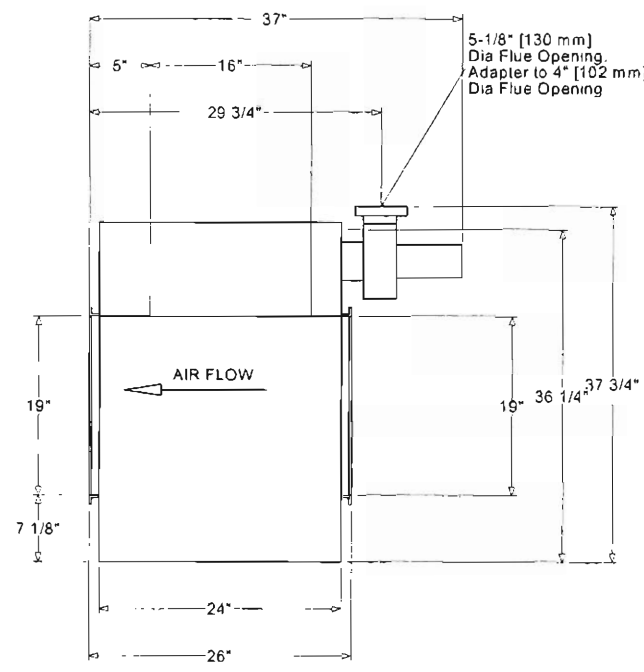
Unit Dimensions - Indoor Gas Heating Products
Item: B2 Qty: 1 Tag(s): DF-2



SHIP WEIGHT	
194	lb

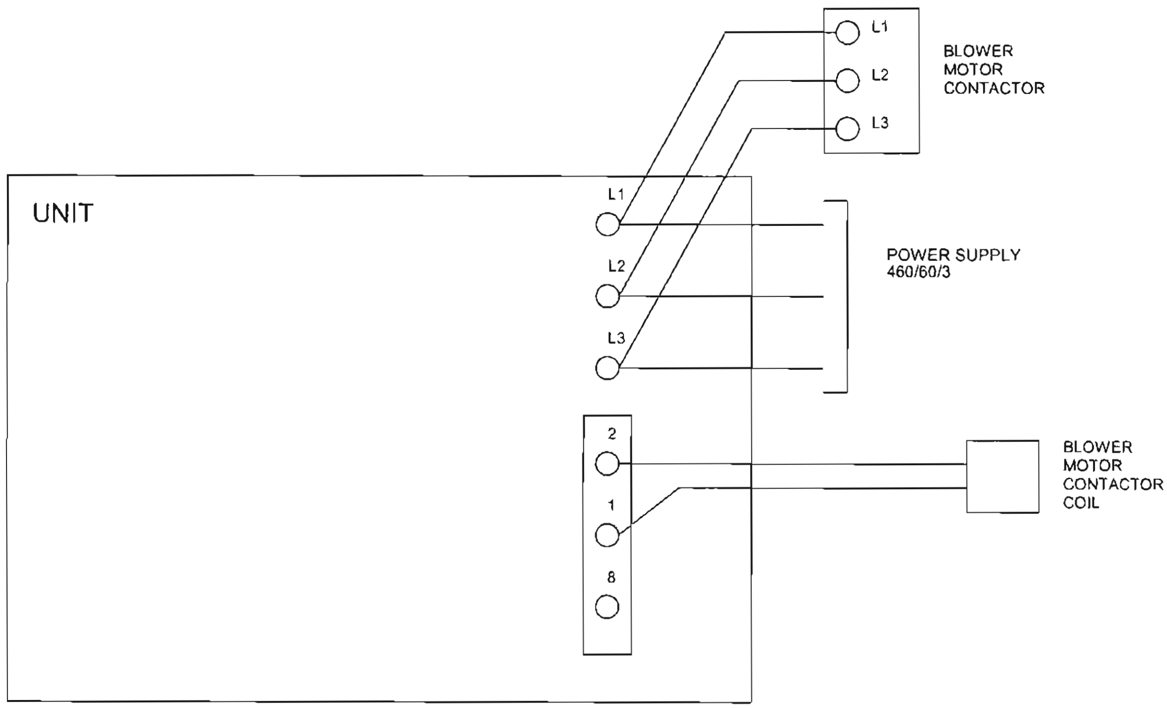


FRONT VIEW



RIGHT VIEW

Field Wiring - Indoor Gas Heating Products
Item: B1, B2 Qty: 5 Tag(s): DF-1, DF-2



CAUTION
USE COPPER CONDUCTORS ONLY!

UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS

FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT

ATTENTION
N'UTILISER QUE DES CONDUCTEURS EN CUIVRE!

LES BORNES DE L'UNITÉ NE SONT PAS CONÇUES POUR RECEVOIR D'AUTRES TYPES DE CONDUCTEURS

L'UTILISATION DE TOUT AUTRE CONDUCTEUR PEUT ENDOMMAGER L'ÉQUIPEMENT

PRECAUCIÓN
¡UTILICE ÚNICAMENTE CONDUCTORES DE COBRE!

LAS TERMINALES DE LA UNIDAD NO ESTÁN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES

SI NO LO HACE PUEDE OCASIONAR DAÑO AL EQUIPO

⚠ WARNING
HAZARDOUS VOLTAGE!

DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW LOCK OUT AND TAG PROCEDURES BEFORE SERVICING. INSURE THAT ALL MOTOR CAPACITORS HAVE DISCHARGED STORED VOLTAGE. UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE INSTRUCTIONS FOR CAPACITOR DISCHARGE.

FAILURE TO DO THE ABOVE BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY

⚠ AVERTISSEMENT
TENSION DANGEREUSE!

COUPER TOUTES LES TENSIONS ET OUVRIR LES SECTIONNEURS À DISTANCE PUIS SUIVRE LES PROCÉDURES DE VERROUILLAGE ET DES ÉTIQUETTES AVANT TOUTE INTERVENTION. VÉRIFIER QUE TOUS LES CONDENSATEURS DES MOTEURS SONT DÉCHARGÉS. DANS LE CAS D'UNITÉS COMPORTANT DES ENTRAÎNEMENTS À VITESSE VARAIBLE, SE REPORTER AUX INSTRUCTIONS DE L'ENTRAÎNEMENT POUR DÉCHARGER LES CONDENSATEURS.

NE PAS RESPECTER CES MESURES DE PRÉCAUTION PEUT ENTRAÎNER DES BLESSURES GRAVES POUVANT ÊTRE MORTELLES

⚠ ADVERTENCIA
¡VOLTAJE PELIGROSO!

DESCONECTE TODA LA ENERGÍA ELÉCTRICA INCLUSO LAS DESCONEXIONES REMOTAS Y SIGA LOS PROCEDIMIENTOS DE CIERRE Y ETIQUETADO ANTES DE PROCEDER AL SERVICIO. ASEGÚRESE DE QUE TODOS LOS CAPACITORES DEL MOTOR HAYAN DESCARGADO EL VOLTAJE ALMACENADO. PARA LAS UNIDADES CON EJE DE DIRECCIÓN DE VELOCIDAD VARIABLE, CONSULTE LAS INSTRUCCIONES PARA LA DESCARGA DEL CONDENSADOR.

EL NO REALIZAR LO ANTERIORMENTE INDICADO, PODRÍA OCASIONAR LA MUERTE O SERIAS LESIONES PERSONALES

Admiral
AIR CONDITIONING
130-12 90TH AVENUE RICHMOND HILL, NEW YORK 11418
(718) 441-7200 FAX (718) 849-0370

H.V.A.C. SUBMITTAL

****

PROJECT: NEW RETAIL CENTER
301 WEST 125TH STREET
NEW YORK, NEW YORK

****

CONTRACTOR: H & H BUILDERS

****

ENGINEER: SRA ARCHITECTURE & ENGINEERING

....

TAG: PACKAGED ROOFTOP UNITS
DATE: 08.05.2011
SUBMISSION #: 1 OF 1
REVISION #: 0

Submittal

Prepared For:
Engineer: S R A Architecture and Engineering

Date: *August 04, 2011*

Customer P.O. Number:
Customer Project Number:

Sold To:
Admiral Air Conditioning
130-12 90th Avenue
RICHMOND HILL, NY 11418

Job Number:
Job Name:
301 W 125th St

Trane U.S. Inc. is pleased to provide the enclosed submittal for your review and approval.

Product Summary

Qty	Product
4	Packaged Gas/Electric Rooftop Units
5	Indoor Gas Heating Products
12	Split System Air Conditioning Units (Large)

The attached information describes the equipment we propose to furnish for this project, and is submitted for your approval.

Tim Lomax
Trane
45-18 Court Square
Long Island City, NY 11101-4347
Phone: (718) 269-3600
Cell:
Fax: (718) 269-3601

Table Of Contents

Tag Data - Packaged Gas/Electric Rooftop Units (Qty: 4)

Item	Tag(s)	Qty	Description	Model Number
A1	RTU-1 to 4	4	12 1/2 -25 Ton Packaged Unitary Gas/Elec	YCD240F3H

Product Data - Packaged Gas/Electric Rooftop Units

Item: A1 Qty: 4 Tag(s): RTU-1 to 4

Standard gas/electric unit
Downflow airflow
20 ton Nominal cooling capacity R410A
208-230 Volt 60 Hertz 3 phase
High heat capacity
0-100% Economizer, dry bulb control (Fld)
Programmable Sensor with Night Setback and System Function Lights (Fld)
2nd thru 5th Year replacement compressor warranty

Not Including: Disconnects, Curbs and Power Exhaust

Performance Data - Packaged Gas/Electric Rooftop Units

Tags	RTU-1 to 4
Design airflow (cfm)	8000
ESP (in H2O)	1.000
Actual ESP (in H2O)	0.000
Indoor mtr operating power (bhp)	5.27
Indoor rpm (rpm)	837
Cooling EDB (F)	80.00
Cooling EWB (F)	67.00
Cooling LDB (F)	56.74
Cooling LWB (F)	56.32
Total capacity (MBh)	258.93
Sensible capacity (MBh)	197.33
Ambient temp (F)	95.00
Total capacity (MBh)	258.93
Sensible capacity (MBh)	197.33
Heating EAT (F)	70.00
Heating LAT (F)	109.21
Heating delta T (F)	37.30
Input htg capacity (MBh)	400.00
Output htg capacity (MBh)	324.00
Output htg capacity w/fan (MBh)	340.60
MCA (A)	108.00
MFS or Max Circuit Breaker (A)	125.00
Max. unit operating weight (lb)	2323.0
Refrig charge (HFC-410A) - ckt 1 (lb)	13.5
Refrig charge (HFC-410A) - ckt 2 (lb)	7.0
ASHRAE 90.1	Yes
SEER/EER @ AHRI (EER)	10.0
IEER ( )	11.50

Mechanical Specifications - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4

General (R-410)

The units shall be dedicated downflow or horizontal airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for all units. Cooling performance shall be rated in accordance with AHRI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation and control sequence, before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be UL listed and labeled, classified in accordance to UL 1995/C 22.2, 236-05 3rd Edition.

Casing (R-410)

Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. In order to ensure a water and air tight seal, service panels shall have lifting handles and no more than three screws to remove. All exposed vertical panels and top covers in the indoor air section shall be insulated with a 1/2 inch, 1 pound density foil-faced, fire-resistant, permanent, odorless, glass fiber material. The base of the downflow unit shall be insulated with 1/2 inch, 1 pound density foil-faced, closed-cell material. The downflow unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 11/8 inch high supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting.

Unit Top (R-410)

The top cover shall be one piece, or where seams exist, double hemmed and gasket sealed to prevent water leakage.

Filters (R-410)

Two inch standard filters shall be factory supplied on all units. Optional two inch pleated media filters shall be available.

Compressors (R-410)

All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of nameplate voltage. Internal overloads shall be provided with the scroll compressors. All models shall have crankcase heaters, phase monitors (for 17½, 20 and 25 Ton only) and low and high pressure control as standard.

Crankcase Heaters (R-410)

These band heaters provide improved compressor reliability by warming the oil to prevent migration during off-cycles or low ambient conditions. These are standard on all Voyager models.

Refrigerant Circuits (R-410)

Each refrigerant circuit shall have independent fixed orifice or thermostatic expansion devices, service pressure ports, and refrigerant line filter driers factory installed as standard. An area shall be provided for replacement suction line driers.

Evaporator and Condenser Coils (R-410)

Microchannel coils will be burst tested by the manufacturer. Internally finned, 5/16" copper tubes mechanically bonded to a configured aluminum plate fin shall be standard for evaporator coils. Condenser coils may also be microchannel type (major design sequence F units only). Coils shall be leak tested to ensure the pressure integrity. The evaporator coil and condenser coil shall be tested to 225 psig and pressure tested to 450 psig. All dual compressor units shall have intermingled evaporator coils. Sloped condensate drain pans are standard. Round tube plate fin type condenser coils are patent-pending 1+1+1 coils, permanently gapped for easy cleaning.

Gas Heating Section (R-410)

The heating section shall have a drum and tube heat exchanger design using corrosion resistant steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. In order to provide reliable operation, a negative pressure gas valve shall be used on standard furnaces and a pressure switch on furnaces with modulating heat that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger 45 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat. Units shall be suitable for use with natural gas or propane (field installed kit) and shall also comply with California requirements for low NOx emissions. The 12½- 25 tons shall have two stage heating (Gas/Electric Only).

Outdoor Fans (R-410)
The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and shall have built-in thermal overload protection.

Indoor Fan (R-410)
Units above shall have belt driven, FC centrifugal fans with adjustable motor sheaves. Units with standard motors shall have an adjustable idler-arm assembly for quick-adjustment of fan belts and motor sheaves. All motors shall be thermally protected. Oversized motors shall be available for high static application. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

Controls (R-410)
Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Unit shall provide an external location for mounting a fused disconnect device. ReliaTel controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized control shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

Phase monitor
Phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor is equipped with an LED that provides an ON or FAULT indicator. There are no field adjustments. The module will automatically reset from a fault condition.

High Pressure Cutout (R-410)
This option is offered for units that do not have High Pressure cutout as standard.

Discharge Line Thermostat (R-410)
A bi-metal element discharge line thermostat is installed as a standard option on the discharge line of each system. This standard option provides extra protection to the compressors against high discharge temperatures in case of loss of charge, extremely high ambient and other conditions which could drive the discharge temperature higher. Discharge line thermostat is wired in series with high pressure control. When the discharge temperature rises above the protection limit, the bi-metal disc in the thermostat switches to the off position, opening the 24 VAC circuit. When the temperature on the discharge line cools down, the bi-metal disc closes the contactor circuit, providing power to the compressor. When the thermostat opens the fourth time, the ReliaTel control must be manually reset to resume operation on that stage.

Accessory - Economizer - Downflow (R-410A)
The assembly includes fully modulating 0-100 percent motor and dampers, barometric relief, minimum position setting, preset linkage, wiring harness with plug, fixed dry bulb and spring return actuator. The barometric relief damper shall be standard with the downflow economizer and shall provide a pressure operated damper that shall be gravity closing and shall prohibit entrance of outside air during the equipment "off" cycle. Solid state enthalpy and differential enthalpy control shall be field-installed.

Accessory - BAYSENS119 Programmable Zone Temperature Sensor Configured as a Constant Volume Unit (R-410A)
The electronic programmable sensor is Auto or Manual changeover with seven day programming. Auto or Manual selection of Fan Auto, Fan On. Programmable sensor has System Off, Auto, Heat, Cool, and Service /LCD indicators as standard. Night setback sensor has up to four programs per day which can be individually configured to occupied or unoccupied.

Accessory - Digital Display Zone Sensor (R-410A)

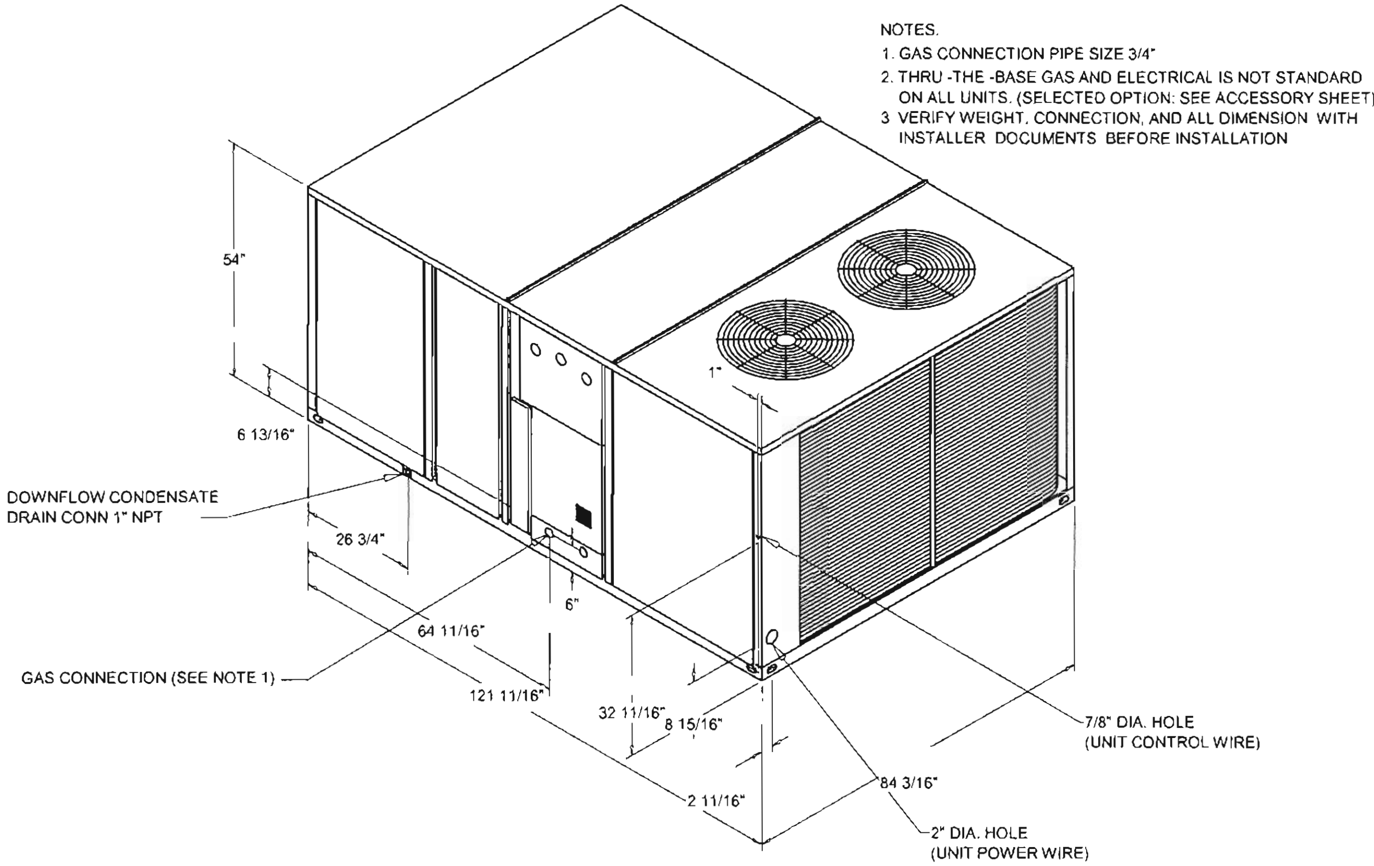
The Digital LCD (Liquid Crystal Display) zone sensor has the look and functionality of standard zone sensors. This sensor includes a digital display of set point adjustment and space temperature in F (Fahrenheit) or C (Celsius). Includes FAN and SYSTEM buttons (supports the service functions of the standard sensor). E-squared memory stores last programmed set points. Requires 24 VAC (Volts AC). This sensor should be utilized with ReliaTel¿ controls.

Accessory - Zone Sensors (R-410A)

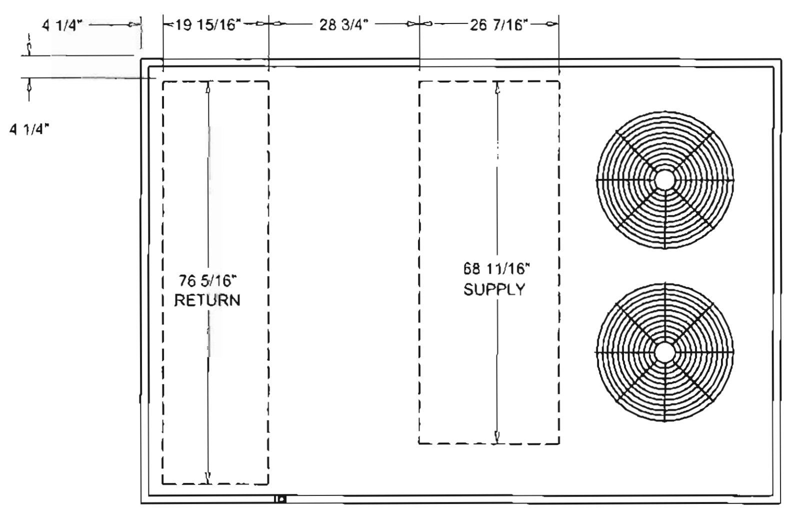
This option shall be provided to interface with the Micro equipped Voyagers and shall be available in either manual, automatic, programmable with night setback, with system malfunction lights or remote sensor options.

Unit Dimensions - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4

NOTES.
1. GAS CONNECTION PIPE SIZE 3/4"
2. THRU -THE -BASE GAS AND ELECTRICAL IS NOT STANDARD ON ALL UNITS. (SELECTED OPTION: SEE ACCESSORY SHEET)
3. VERIFY WEIGHT, CONNECTION, AND ALL DIMENSION WITH INSTALLER DOCUMENTS BEFORE INSTALLATION



PACKAGED GAS/ELECTRIC - DOWNFLOW
ISOMETRIC DRAWING



PACKAGED GAS/ELECTRIC - DOWNFLOW
PLAN VIEW DRAWING

Unit Dimensions - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4

ELECTRICAL / GENERAL DATA

GENERAL PERFORMANCE

Mobel (Ton)	YCD240F (20 0)
Unit Operating Voltage Range:	187-253
Unit Primary Voltage	208
Unit Secondary Voltage	230
Unit Hertz:	60
Unit Phase	3
EER:	10.0

Standard Motor

Minimum Circuit Ampacity	108.0
Maximum Fuse Size	125.0
Maximum (HACR) Circuit Breaker.	125 0

Oversized Motor

MCA	N/A
MFS	N/A
MCB (HACR)	N/A

Field Installed Oversized Motor

MCA	N/A
MFS:	N/A
MCB (HACR)	N/A

GAS HEATING

Heating Models	High
Heating and 1 Stage Input (Btu/h)	400,000 / 300,000
Heating and 1 Stage Output (Btu/h)	324,000 / 243,000
Min./Max. Gas Input - Pressure Natural or LP.	2.5 / 14.0
Gas Connection Pipe Size	3/4"

COMPRESSOR

	Circuit #1 / 2
Number.	2
Horsepower	11.8/6.9
Phase:	3
Rated Load Amps:	42.5/26.2
Locked Rotor Amps	304.0/164 0

INDOOR MOTOR

Number:	1
Horsepower:	5.00
Motor Speed (RPM):	3,450
Phase.	3
Full Load Amps.	16 7
Locked Rotor Amps:	109.0

Oversized Motor

Number.	N/A
Horsepower	N/A
Motor Speed (RPM)	N/A
Phase:	N/A
Full Load Amps:	N/A
Locked Rotor Amps	N/A

Field Installed Oversized Motor

Number:	N/A
Hp:	N/A
Motor Speed (RPM)	N/A
Phase:	N/A
FLA:	N/A
LRA	N/A

OUTDOOR MOTOR

Number:
Horsepower:
Motor speed (RPM):
Phase:
Full Load Amps.
Locked Rotor Amps:

POWER EXHAUST
(Field Installed Power Exhaust)

Horsepower	N/A
Motor Speed (RPM):	N/A
Phase:	N/A
Full Load Amps:	N/A
Locked Rotor Amps	N/A

COMBUSTION BLOWER MOTOR
(Gas-Fired Heating only)

Horsepower:	0.1
Motor Speed (RPM):	3,500/2,800
Phase:	1
Full Load Amps:	0.8
Locked Rotor Amps	2.00

FILTER

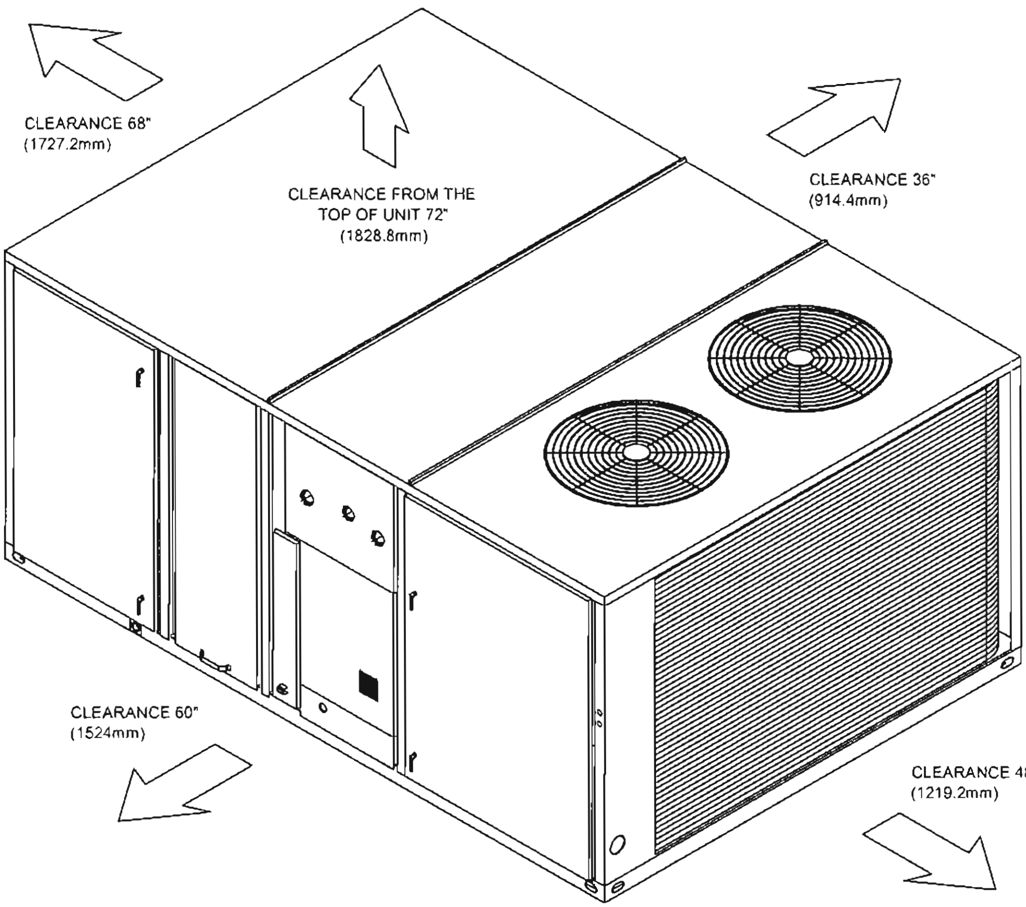
Type	Throwaway
Furnished:	Yes
Number:	4 / 4
Recommended Size:	20"x20"x2" / 20"x25"x2"

REFRIGERANT

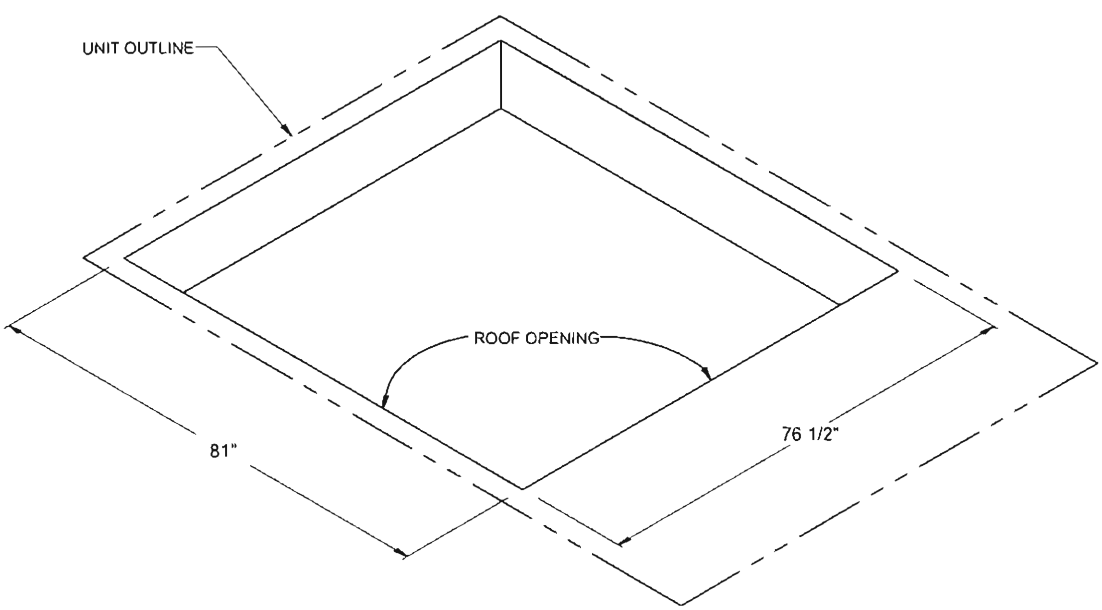
	Circuit #1 / 2
Type:	R410
Factory Charge Circuit #1 / 2:	13.7 lb / 7.0 lb

NOTES:
1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.

Weight, Clearance & Rigging Diagram - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4

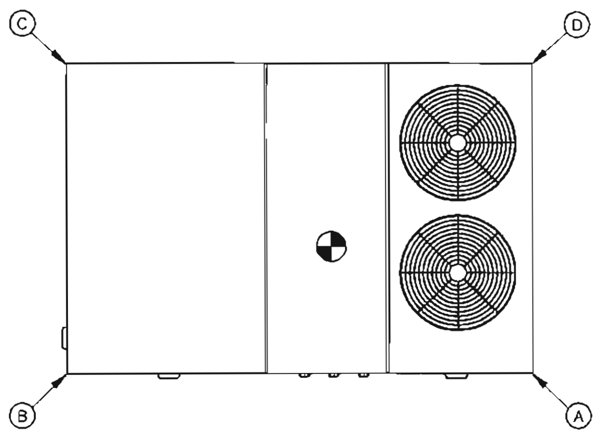


DOWNFLOW-PACKAGED GAS/ELECTRIC CLEARANCE



DOWNFLOW-PACKAGED GAS/ELECTRIC ROOF OPENING CLEARANCE

Weight, Clearance & Rigging Diagram - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4



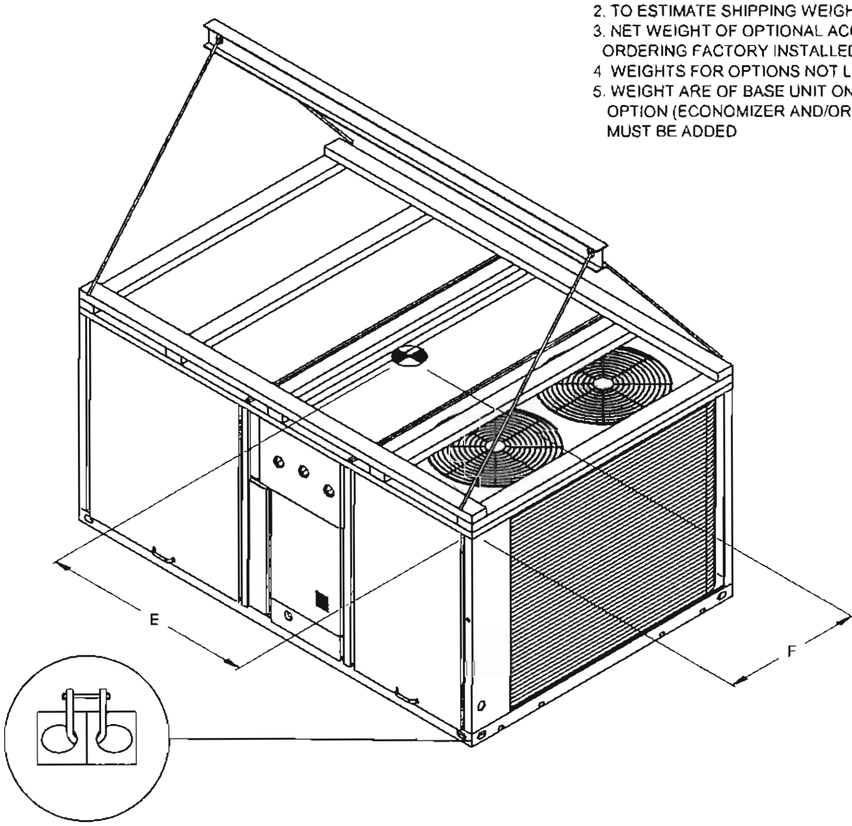
CORNER WEIGHT

INSTALLED OPTIONS NET WEIGHT DATA

Accessory	Accessory
Economizer	80.0 lb
Motorized Outside Air Damper	
Manual Outside air Damper	
Oversized Motor	
High Efficiency Motor	
High Static Drive	
Thru the Base Electrical	
Unit Mounted Circuit Breaker	
Unit Mounted Disconnect	
Power Exhaust	
Hinged Doors	
Zone Sensor	1.0 lb
LPG Conversion Kit	
Powered Convenience Outlet	
Roof Curb	

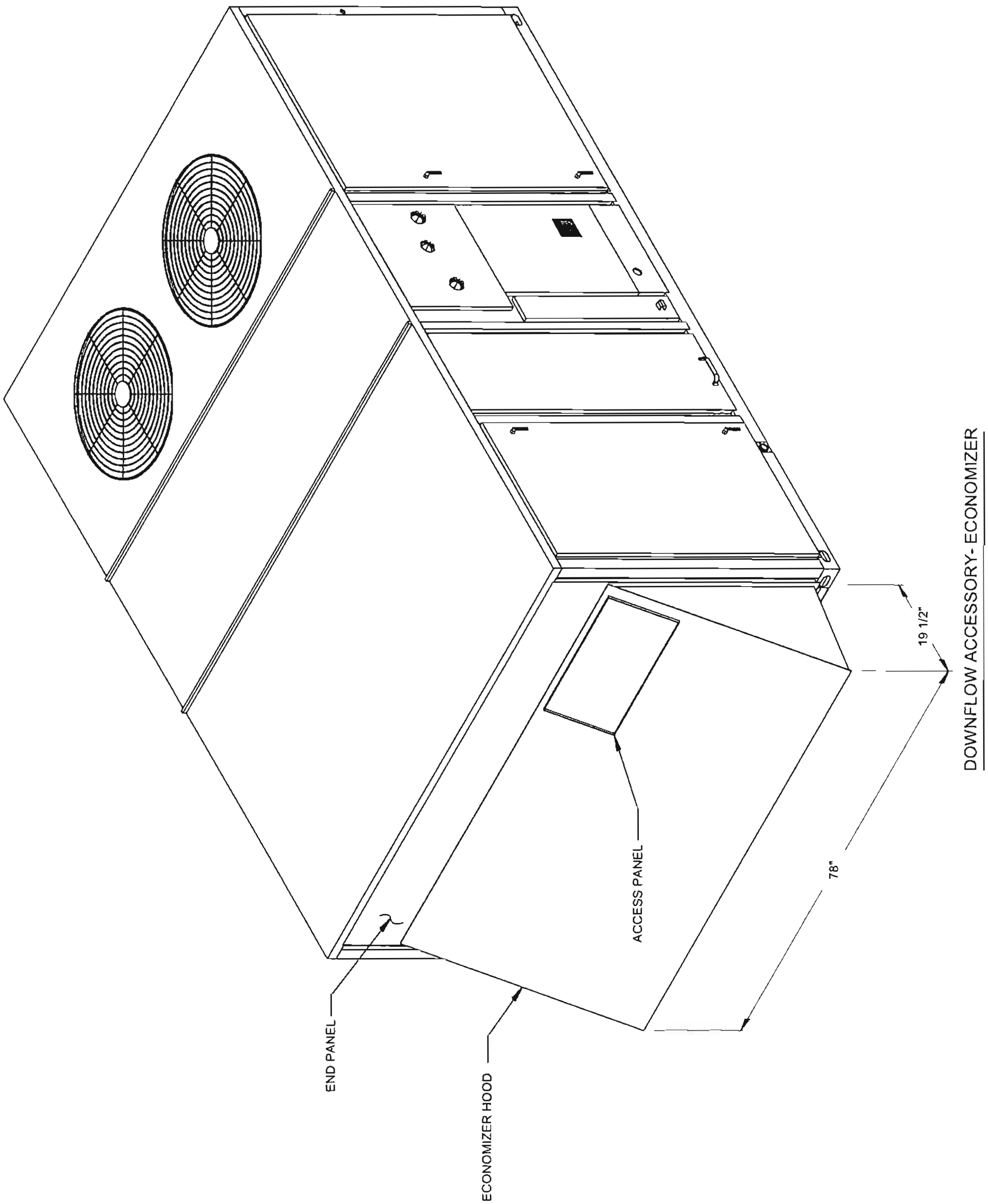
BASE UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITY	
SHIPPING	NET	A	B	C	D	E	F
2528.0 lb	2069.0 lb	659.0 lb	551.0 lb	402.0 lb	455.0 lb	57"	35"

NOTE:
1. CORNER WEIGHTS ARE GIVEN FOR INFORMATION ONLY
2. TO ESTIMATE SHIPPING WEIGHT OF OPTION/ACCESSORIES ADD 5 LBS TO NET WEIGHT
3. NET WEIGHT OF OPTIONAL ACCESSORIES SHOULD BE ADD TO UNIT WEIGHT WHEN ORDERING FACTORY INSTALLED ACCESSORIES.
4. WEIGHTS FOR OPTIONS NOT LISTED ARE < 5 LBS
5. WEIGHT ARE OF BASE UNIT ONLY FOR TOTAL WEIGHT. 10 DIGIT FACTORY INSTALLED OPTION (ECONOMIZER AND/OR OVERSIZED MOTOR OR FIOP/ACCESSORY WEIGHT MUST BE ADDED

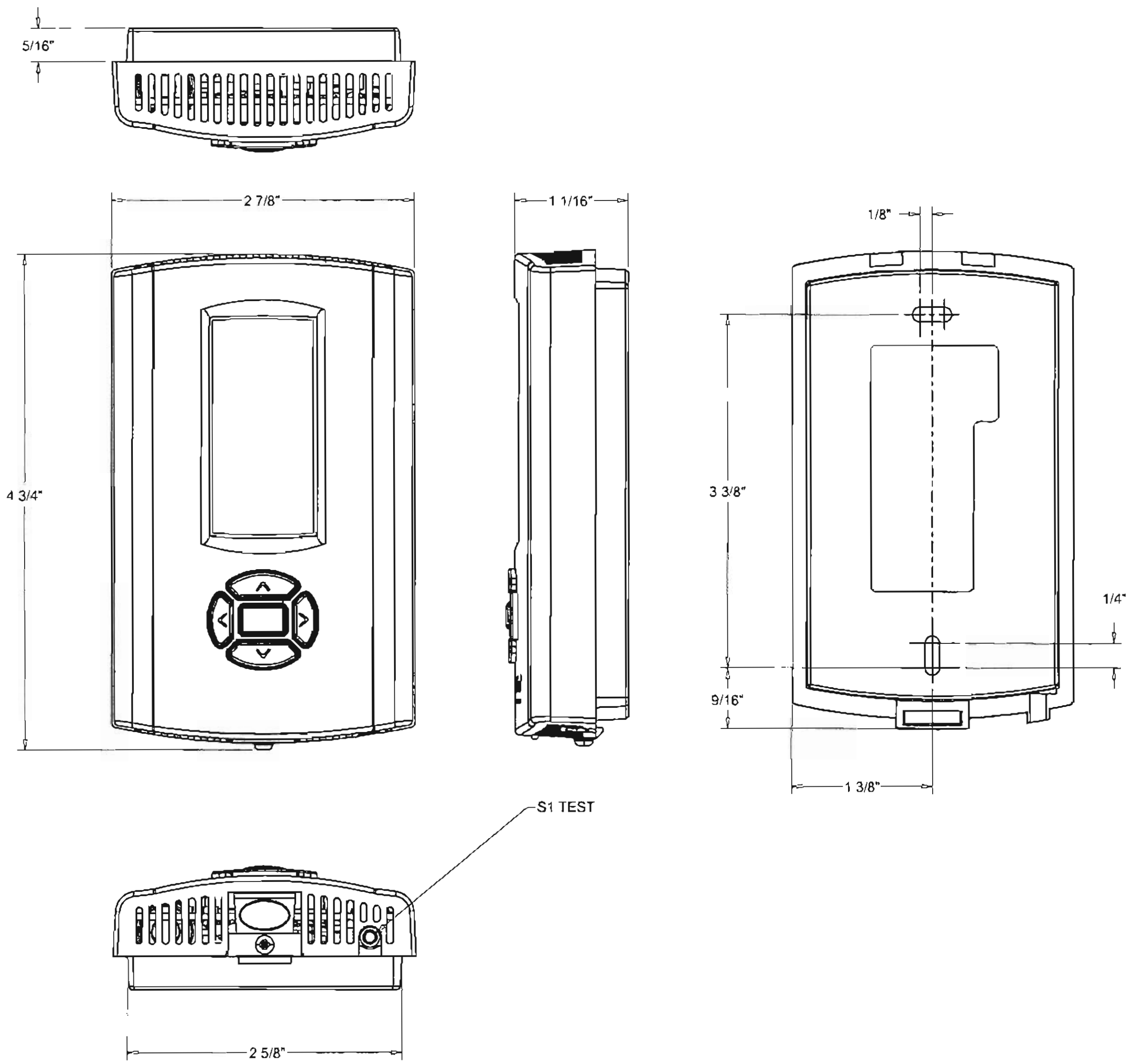


RIGGING AND CENTER OF GRAVITY

Accessory - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4

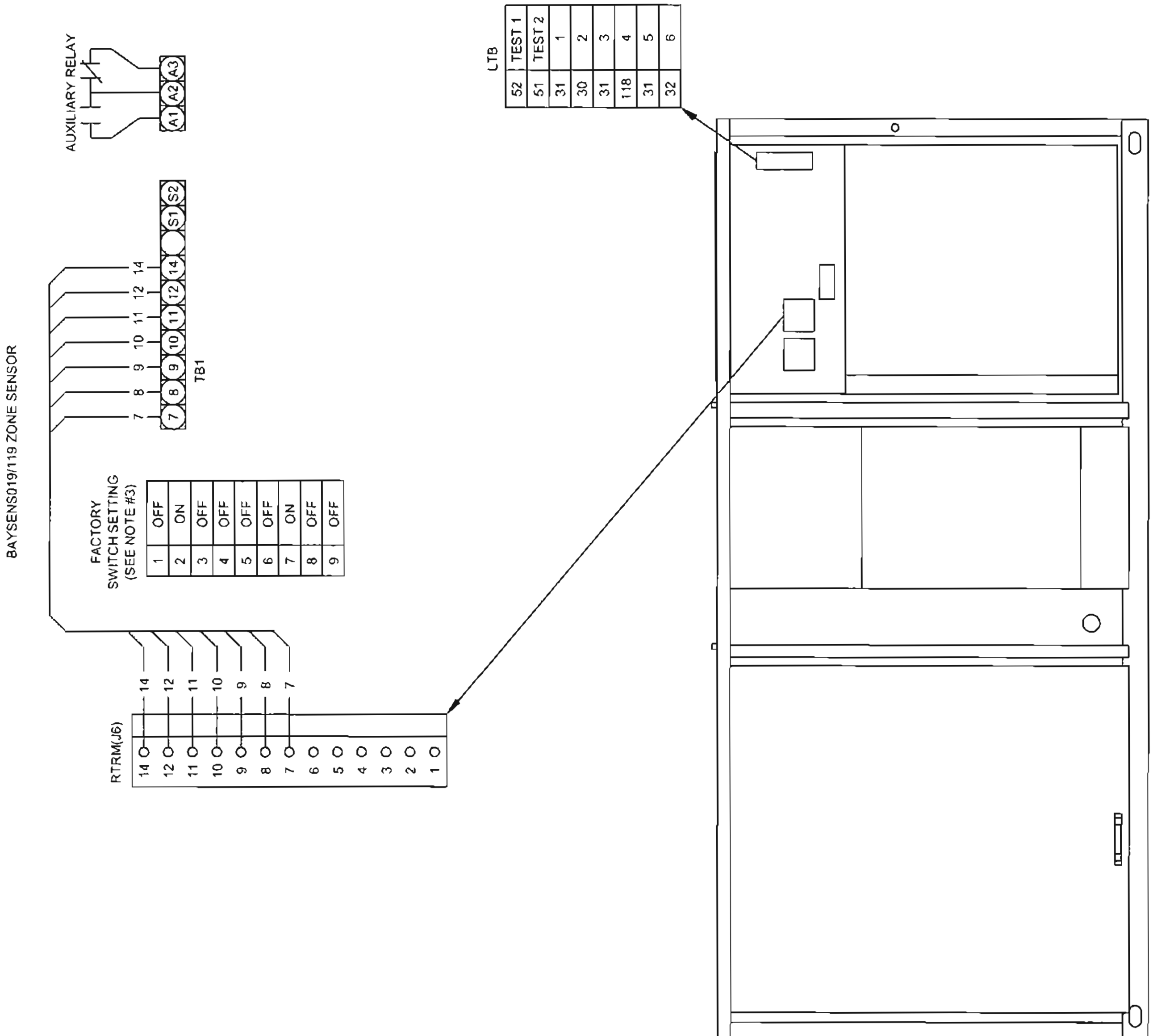


Accessory - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4



ZONE SENSOR-BAYSENS119 PROGRAMMABLE SENSOR

Field Wiring - Packaged Gas/Electric Rooftop Units
Item: A1 Qty: 4 Tag(s): RTU-1 to 4



ZONE SENSOR WIRE TABLE	
WIRE SIZE	MAXIMUM WIRE LENGTH
22 GAUGE	1800'
20 GAUGE	3000'
18 GAUGE	4500'
16 GAUGE	7200'
14 GAUGE	11700'

NOTE:

1. ALL WIRING AND DEVICES SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN WITH NATIONAL AND LOCAL ELECTRICAL CODES.
2. LOW VOLTAGE CONTROL WIRING MUST NOT BE RUN IN CONDUIT WITH POWER WIRING
3 CUT WIRE JUMPER ADJACENT TO THE TERMINAL 1 ON ZONE SENSOR

Field Installed Options - Part/Order Number Summary
This is a report to help you locate field installed options that arrive at the jobsite. This report provides part or order numbers for each field installed option, and references it to a specific product tag. It is NOT intended as a bill of material for the job.

Product Family - Packaged Gas/Electric Rooftop Units

Item	Tag(s)	Qty	Description	Model Number
A1	RTU-1 to 4	4	12 1/2 -25 Ton Packaged Unitary Gas/Elec	YCD240F3H

Field Installed Option Description	Part/Ordering Number
0-100% Economizer, dry bulb control	BAYECON090A
Programmable Sensor with Night Setback and System Function Lights	BAYSENS119A

Product Family - Split System Air Conditioning Units (Large)

Item	Tag(s)	Qty	Description	Model Number
C1	AHU/CU-1	11	6 - 20 Ton Unitary Split Systems	TTA240E300--TWE240E300
C2	AHU/CU-2	1	6 - 20 Ton Unitary Split Systems	TTA120D300--TWE120D300

Field Installed Option Description	Part/Ordering Number
Low Ambient Control if no Hot Gas Bypass or Reliatel	BAYLOAMU02B

A.O. Smith DEL-50D Commercial Tank Type Water Heater, Light Duty Electric, 50 Gallon, Dura-Power Preferred, 12KW Input

The Highest Standards, The Best Performance! The innovative streak that runs through all A.O. Smith products is also proudly on display in our commercial electric line. With features such as the intelligent control system (DVE & DSE models) and the now standard 24k gold elements (optional on DSE models), our water heaters can sustain that performance even in the harshest water conditions.

A.O. Smith DEL-50D Commercial Tank Type Water Heater, Light Duty Electric, 50 Gallon, Dura-Power Preferred, 12KW Input Features:

- Glass lined tank - tank interior is coated with glass specially developed by A.O. Smith Ceramic Research for water heater use
- Elements - zinc plated copper sheaths for longer life. Medium watt density; means lower surface temperature to minimize scale build-up and more surface to heat water.
- Standard voltages - 120, 277 single phase and 208, 240 and 480V unbalanced three-phase delta; easily converted to single-phase at terminal block (except 208V with 6000 watt elements). Single element heater, single-phase only.
- Factory installed terminal block -just bring the service to heater and connect to block. Terminal block not supplied on 120V & 277 volt models.
- Controls - temperature control (adjustable through a range of 110 Degrees to 170 Degrees Fahrenheit on single element and120 Degrees to 180 Degrees Fahrenheit on dual element) and manual reset high temperature cutoff per element (dual elementmodels). Factory wired for non-simultaneous operation; easily converted to simultaneous element operation (three phase models only)
- CSA certified and ASME rated T&P relief valve
- Simplified circuitry, color coded for ease of service
- Anode rod for maximum corrosion protection
- Cabinet has bonderized undercoat with baked enamel finish
- Top inlet and outlet openings
- Drain valve
- Surface mounted thermostats
- UL approved field conversion program.

A.O. Smith DEL-50D Commercial Tank Type Water Heater, Light Duty Electric, 50 Gallon, Dura-Power Preferred, 12KW Input Specifications:

- Application: Plumbing
- Capacity: 50 Gallons
- Type: Electric
- Number of Elements: 2
- Maximum Kilo Input: 12
- Max PSI: 150 psi
- Height: 32-1/4"
- Diameter: 26-1/2"
- Weight: 170 lbs
- Manufactures Warranty: Three Years Limited Tank

APPENDIX D

Stamped Mechanical Drawings

SRA
Architecture + Engineering, P.C.

August 8,2011

Mr. Maurizio Bertini
Section Chief-Air and Noise Program
E-Designations Program
Office of environmental Remediation
253 Broadway, 14th Floor
New York, NY 10007.

Re: 2329 Frederick Douglass Boulevard
Block: 1952, Lot:29
E:
OER #:12CBP020M

Dear Mr. Bertini,

This is to inform you that the above referenced property will be entirely developed as a 3 story building with a basement. The entire building will be for Commercial/Retail use.

To satisfy the Air Quality "E" Designation, Natural Gas will be utilized for the HVAC system to be installed in the building. The units are as follows; four (4) Trane 20 Ton Roof Top Units Model TWE240, Eleven (11) 20 Ton Trane Air Cooled Condensing Units model TTA240, One (1) 10 Ton Trane Air Cooled Condensing Unit TTA120, Eleven (11) Trane Indoor Duct Furnaces model GLND030EDG and One (1) Trane Indoor Duct Furnace model GLND015EDG . A total of 6 electric water heaters, AO Smith Model DEL 50 will be installed throughout the building 1 on the 3rd 2 on the 2nd 2 on the ground floor and 1 in the basement. Not shown on Plans

Four (4) 20 Ton Trane roof top packaged gas/electric heating units with a capacity of 191,000 BTU, Model #TWE240. Eleven (11) 20 Ton Trane roof top air cooled condensing units with a capacity of 200,000 , Model #TTA240 BTU. One (1) 10 Ton Trane roof top air cooled condensing units with a capacity of 120,000 BTU, Model #TTA120. Eleven (11) Trane indoor duct furnaces with a capacity of 300,000/240,000(input/output)BTU , Model GLND030EDG will each be installed inside the Basement, 1st and 2nd floor of the proposed new development. One (1) Trane indoor duct furnace with a capacity of 150,000/120,000(input/output)BTU, Model GLND015EDG will be installed inside the First floor of the proposed new development (plans M-101). All of the twelve (12) indoor duct furnaces will be exhausted by means of 4 exhaust stacks running up to the roof and extending 4' above top of roof (plan M-104).

312 Spring Street · New York, NY 10013
Phone (212) 505-1986 · Fax (212) 505-2794

Originally, the notice from the City asked us to provide "windows of OITC 35".
The CEQR Environmental Designations says that this block and lot requires "Window Wall Attenuation and Alternate Ventilation". Upon further investigation, the 125th Street Corridor Rezoning and Related Actions EIS, New York City Department of City Planning documentation shows a requirement for OITC 40/30, which means: OITC 30 for the side facing Frederick Douglass Boulevard, and
OITC 40 for the south facade facing 125th Street. You explained that we can knock down that requirement by 5 OITC rating points for commercial use, which results in:
OITC 25 for the side facing Frederick Douglass Boulevard, and OITC 35 for the south facade facing 125th Street.

To ensure the acceptable interior noise environment all glazing will be as follows;
In the calculations, "750 OG Acoustical Test with Standard Insulated Unit" represents 1" insulated glass with ¼" annealed exterior, ½" airspace, and ¼" annealed interior glass from, YCW Model 750 OG from YKK AP AMERICA. This has a rating of OITC 26.
In the calculations, "Lam. ¼"" glass .030, ½" airspace, lam. ¼" glass .090" represents ¼" laminated glass with a .030 interlayer, ½" airspace, and ¼" laminated glass with a .090 interlayer, from Solutia, "Laminated Glass with Saflex interlayer". This has an OITC rating of 35.

To satisfy the requirements for an alternate means of ventilation the natural gas HVAC system described above has been designed to provide fresh air to all areas of the Building.

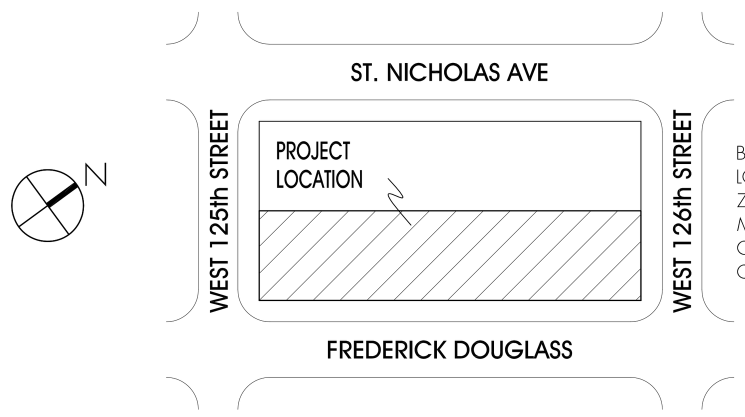
Sincerely,

NEW RETAIL CENTER

301 West 125th Street
New York, NY 10027

MECHANICAL SET

PLOT PLAN:



BLOCK: 1952
LOT: 29
ZONE: C4-4D COMMERCIAL
MAP: 6A
CONSTRUCTION CLASS.: IIC 2 HRS PROTECTED
OCCUPANCY CLASS.: M-MERCANTIL

DRAWING LIST

PAGE	SHEET NUMBER	SHEET TITLE	08.25.11 ISSUED FOR DEP	ADDENDUM
	GENERAL			
1	M-001.00	PLOT PLAN & PROJECT INFORMATION, DRAWING LIST, & MECHANICAL GENERAL NOTES	●	
2	M-002.00	MECHANICAL EQUIPMENT SCHEDULE & RISER DIAGRAMS	●	
3	M-003.00	MECHANICAL HVAC DETAILS	●	
	MECHANICAL			
4	M-100.00	CELLAR HVAC LAYOUT	●	
5	M-101.00	1st FLOOR HVAC LAYOUT	●	
6	M-102.00	2nd FLOOR HVAC LAYOUT	●	
7	M-103.00	3rd FLOOR HVAC LAYOUT	●	
8	M-104.00	ROOF HVAC LAYOUT	●	

HEATING, VENTILATING, AND AIR CONDITION INSPECIFICATIONS

THE ENTIRE MECHANICAL INSTALLATION SHALL CONFORM TO THE FOLLOWING NOTES AND SPECIFICATIONS.

MECHANICAL GENERAL PROVISIONS

1.01 GENERAL

A. MATERIALS AND WORKMANSHIP, UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS. ALL MATERIALS AND EQUIPMENT TO BE NEW UNLESS OTHERWISE NOTED.
B. ALL APPLICABLE CODES, LAWS AND REGULATIONS, GOVERNING OR RELATING TO ANY PORTION OF THIS WORK, INCLUDING UTILITY COMPANY RULES AND REGULATIONS AND OSHA REQUIREMENTS ARE HEREBY INCORPORATED INTO AND MADE A PART OF THESE SPECIFICATIONS. THESE PROVISIONS SHALL BE CARRIED OUT BY THE CONTRACTOR WHO SHALL INFORM THE OWNER, PRIOR TO SUBMITTING A PROPOSAL, OF ANY WORK OR MATERIALS WHICH VIOLATE ANY OF THE LAWS AND REGULATIONS. ANY WORK DONE BY THE CONTRACTOR CAUSING SUCH VIOLATIONS SHALL BE CORRECTED BY THE CONTRACTOR.
C. CONTRACTOR BIDDING THIS JOB SHALL VISIT AND INSPECT THE JOB SITE TO BECOME FULLY KNOWLEDGEABLE OF EXISTING CONDITIONS PRIOR TO SUB- MITTING HIS BID. CONTRACTOR SHALL COORDINATE THE SITE VISIT WITH BUILDING MANAGEMENT AND/OR OWNER. CONTRACTOR SHALL ASK THE BUILDING MANAGEMENT AND/OR OWNERS REPRESENTATIVE ANY QUESTIONS HE MAY HAVE PERTAINING TO BUILDING STANDARDS AND EXISTING CONDITIONS THAT PRO- HIBIT THE PROPER INSTALLATION OF HIS WORK AS PER PLAN AND SPECIFICATION.

1.02 NEW WORK

A. INSTALL ALL WORK SO AS TO BE READILY ACCESSIBLE FOR OPERATION, MAINTENANCE AND REPAIR.
B. PLAN INSTALLATION OF NEW WORK TO ENSURE MINIMUM INTERFERENCE WITH REGULAR OPERATION OF EXISTING FACILITIES. ALL SYSTEM SHUTDOWNS AFFECTING OTHER AREAS SHALL BE COORDINATED WITH BUILDING OWNER AND BUILDING MANAGEMENT. INSTALL ISOLATION VALVES AT POINTS OF CONNECTION TO THE EXISTING PIPING.

1.03 SITE VERIFICATION

A. INVESTIGATE EACH SPACE THROUGH WHICH EQUIPMENT MUST BE MOVED AND WHEN NECESSARY EQUIPMENT SHALL BE SHIPPED FROM MANUFACTURER IN CR- ATED SECTIONS OF SIZE SUITABLE FOR MOVING THROUGH RESTRICTED SPACES AVAILABLE. ASCERTAIN FROM BUILDING OWNER AND TENANT AT WHAT TIMES OF DAY EQUIPMENT COULD BE MOVED THROUGH CERTAIN RESTRICTED AREAS, AND REVIEW WITH OWNER PLANNED APPROACH FOR ANY REQUIRED EQUIPMENT RIGGING INTO BUILDING.
B. ALL DUCTWORK AND PIPING ARE SHOWN DIAGRAMMATICALLY AND DO NOT SHOW ALL OFFSETS, DROPS AND RISES OF RUNS. THE CONTRACTOR SHALL ALLOW IN HIS BID FOR ROUTING OF DUCTWORK AND PIPING TO AVOID OBSTRUCTIONS. EXACT LOCATIONS SUBJECT TO APPROVAL.
C. DURING THIS INSPECTION THE CONTRACTOR FINDS ANY OBSTRUCTION OR INTERFERENCE THAT MAY PROHIBIT THE PROPER INSTALLATION OF HIS WORK HE IS TO MAKE IT KNOWN TO THE BUILDING MANAGEMENT AND/OR OWNER BEFORE AND AT THE TIME OF SUBMITTING HIS PROPOSAL.
D. BY SUBMISSION OF THE BID IT IS UNDERSTOOD THAT SUCH INSPECTION HAS BEEN MADE AND INCLUDES ALL THE MATERIALS AND REQUIRED RELOCATION, FOR ALL WORK.
E. WHEN CONFLICTS OCCUR IN THE SPECIFICATIONS OR IN THE DRAWINGS OR BETWEEN EITHER, PROVIDE THE ITEM OF GREATER QUANTITY OR HIGHER COST.
F. PROVIDE ALL ITEMS OF LABOR OR MATERIALS NOT SPECIFICALLY INDICATED,BUT REQUIRED TO COMPLETE THE INTENDED INSTALLATIONS.

1.04 COORDINATION BETWEEN TRADES

A. THIS CONTRACTOR IS RESPONSIBLE FOR FIELD CONDITIONS AND FIELD COORDINATION WITH ALL OTHER TRADES.

3.01 CUTTING AND PATCHING

A. THIS CONTRACTOR SHALL INCLUDE FOR ALL CUTTING AND PATCHING AS REQUIRED BY HIS TRADE.
B. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING, FITTING, PATCHING,WATER PROOFING, FIREPROOFING AND FLASHING THAT MAY BE REQUIRED TO SUPPORT THE PUMPS PIPING, DUCTWORK, EQUIPMENT, ETC.
C. THIS CONTRACTOR SHALL COORDINATE SUPPORTS, HOUSEKEEPING PADS AND FLASHING WITH BUILDING MANAGEMENT AND SUBMIT THE METHOD OF SUPPORT INCLUDING THE ROOF MOUNTED EQUIPMENT FOR REVIEW TO THE OWNER.
D. THIS CONTRACTOR SHALL PROVIDE SLEEVES FOR DUCTS AND PIPING AND PROVIDE ESCUTCHEONS. SEAL OPENINGS AROUND DUCTS AND PIPING THROUGH PARTITIONS, WALLS AND FLOOR (NOT IN SHAFTS) WITH MINERAL WOOL OR OTHER NON-COMBUSTIBLE MATERIAL.
E. PROVIDE NECESSARY FLASHING AND COUNTERFLASHING TO MAINTAIN WATERPROOF INTEGRITY OF THE BUILDING AS REQUIRED BY REMOVAL AND/OR INSTALLATION OF PIPES, DUCTS, CONDUITS AND EQUIPMENT. SUBMIT FOR REVIEW TO THE OWNER.
F. NEW ROOFING MATERIALS USED IN PATCHING THE EXISTING ROOF SHALL BE COMPATIBLE WITH EXISTING ROOFING MATERIALS AND SHALL BE SUBMITTED TO THE BUILDING OWNER FOR HIS APPROVAL.

SCOPE OF WORK

1.01 GENERAL

A. PROVIDE REQUIRED LABOR, MATERIALS, EQUIPMENT AND SERVICES NECESSARY FOR A COMPLETE AND SAFE INSTALLATION OF HVAC WORK, IN CONFORMITY WITH THE REQUIREMENTS OF BUILDING CODES AND AUTHORITIES HAVING JURISDICTION; ALL AS INDICATED ON DRAWINGS AND/OR HEREIN SPECIFIED.
B. CONTRACTOR SHALL FURNISH AND INSTALL EQUIPMENT,DUCTWORK, INTERCONNECTING PIPING,FITTING,INSULATION,INTERLOCK AND CONTROL WIRING, ETC.

1.02 PERMITS

A. SECURE PERMITS, LICENSES AND CERTIFICATES. PAY FEES AND CHARGES FOR WORK INSTALLED CERTIFYING COMPLIANCE WITH LOCAL CODES AND GOVERNING AUTHORITIES. DELIVER CERTIFICATES TO BUILDING MANAGEMENT OFFICE PRIOR TO THE COMMENCEMENT OF WORK.

1.03 EQUIPMENT SUPPORT

A. SUPPORT CEILING MOUNTED EQUIPMENT, DUCTWORK AND PIPING FROM BUILDING STRUCTURE AND/OR FRAMING IN AN APPROVED MANNER. WHERE OVERHEAD CONSTRUCTION DOES NOT PERMIT FASTENING OF SUPPORTS AND EQUIPMENT, PROVIDE ADDITIONAL STEEL FRAMING.
B. FOR FLOOR MOUNTED EQUIPMENT PROVIDE MINIMUM 4" HIGH CONCRETE HOUSEKEEPING PADS. COORDINATE WITH STRUCTURAL ENGINEER.
C. FOR ROOF MOUNTED EQUIPMENT PROVIDE ROOF CURBS,HOUSEKEEPING PADS AND DUNNAGE. COORDINATE WITH STRUCTURAL ENGINEER.

1.04 PREPARATION OF EQUIPMENT AND SYSTEMS

A. PROVIDE OPERATING CHARGE OF REFRIGERANT AND OIL.
B. PRESSURE TEST ALL PIPING SYSTEMS.

2.01 IDENTIFICATION

A. VALVES TAGS AND SYSTEMS CHARTS: MINIMUM 2" DIAMETER ALUMINUM TAGS WITH IDENTIFICATION NUMBER AND SYSTEM NUMBERS FOR VALVES & CONTR-OLS. FASTEN WITH HEAVY ALUMINUM, BRASS HOOKS OR CHAIN. NUMBERING AND TYPE OF TAG SHALL FOLLOW EXISTING BUILDING SYSTEM. CHART OF SYSTEMS SHALL BE SCHEMATIC WITH LOCATION AND FUNCTION OF TAGGED VALVES. MOUNT ON WOOD PLAQUE WITH CLEAR PLASTIC LAMINATIONS COVERING DIAGRAMS.
B. NAMEPLATES : PROVIDE NAMEPLATES (FASTENED WITH EPOXY CEMENT) ON MAJOR EQUIPMENT ITEMS INDICATING UNIT NUMBER.
C. PIPING SHALL BE LABELED TO INDICATE SIZE, PURPOSE, AND DIRECTION OF FLOW IN SUCH A MANNER THAT IT CAN EASILY BE READ FROM THE FLOOR.LETTERS SHALL BE NOT LESS THAN 2".

TESTING, BALANCING AND ADJUSTING

1.01 GENERAL

A. AIR SYSTEM BALANCING SHALL BE PERFORMED BY AN INDEPENDENT ORGANIZATION SPECIALIZING IN SYSTEM BALANCING AND PROCEDURES HAVING AT LEAST FIVE (5) YEARS EXPERIENCE AND SHALL BE ASSOCIATED AIR BALANCING COUNCIL CERTIFIED(AABB).
B. TEST AND BALANCE HVAC AIR SYSTEMS TO WITHIN +10 %, -5 % OF DESIGN FLOWS.
C. PERFORM TESTS PER AABC NATIONAL STANDARDS OR EQUIVALENT NEBB (NATIONAL ENVIRONMENTAL BALANCING BUREAU) METHODS. RECORD DATA ON STANDARD AABC OR NEBB FORMS.
D. ADJUSTMENTS AND TESTS SHALL BE MADE UNDER SIMULATED MAXIMUM LOAD CONDITIONS.
E. MAKE ALL REQUIRED ADJUSTMENTS TO EXISTING AIR SYSTEMS UNTILL ALL SPECIFIED PERFORMANCES ARE MET. BEFORE COMMENCEMENT OF CONSTRUCTION, TEST EXISTING EQUIPMENT TO ESTABLISH OUTPUT, ETC. SUBMIT CERTIFIED REPORTS INCLUDING TOTAL SYSTEM CFM, MOTOR AMPERAGE DRAW, RPM, STATIC PRESSURE, OUTDOOR TEMPERATURE AT TIME OF TEST, RETURN AIR, MIXED AIR, DISCHARGE AIR AND SETTING OF ALL CONTROLLERS.

1.02 EXECUTION

A. CHECK FANS AND PUMPS, INSTRUMENTATION DEVICES, CONTROL DEVICES,DAMPERS, ETC., FOR PROPER OPERATION AND CALIBRATION. REPORT DEFICIENCIES WHICH CANNOT BE CORRECTED. MARK AND LOCK DAMPERS AT THEIR PROPER POSITION.
B. ADJUST, TEST AND CONFIRM DESIGN AIR AND WATER FLOW RATES, PRESSURES, TEMPERATURES, AIR AND WATER QUANTITIES, EQUIPMENT SPEED AND MOTOR AMPERAGES FOR EACH SEGMENT BRANCH, AND COMPONENT OF EACH SYSTEM.
C. VERIFY THAT DIFFUSER DISCHARGE PATTERNS HAVE BEEN PROPERLY SET. AIR FLOWS SHALL BE BALANCED WITH VOLUME DAMPERS INSTALLED IN BRANCH DUCTWORK. OPPOSED BLADE DAMPERS (OBD) IN THE DIFFUSERS SHALL BE SET IN THE FULLY OPEN POSITION DURING BALANCING. AFTER THE MAIN SYSTEM IS BALANCED WITHIN LIMITS SPECIFIED ABOVE, OBD CAN BE USED FOR MINOR ADJUSTMENTS.
D. SET MAXIMUM AND MINIMUM CFM SET POINTS ON ALL NEW VAV BOXES PER DESIGN MAXIMUM AND MINIMUM CFM SCHEDULED ON DRAWINGS.
E. DETERMINE REQUIRED MINIMUM STATIC PRESSURE SET POINT OF BASE BUILDING AIR HANDLING UNIT TO ENSURE THAT DESIGN AIRFLOWS ARE ATTAINED.

1.03 SUBMITTALS

A. PREPARE REPORT, INCLUDING FORMS AND SUBMIT FOR REVIEW
B. ALL SUBMITTALS SHALL INCLUDE ADEQUATE DESCRIPTIVE LITERATURE, CATALOG CUTS, SHOP DRAWINGS AND OTHER DATA NECESSARY ASCERTAIN THAT THE PROPOSED EQUIPMENT AND MATERIALS COMPLY WITH SPECIFICATION REQUIREMENTS. CATALOG CUTS SUBMITTED FOR APPROVAL SHALL BE LEGIBLE AND SHALL CLEARLY IDENTIFY EQUIMENT BEING SUBMITTED.
C. SUBMIT EACH SECTION SEPARATELY AND INCLUDE THE FOLLOWING:INFORMATION WHICH CONFORMS TO CONTRACT REQUIREMENTS. INCLUDE THE MANUFACTURER'S NAME, MODEL OR CATALOG NUMBERS, CATALOG INFORMATION,TECHNICAL DATA SHEETS, SHOP DRAWINGS, PICTURES, NAMEPLATE DATA AND TEST REPORTS AS REQUIRED.

MAINTENANCE

1.01 SERVICE CONTRACT

A. THIS CONTRACTOR SHALL ASSUME COMPLETE RESPONSIBILITY FOR START-UP AND 24HOUR/DAY SERVICE WITH A MAXIMUM RESPONSE TIME OF 4 HOURS AND QUARTERLY PREVENTIVE MAINTENANCE (4 MAINTENANCE INSPECTIONS A YEAR) FOR A PERIOD OF ONE YEAR FOR ALL NEW EQUIPMENT, AS INDICATED UNDER "EQUIPMENT". THE COST OF THIS SHALL BE INCLUDED IN THIS CONTRACT.
B. THIS ONE YEAR MAINTENANCE CONTRACT SHALL INCLUDE, BUT IS NOT LIMITED TO THE FOLLOWING WORK:
1. CHECK LINES FOR LEAKAGE.
2. REFILL LINES IF NECESSARY.
3. LUBRICATE MOTORS.
4. CHECK OPERATION OF THERMOSTATS AND MAKE CORRECTIONS REQUIRED.
5. REPLACE RETURN AIR FILTERS.
6. CLEAN CONDENSER COILS.
7. CHECK AND TIGHTEN ELECTRICAL CONNECTIONS.
8. CHECK CONTROLS AND MAKE CORRECTIONS IF NECESSARY.
9. CHECK FOR NOISE AND VIBRATION.
10. CHECK REFRIGERANT PRESSURE DURING OPERATION.
11. CHECK CURRENT (AMPERAGE) DRAW OF ALL MOTORS.
12. CHECK OPERATION OF CONDENSATE DRAIN SYSTEM.
13. CHECK AND ADJUST BLOWER FAN BELT TENSION.
14. CHECK AIR TEMPERATURE ACROSS EVAPORATOR.

1.02 GUARANTEE

A. CONTRACTOR SHALL FURNISH A WRITTEN GUARANTEE TO REPLACE OR REPAIR PROMPTLY, AND ASSUME FULL RESPONSIBILITY OF ALL EXPENSES INCURRED FOR, ANY WORKMANSHIP AND/OR EQUIPMENT IN WHICH DEFECTS OCCUR WITHIN ONE YEAR FROM DATE OF ACCEPTANCE BY OWNER.

1.03 CONTROLLED INSPECTION

A. CONTROLLED INSPECTIONS SHALL BE PERFORMED BY THIS CONTRACTOR.CONTRACTOR SHALL ROVIDE THE NAME OF A LICENSED PROFESSIONAL ENGINEER TO TENANT OR TENANT REPRESENTATIVE WHEN AWARDED CONTRACT.

SUBMITTAL DATA

1.01 COORDINATION

A. ALL PIPING, DUCTWORK, AND EQUIPMENT LAYOUT SHALL BE SUBMITTED ON 3/8" SCALE DRAWINGS AND SHALL BE COORDINATED AND STAMPED BY ALL TRADES. SHOP DRAWINGS SHALL SHOW LOCATION OF ALL NEW EQUIPMENT, AND NEW WORK.

1.02 SHOP DRAWINGS

A. SUBMIT COORDINATED SHOP DRAWINGS FOR ALL EQUIPMENT, DIFFUSERS, TERMINAL UNITS, AUTOMATIC CONTROL DIAGRAMS, DUCTWORK LAYOUT,PIPING LAYOUT, AND SHEET METAL CONSTRUCTION STANDARDS.
B. SUBMIT ALL SHOP DRAWINGS FOR REVIEW AND APPROVAL TO CLIFFORD DIAS P.E., P.C. OFFICE PRIOR TO PURCHASE, FABRICATION AND INSTALLATION.
C. SUBMIT AIR AND WATER BALANCE REPORTS.
D. FOR COORDINATED DUCTWORK AND PIPING SHOP DRAWINGS, SUBMIT ONE PAPER SEPIA AND WHITE PRINTS. FOR SUBMISSIONS ON 8-1/2" X 14" OR SMALLER, SUBMIT ONE ORIGINAL AND TWO COPIES. IF SUBMISSIONS ARE CATALOG CUTS: SUBMIT ONE ORIGINAL AND TWO COPIES. ALL CATALOG CUTS SHALL BE COMPLETE.
E. WHEN NECESSARY TO ELIMINATE CONFLICTS, THE CONTRACTOR SHALL REVISE SHOP DRAWINGS AS REQUIRED AT NO ADDITIONAL COST TO THE OWNER.

1.03 AS-BUILT DRAWINGS

A. CONTRACTOR SHALL SUBMIT 'AS-BUILT' SEPIA-MYLAR RECORD DRAWINGS(SIZE 1/8" = 1'- 0") AS COMPLETION OF PROJECT.

1.04 OPERATION, MAINTENANCE MANUALS AND INSTRUCTIONS

A. FURNISH TO CLIFFORD DIAS ENGINEERING P.E., P.C. FOUR (4) BOUND AND INDEXED COPIES OF THE FINAL APPROVED INSTALLATION, OPERATIONS AND MAINTENANCE MANUALS FOR NEW EQUIPMENT AND SYSTEMS.
B. THE MANUAL SHALL PROVIDE DETAILED INFORMATION ON THE APPROVED INSTALLATION, OPERATION AND USE, TROUBLESHOOTING, PARTS LIST, LUBRICATION AND PERIODIC MAINTENANCE, TOGETHER WITH THE SOURCE OF REPLACEMENT PARTS AND SERVICE FOR THE ITEMS OF EQUIPMENT AND THE SYSTEMS COVERED, INCLUDING ELECTRICAL EQUIPMENT, DEVICES AND SYSTEMS.
C. THE MANUAL SHALL INCLUDE 'AS-BUILT' RECORD DRAWINGS AND ALL BALANCING REPORTS.
D. CONTRACTOR SHALL INCLUDE FOR ONE FULL DAY FOR THE INSTRUCTION OF CLIENT'S PERSONNEL AND THE BUILDING ENGINEERS IN THE OPERATION OF THE SYSTEM.

SHEET METAL WORK

1.01 STANDARDS

A. EXCEPT AS OTHERWISE NOTED, ALL DUCTWORK AND OTHER SHEET METAL WORK SHALL BE INSTALLED IN ACCORDANCE WITH LATEST EDITION OF THE SHEET METAL AND AIR CONDITIONING NATIONAL ASSOCIATION, INC. (SMACNA), "HVAC DUCT CONSTRUCTION STANDARDS" MANUAL. DUCTWORK SHALL BE GALVANIZED SHEET STEEL UNLESS OTHERWISE NOTED.
B. MINIMUM DUCTWORK STATIC PRESSURE CONSTRUCTION SHALL BE 2"W.G.DUCTWORK STATIC PRESSURE CONSTRUCTION SHALL BE 4" W.G. FOR OPERATING PRESSURE ABOVE 2" W.G. BUT NOT EXCEEDING 4" W.G. ALL DUCTS SHALL BE SEAL CLASS 'A'.
C. UNEQUAL ELBOWS ARE NOT ACCEPTABLE, EXCEPT RADIUS BRANCH DUCTWORK WITH THROAT.
D. DUCTWORK UPSTREAM OF VARIABLE VOLUME DEVICES SHALL BE PRESSURE CLASS 4 IN. W.G.

1.02 FLEXIBLE DUCTS

A. SHALL BE SIMILAR TO CLEVAFLEX TYPE 12FV WITH 1" THICK INSULATION AND SHALL CONFORM TO UL 181 AND NFPA BULLETIN 90A. THE FUEL CONTRIBUTED AND SMOKE DEVELOPED SHALL NOT EXCEED 50 AND FLAME SPREAD SHALL NOT EXCEED 25.
B. Ø MAXIMUM LENGTH SHALL NOT EXCEED (18) INCHES.
C. FLEXIBLE DUCTWORK SHALL ONLY BE PERMITTED BETWEEN DUCTWORK AND SUPPLY DIFFUSERS.

1.03 ALUMINUM DUCTWORK

A. PROVIDE WATERTIGHT ALUMINUM DUCTWORK FOR DUCTWORK EXPOSED TO OUTSIDE EXHAUST AND RELIEF DUCTWORK (MINIMUM 10' FROM DISCHARGE LOUVERS).PITCH DUCTWORK TOWARDS LOUVERS.
B. PROVIDE WATERTIGHT ALUMINUM DUCTWORK FOR DUCTWORK EXPOSED TO OUTSIDE, FROM AIR HANDLING UNIT FOR A MINIMUM LENGTH OF 5' INSIDE THE PLENUM SPACE., AND FROM THE EXHAUST FAN'S COWL TO A MINIMUM LENGTH OF 10' INSIDE THE PLENUM SPACE.

1.04 SOUNDLINED DUCTWORK

A. SOUNDLINING SHALL BE NOMACO FIBER FREE LINER, MIN. 1.5 LB. DENSITY, 1" THICKNESS, MAX. 0.25 K FACTOR AT 75 F. MEAN TEMPERATURE AND MUST HAVE A MAXIMUM WATER VAPOR TRANSMISSION RATE OF 0.0 PERM-IN (FLAME SPREAD LESS THAN 25, SMOKE DEVELOPED LESS THAN 50.
B. APPLY LINING WITH ADHESIVE OVER ENTIRE SURFACE AND SECURE WITH WELD PINS SPACED16" ON CENTERS. COAT EDGES WITH SEALER AND PROVIDE SHEET METAL EDGE PROTECTORS. SEALER SHALL BE IN CONFORMANCE WITH NFPA 90. PROVIDE 2" SOUNDLINING FOR MIXED AIR AND RELIEF AIR PLENUMS AND SUPPLY AIR PLENUMS AT SLOT DIFFUSER.
C. DIMENSIONS SHOWN ARE CLEAR INSIDE DIMENSIONS.

1.05 FLEXIBLE CONNECTIONS

A. NEOPRENE-COATED GLASS FABRIC, 30 OZ. PER SQ.YD. WITH SEWED AND CEMENTED SEAMS, SIMILAR TO VENT FABRICS. PROVIDE FLEXIBLE CONNECTIONS BETWEEN ALL EQUIPMENT AND DUCTWORK.

2.01 DEVICES

A. FIRE DAMPERS: FIRE DAMPERS SHALL BE SIMILAR TO RUSKIN CURTAIN TYPE IBD WITH BLADES OUTSIDE AIR STREAM, GALVANIZED STEEL CONSTRUCTION, EQUIPPED WITH FUSIBLE LINK, UL LISTED AND INSTALLED IN CONFORMANCE WITH UL AND NFPA STANDARD 90A, AND APPROVED FOR USE BY THE AUTHORITIES HAVING JURISDICTION.
B. FIRE DAMPERS SHALL BE APPROVED BY THE NEW YORK CITY BOARD OF STANDARDS AND APPEALS.
C. COMBINATION FIRE SMOKE DAMPERS: COMBINATION FIRE AND SMOKE DAMPERS UL LISTED SHALL BE SIMILAR TO RUSKIN MFG CO. MODEL FSD-60, LEAKAGE CLASS 1, COMPLETE WITH ELECTRIC DAMPER OPERATOR, ELECTRIC FIRESTAT, SMOKE DETECTORS, 2 DAMPER POSITION SWITCHES AND JUNCTION BOX.
D. COMBINATION FIRE AND SMOKE DAMPERS SHALL BE APPROVED BY THE NEWYORK BOARD OF STANDARDS AND APPEALS.
E. VOLUME DAMPERS: SAME MATERIAL AS DUCT, PER SMACNA, EXCEPT PROVIDE BEARING AT ONE END OF DAMPER ROD AND QUADRANT, WITH LEVER AND LOCKSCREW AT OTHER END. FOR INSULATED DUCTS, QUADRANTS MOUNTED ON COLLAR TO CLEAR INSULATION, INSTALL WITH LEVERS ACCESSIBLE. BALANCING DAMPERS SHALL BE THE OPPOSED BLADE TYPE.
F. ACCESS DOORS: INSULATED OR UNINSULATED, SAME AS DUCT. PROVIDE MINIMUM 20" X 14" ACCESS DOORS ON MAIN DUCTS, 12" X 6" ACCESS DOORS ON BRANCH DUCTS, UNLESS OTHERWISE NOTED. ALL ACCESS DOORS TO BE HINGED, WITH LATCH SIMILAR TO VENTLOCK #100. PROVIDE ACCESS DOORS IN DUCTS ADJACENT TO FIRE DAMPERS, COMBINATION FIRE AND SMOKE DAMPERS, BALANCING DAMPERS, FIRE AND SMOKE DAMPERS, AUTOMATIC DAMPERS (LINKAGE SIDE), COILS IN DUCTS (ENTERING AND LEAVING SIDE), SMOKE DETECTION HEADS, FAN BEARINGS ENCLOSED IN DUCT AND BOTH SIDES OF DUCTS WHERE NECESSARY TO PROVIDE MAINTENANCE ACCESSIBILITY TO EQUIPMENT ON THE OTHER SIDE.
G. TURNING VANES: GALVANIZED STEEL, DOUBLE THICKNESS VANES WITHMINIMUM 2" INSIDE RADIUS. ALL SQUARE ELBOWS SHALL HAVE TURNING VANES.
H. ACCESS TILE IDENTIFICATIONS: PROVIDE BUTTONS, TABS AND MARKERS TO IDENTIFY LOCATION OF ALL CONCEALED VALVES, DAMPERS, AND EQUIPMENT. SUBMIT TO ARCHITECT FOR APPROVAL.

PIPING

1.01 GENERAL

A. PIPING SHALL BE COMPLETE WITH PIPE FITTINGS, VALVES, COUPLING,STRAINERS, HANGER RODS, HANGERS, SUPPORTS, GUIDES, SLEEVES, AND ACCESSORIES IN CONFORMANCE WITH THE LATEST CODES AND ASME, ANSI, ASTM, AND MSS STANDARDS.
B. NO PIPING SHALL BE LESS THAN 3/4", UNLESS OTHERWISE NOTED.
C. FOR PIPE SIZE NOT INDICATED ON PLANS, SEE MANUFACTURER'S EQUIPMENT CONNECTION DETAILS.
D. PROVIDE FITTINGS FOR CHANGE IN PIPE SIZE AND FOR FINAL CONNECTION AT EQUIPMENT, AS REQUIRED.
E. PROVIDE UNION CONNECTIONS AT EACH PIECE OF EQUIPMENT AND ON EACH SIDE OF ALL VALVES AND IN-LINE EQUIPMENT.
F. PROVIDE 3/4" DRAIN VALVE AND CAPPED HOSE NIPPLE AT LOW POINTS IN SYSTEMS AND WHERE INDICATED.
G. PROVIDE DIELECTRIC GASKETS BETWEEN JOINTS OF DISSIMILAR METALS,SLEEVES, AND WASHERS BETWEEN FLANGES, BOLTS, AND NUTS.
H. PROVIDE MINIMUM PITCH TO INSURE ADEQUATE VENTING AND DRAINAGE.
I. PROVIDE, AS REQUIRED AUTOMATIC AIR VENTS, MANUAL AIR VENTS AND RELIEF AIR VALVES.

2.01 CLEANING AND FILLING

A. AVOID ENTRY OF FOREIGN MATTER INTO PIPING DURING CONSTRUCTION.
B. AFTER COMPLETION OF PIPING, FLUSH WATER SYSTEM WITH WATER UNTIL CLEAR.REMOVE AND CLEAN STRAINER, AND BLOW OFF ALL PIPING LOW POINTS AT THE END OF THE FLUSH PERIOD. REFILL SYSTEM WITH WATER.
C. COMPLETELY BLEED SYSTEM OF ALL AIR.
D. COORDINATE AND PROVIDE WATER TREATMENT IN ACCORDANCE WITH THE BUILDING STANDARD.

2.02 PIPING SUPPORTS

A. HORIZONTAL PIPING SHALL BE SUPPORTED BY FORGED STEEL ADJUSTABLE CLEVIS TYPE "CARPENTER & PATTERSON" FIG. #100 OR 100SH OR APPROVED EQUAL.
B. HANGER RODS AND MAXIMUM SPACING SHALL BE AS FOLLOWS : PIPE SIZE ROD DIAMETER MAX SPACING 1-1/4 IN. & BELOW 3/8 IN. N 6 FT.1-1/2 IN. & 2 IN. 3/8 IN.8 FT.2-1/2 IN. & 3 IN.1/2 IN. 8 FT. 4 IN. 5/8 IN.10 FT.
C. PROVIDE ADDITIONAL SUPPORTS AT CHANGE OF DIRECTION, RUNOUTS, AND CONCENTRATED LOADS DUE TO VALVES, ETC.
D. VERTICAL PIPING SHALL BE SUPPORTED WITH BEARING PLATE ON STRUCTURAL SUPPORT. PROVIDE GUIDES AT EVERY SECOND FLOOR (SPACING NOT TO EXCEED 25FT.) SUPPORT AT TOP SHALL BE PROVIDE WITH SPRING HANGER HAVING A PROVISION FOR EXPANSION.

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TITLE:
MECHANICAL PLOT PLAN, LIST OF DWG'S & GRAL NOTES

DATE: Jan. 28, 2011 SC PROJ. #: 01-1103
SCALE:

DWG. NO. M-001.00

AIR HANDLING UNIT

TAG	MANUFACTURER	MODEL NO.	TYPE	AIR FLOW (CFM)	V/PH/HZ	FAN HP	ESP / TSP (IN.WG.)	FAN FLA	NOM. SIZE	SEER / EER	TOTAL CAP.	SEN. CAP.	ENT. DB	ENT. WB	LEAV. DB	LEAV. WB	ENT. REF. TEMP	MEA NUMBER
AHU-1	TRANE	TWE240	HORIZONTAL SPLIT	8000	208/3/60	5	0.1 / 1.2	14.5	20 TONS	11	263.1MBH	191.1MBH	80°F	67°F	54.4°F	54.17°F	105.3°F	452-91-E
AHU-2	TRANE	TWE120	HORIZONTAL SPLIT	4000	208/3/60	2	0.1 / 1.2	8.5	10 TONS	11 .2	124 MBH	98 MBH	80°F	67°F	54.4°F	54.17°F	105.3°F	452-91-E

AIR COOLED CONDENSING UNIT (COOLING ONLY)

TAG	MANUFACTURER	MODEL NO.	NOM. CAP.	REF.	V/PH/HZ	COMPRESSOR RLA	COND. FAN FLA	MCA	MOCP	MEA NUMBER	REMARKS
CU-1	TRANE	TTA240	20 TONS	R410A	208/3/60	39.1	5	98 A	110 A	452-91-E	PROVIDE LOW AMBIENT CONTROL
CU-2	TRANE	TTA120	10 TONS	R410A	208/3/60	30.1	5	42.6 A	60 A	452-91-E	PROVIDE LOW AMBIENT CONTROL

INDOOR DUCT FURNACE

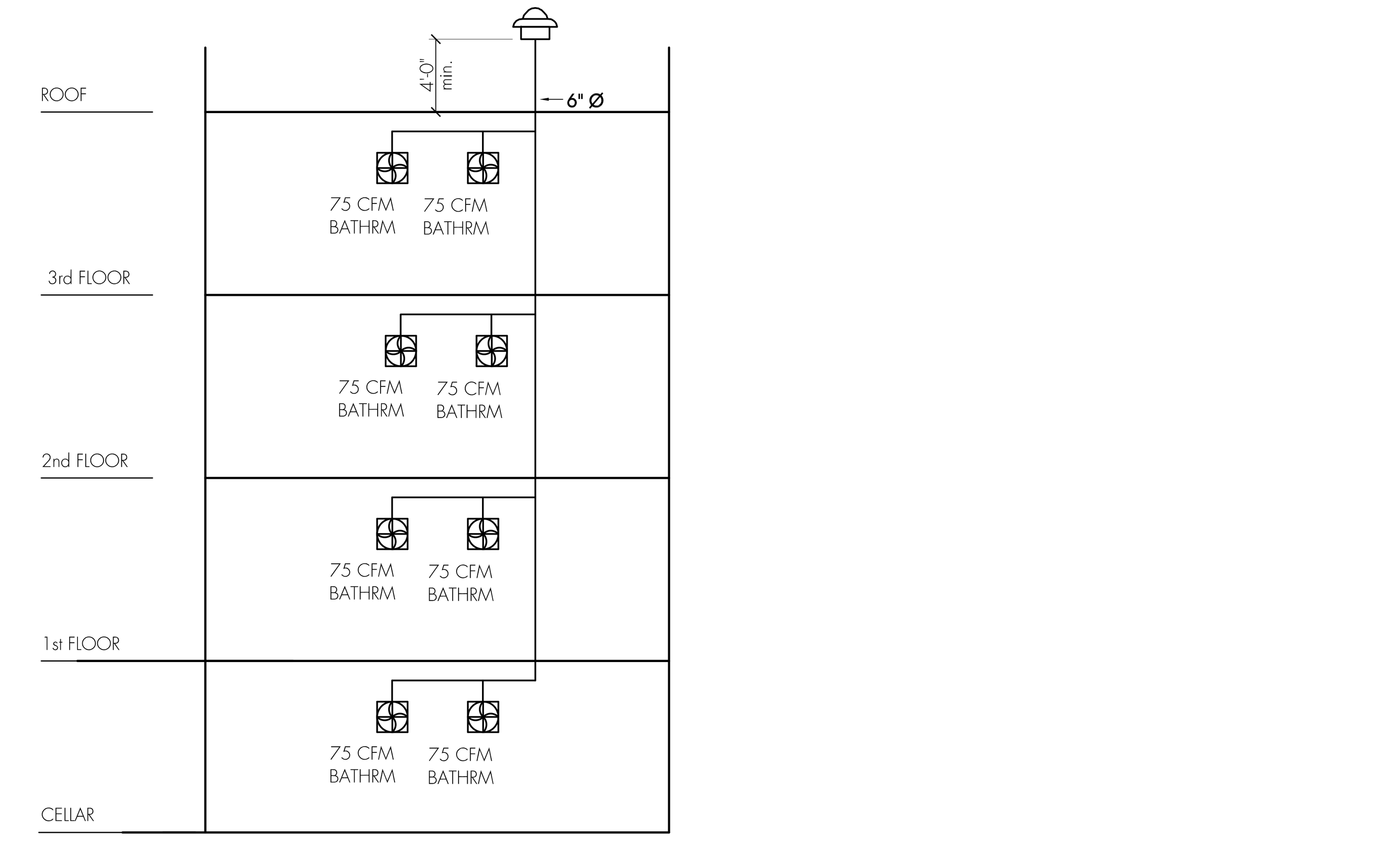
HIGH EFFICIENCY GAS DUCT FURNACE

TAG	MANUFACTURER	MODEL NO.	QTY.	GAS TYPE	INPUT/OUTPUT
DF-1	TRANE	GLND030EDG	4	NATURAL	300 / 240 MBH
DF-2	TRANE	GLND015EDG	1	NATURAL	150 / 120 MBH

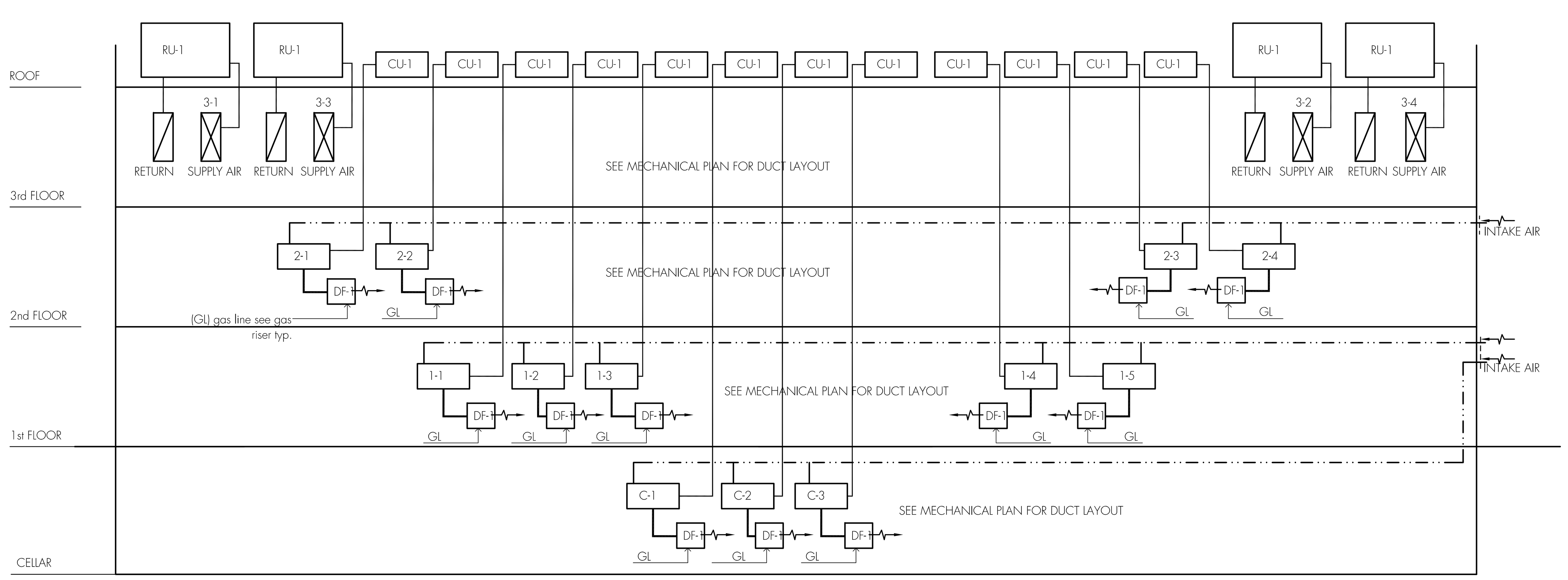
POWER	CONTROLS & SPECIFICATIONS
208/3/60	SINGLE STAGE GAS CONTROL, INTERMITTENT PILOT, SINGLE STAGE PROVIDE 2H/2C PROGRAMMABLE T'STAT TO INTERLOCK WITH AHU CONTROLS.

ROOF TOP UNIT

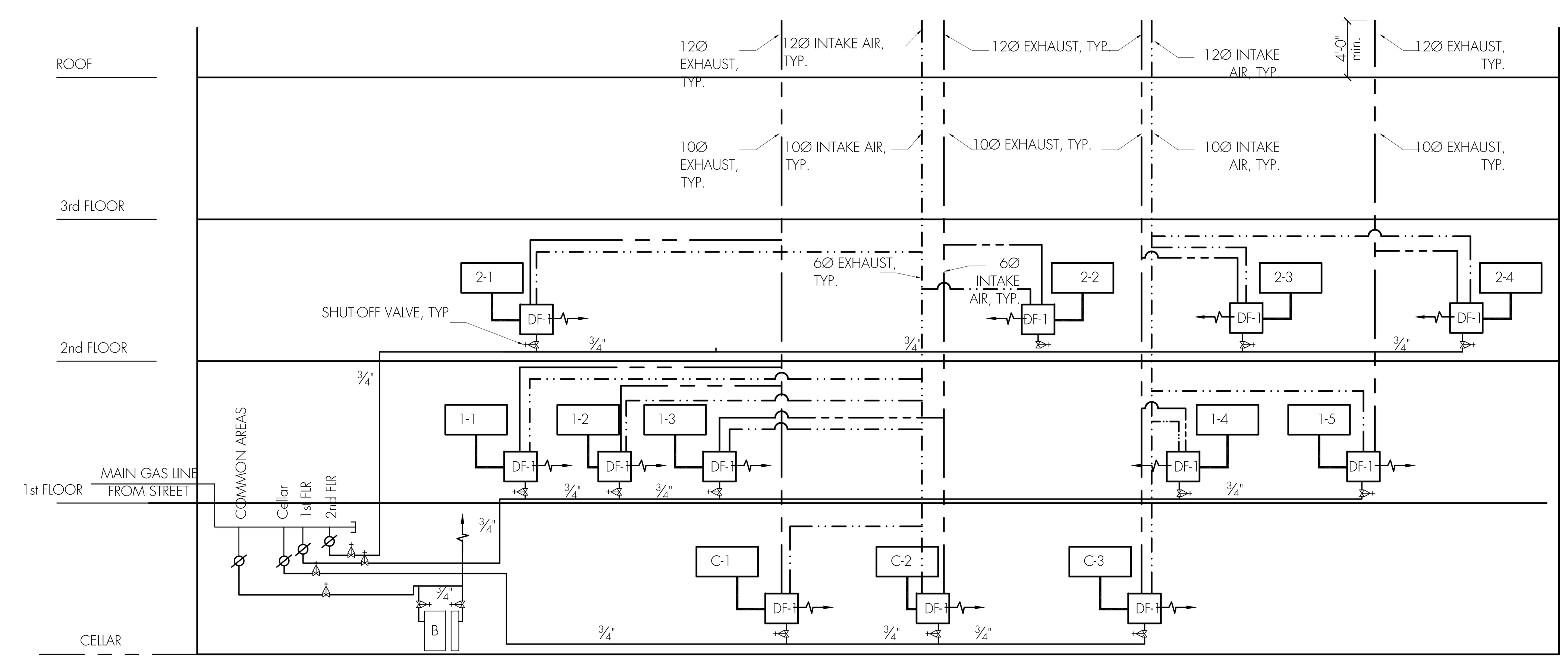
TAG	MANUFACTURER	QTY.	MODEL NO.	TYPE	AIR FLOW (CFM)	COOLING CAPACITY	HEATING INPUT	NOMINAL CAPACITY	SYSTEM POWER	V/PH/HZ	COMPRESSOR			CONDENSER		
											COMP. NO./TYPE	HP	RLA/LRA	HP	FLA/LRA	PH
RTU-1	TRANE	YCD240E	YCD240E	VERTICAL DOWNFLOW	8000	250,000 BTUH	400,000 BTUH	20 TONS	23.53 KW	208/3/60	2 / SCROLLS	10 (EA.)	39.1/267 A	1	5.5/18.3 A	1



EXHAUST RISER DIAGRAM 1
SCALE: NTS



HVAC RISER DIAGRAM 2
SCALE: NTS



GAS RISER DIAGRAM 3
SCALE: NTS

LEGENDS:
— · · — INTAKE AIR VENT
— - - — EXHAUST VENT

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-

SEAL:

STATE OF NEW YORK
SPENCER GORDON
LICENSED PROFESSIONAL ENGINEER

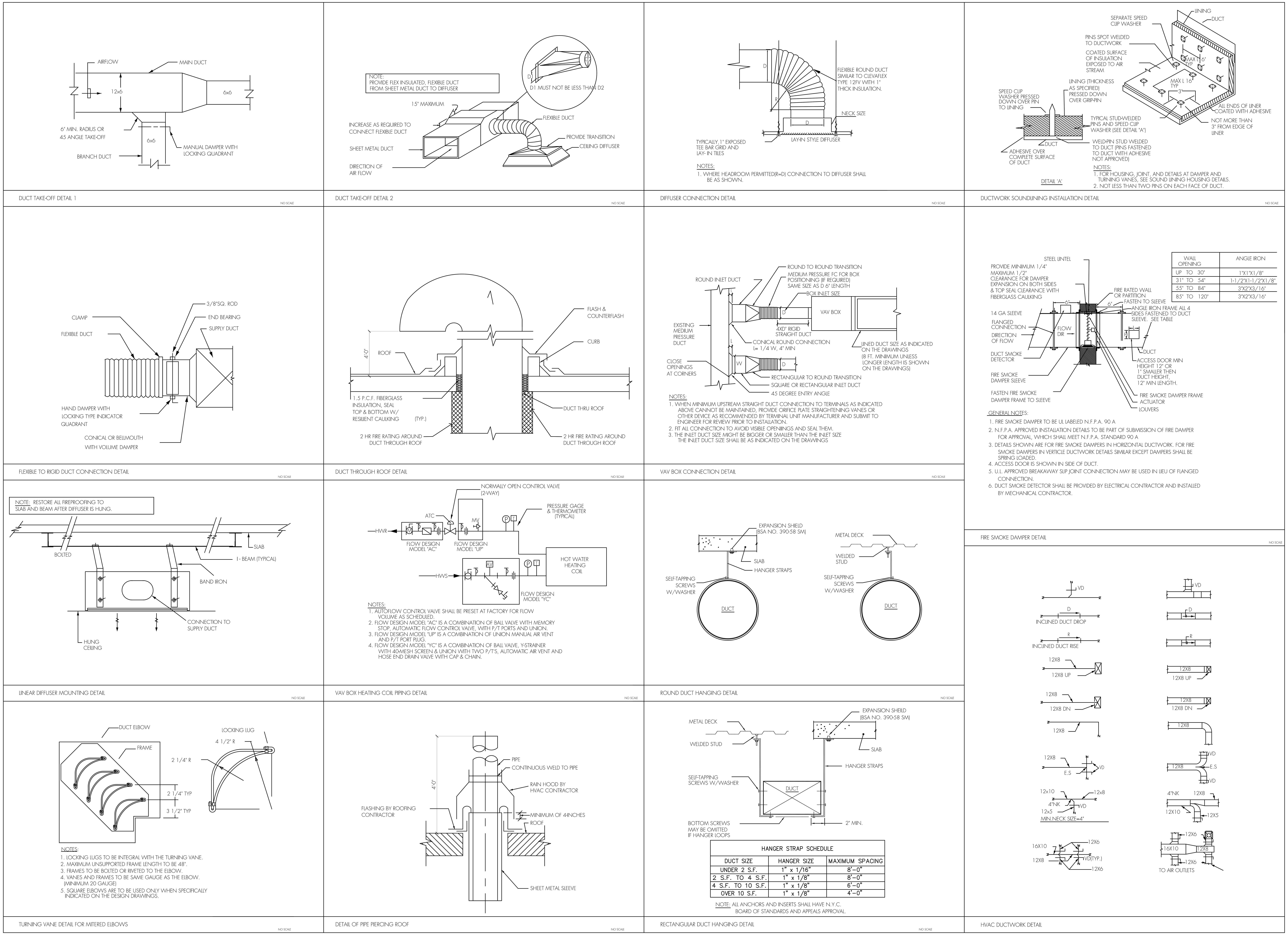
120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
MECHANICAL EQUIPMENT SCHEDULE & RISER DIAGRAMS

DATE: Jan. 28, 2011 | SC | PROJ. #: 01-1103
SCALE :

DWG. NO.
M-002.00
02 of 8



NOTES:
1. WHEN MINIMUM UPSTREAM STRAIGHT DUCT CONNECTION TO TERMINALS AS INDICATED ABOVE CANNOT BE MAINTAINED, PROVIDE ORIFICE PLATE STRAIGHTENING VANES OR OTHER DEVICE AS RECOMMENDED BY TERMINAL UNIT MANUFACTURER AND SUBMIT TO ENGINEER FOR REVIEW PRIOR TO INSTALLATION.
2. FIT ALL CONNECTION TO AVOID VISIBLE OPENINGS AND SEAL THEM.
3. THE INLET DUCT SIZE MIGHT BE BIGGER OR SMALLER THAN THE INLET SIZE THE INLET DUCT SIZE SHALL BE AS INDICATED ON THE DRAWINGS

WALL OPENING	ANGLE IRON
UP TO 30"	1"X1"X1/8"
31" TO 54"	1-1/2"X1-1/2"X1/8"
55" TO 84"	3"X2"X3/16"
85" TO 120"	3"X2"X3/16"

GENERAL NOTES:
1. FIRE SMOKE DAMPER TO BE UL LABELED N.F.P.A. 90 A
2. N.F.P.A. APPROVED INSTALLATION DETAILS TO BE PART OF SUBMISSION OF FIRE DAMPER FOR APPROVAL, WHICH SHALL MEET N.F.P.A. STANDARD 90 A
3. DETAILS SHOWN ARE FOR FIRE SMOKE DAMPERS IN HORIZONTAL DUCTWORK. FOR FIRE SMOKE DAMPERS IN VERTICLE DUCTWORK DETAILS SIMILAR EXCEPT DAMPERS SHALL BE SPRING LOADED.
4. ACCESS DOOR IS SHOWN IN SIDE OF DUCT.
5. U.L. APPROVED BREAKAWAY SLIP JOINT CONNECTION MAY BE USED IN LIEU OF FLANGED CONNECTION.
6. DUCT SMOKE DETECTOR SHALL BE PROVIDED BY ELECTRICAL CONTRACTOR AND INSTALLED BY MECHANICAL CONTRACTOR.

NOTES:
1. AUTOFLOW CONTROL VALVE SHALL BE PRESET AT FACTORY FOR FLOW VOLUME AS SCHEDULED.
2. FLOW DESIGN MODEL "AC" IS A COMBINATION OF BALL VALVE WITH MEMORY STOP, AUTOMATIC FLOW CONTROL VALVE, WITH P/T PORTS AND UNION.
3. FLOW DESIGN MODEL "UP" IS A COMBINATION OF UNION MANUAL AIR VENT AND P/T PORT PLUG.
4. FLOW DESIGN MODEL "YC" IS A COMBINATION OF BALL VALVE, Y-STRAINER WITH 40-MESH SCREEN & UNION WITH TWO P/T'S, AUTOMATIC AIR VENT AND HOSE END DRAIN VALVE WITH CAP & CHAIN.

NOTES:
1. LOCKING LUGS TO BE INTEGRAL WITH THE TURNING VANE.
2. MAXIMUM UNSUPPORTED FRAME LENGTH TO BE 48".
3. FRAMES TO BE BOLTED OR RIVETED TO THE ELBOW.
4. VANES AND FRAMES TO BE SAME GAUGE AS THE ELBOW. (MINIMUM 20 GAUGE)
5. SQUARE ELBOWS ARE TO BE USED ONLY WHEN SPECIFICALLY INDICATED ON THE DESIGN DRAWINGS.

HANGER STRAP SCHEDULE

DUCT SIZE	HANGER SIZE	MAXIMUM SPACING
UNDER 2 S.F.	1" x 1/16"	8'-0"
2 S.F. TO 4 S.F.	1" x 1/8"	8'-0"
4 S.F. TO 10 S.F.	1" x 1/8"	6'-0"
OVER 10 S.F.	1" x 1/8"	4'-0"

NOTE: ALL ANCHORS AND INSERTS SHALL HAVE N.Y.C. BOARD OF STANDARDS AND APPEALS APPROVAL.

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-

SEAL:

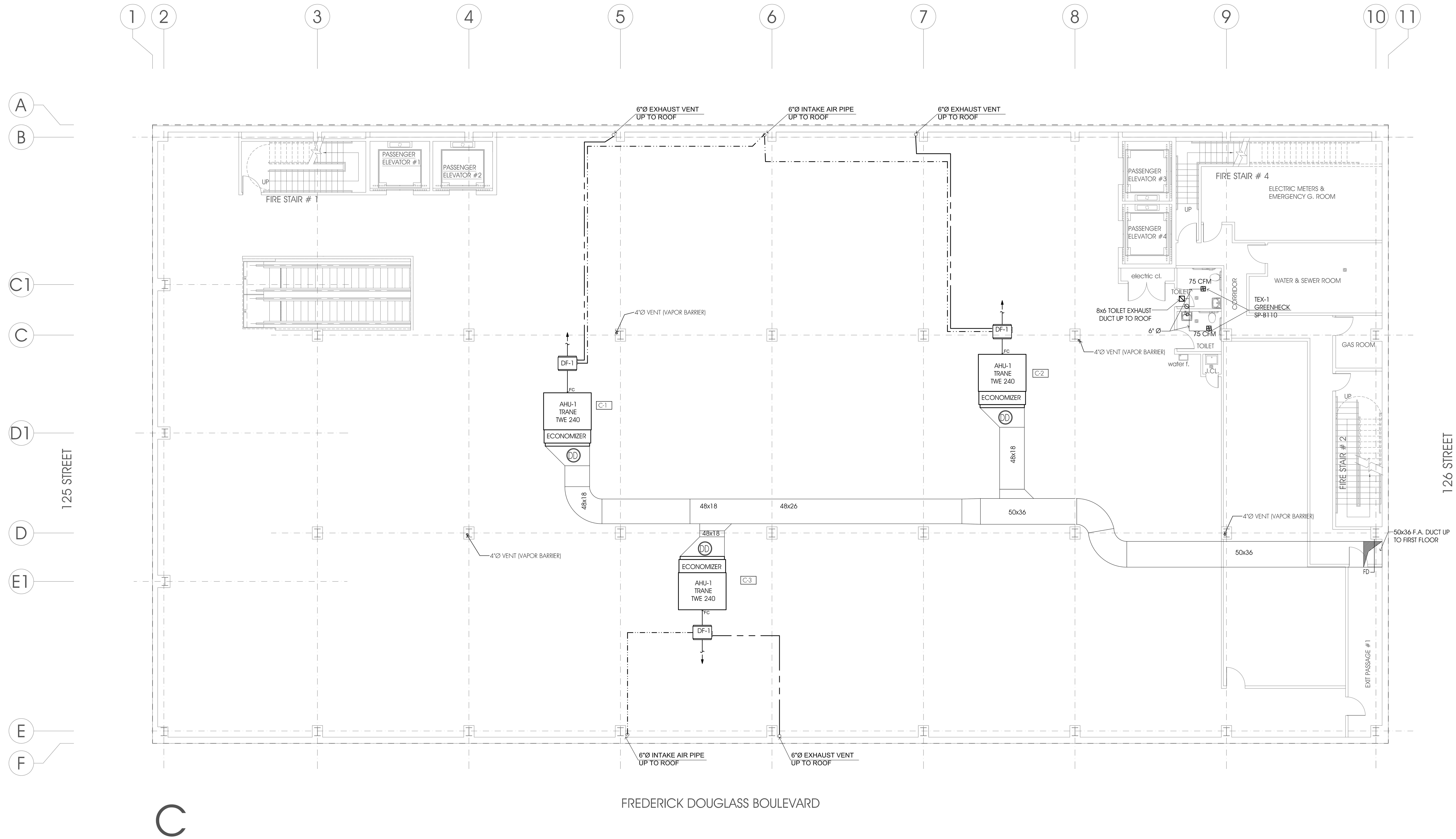
120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
MECHANICAL
HVAC DETAILS

DATE: Jan. 28, 2011 | SC | PROJ. #: 01-1103
SCALE :

DWG. NO.
M-003.00
03 of 8



LEGENDS:

INTAKE AIR VENT

EXHAUST VENT

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-

SEAL:

STATE OF NEW YORK
SPENCER GOROFF
LICENSED PROFESSIONAL ENGINEER

120616057
DEPT. OF BLDGS

DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:

CELLAR
HVAC LAYOUT

DATE: Jan. 28, 2011 | SC | PROJ. #: 01-1103

SCALE :

DWG. NO.

M-100.00

04 of 8

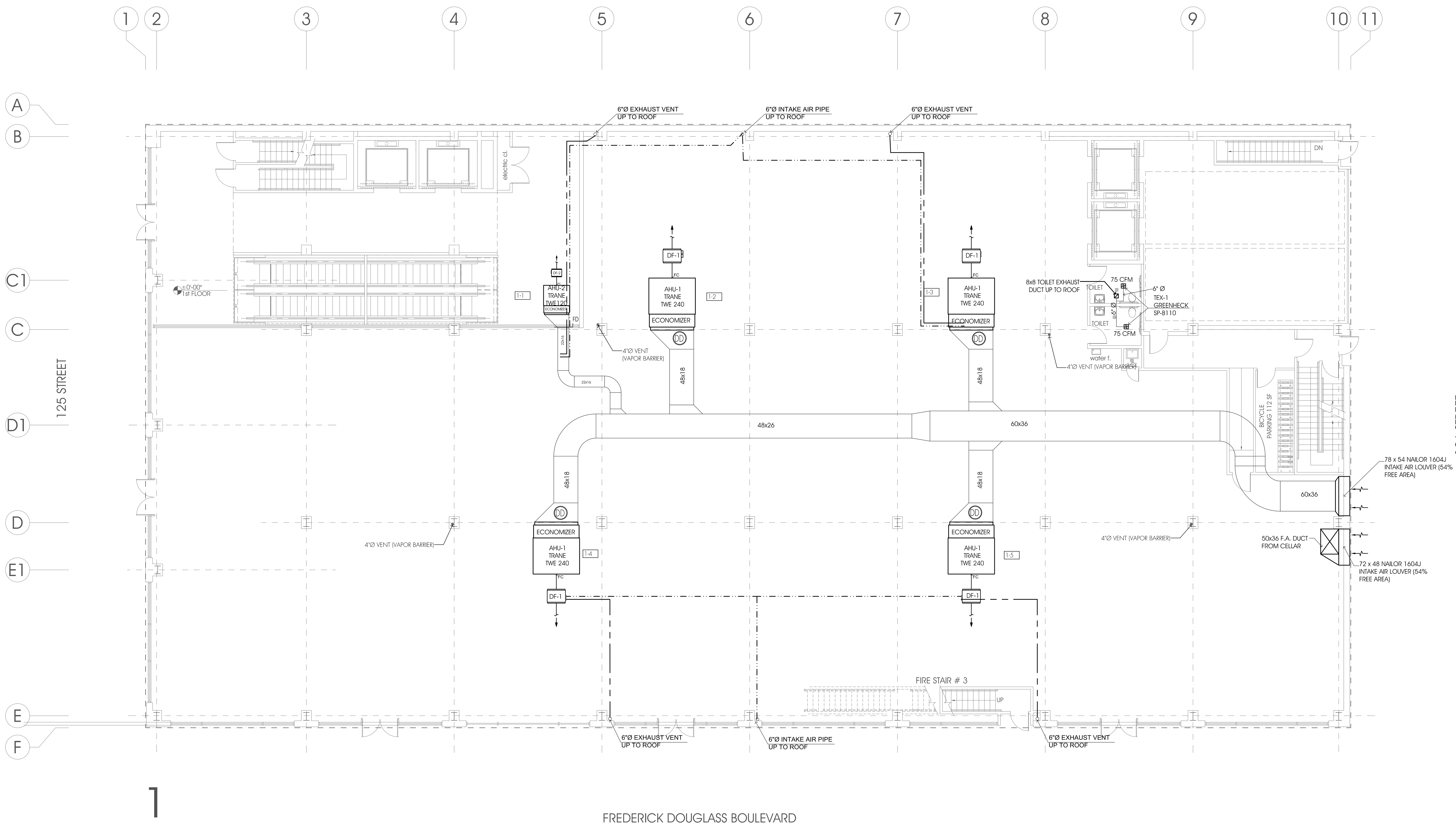
NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-



1

FREDERICK DOUGLASS BOULEVARD

LEGENDS:

INTAKE AIR VENT

EXHAUST VENT

SEAL:

120616057
DEPT. OF BLDGS
DOC # 01

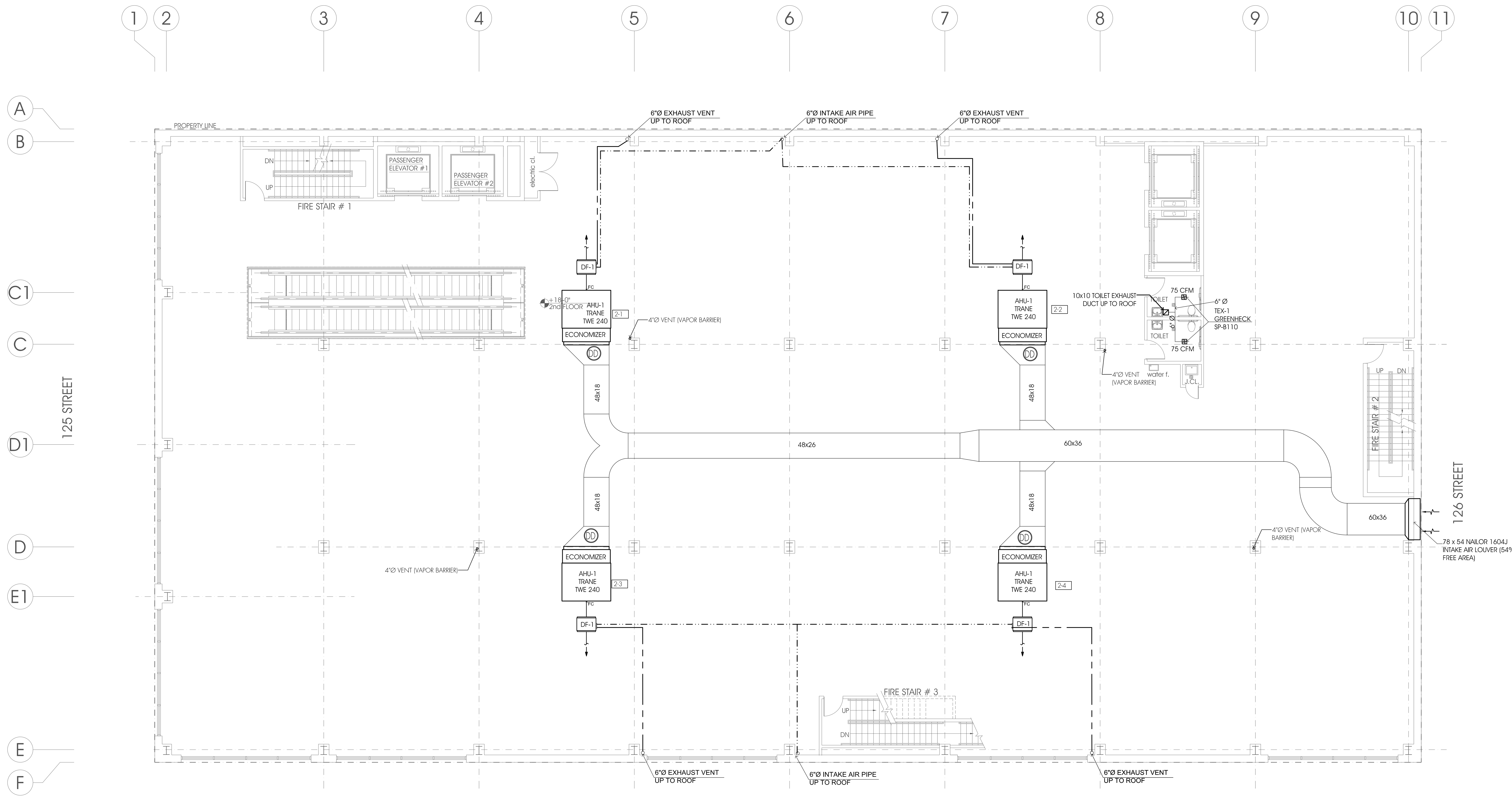
This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:
1st FLOOR HVAC LAYOUT

DATE: Jan. 28, 2011 | SC | PROJ. #: 01-1103

SCALE :

DWG. NO.
M-101.00



2

FREDERICK DOUGLASS BOULEVARD

LEGENDS:

INTAKE AIR VENT

EXHAUST VENT

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-

SEAL:

120616057
DEPT. OF BLDGS

DOC # 01

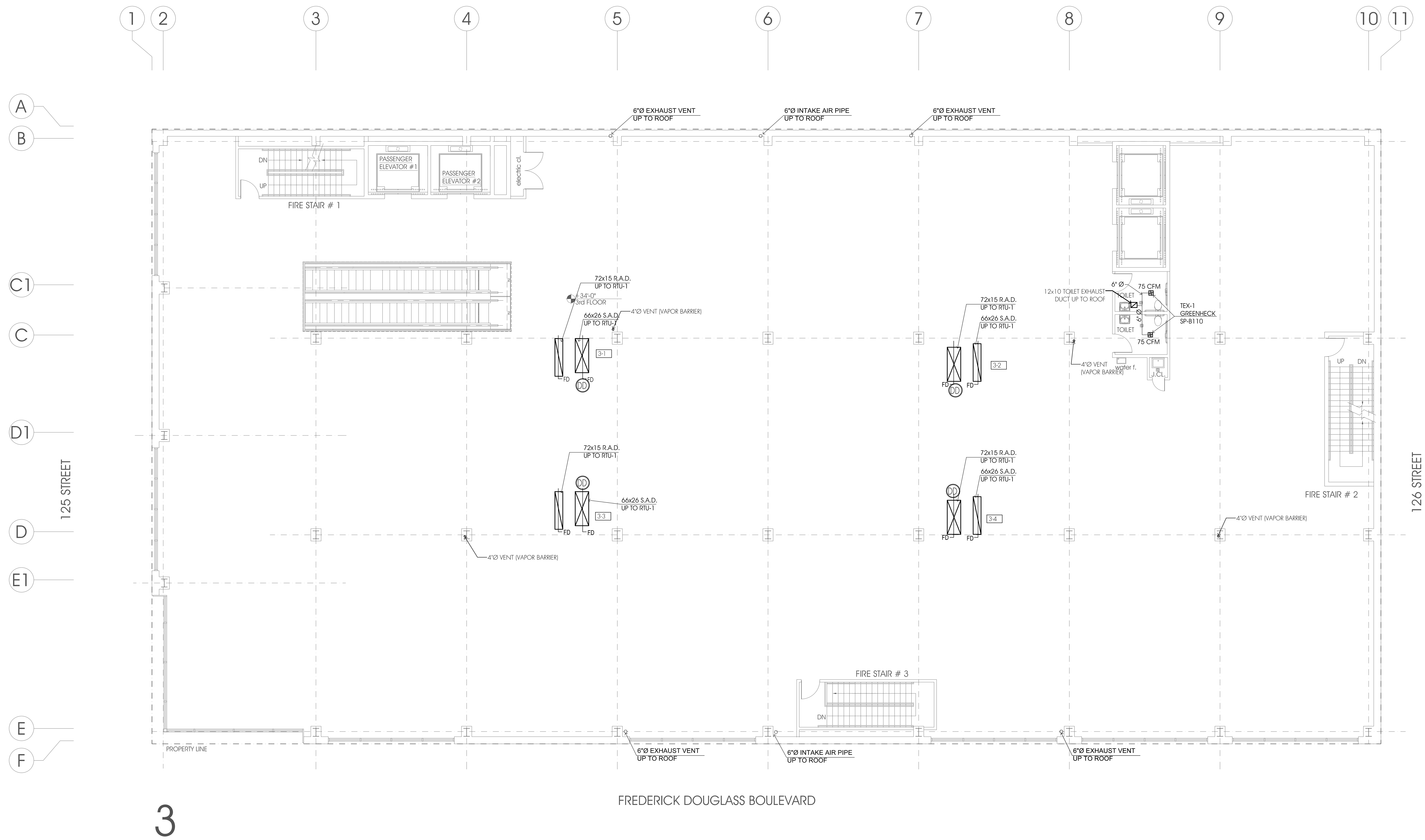
This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE:

2nd FLOOR HVAC LAYOUT

DATE: Jan. 28, 2011 | SC | PROJ. #: 01-1103
SCALE :

DWG. NO.
M-102.00



LEGENDS:

INTAKE AIR VENT

EXHAUST VENT

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.
115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-

SEAL:

STATE OF NEW YORK
LICENSED PROFESSIONAL ENGINEER

120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

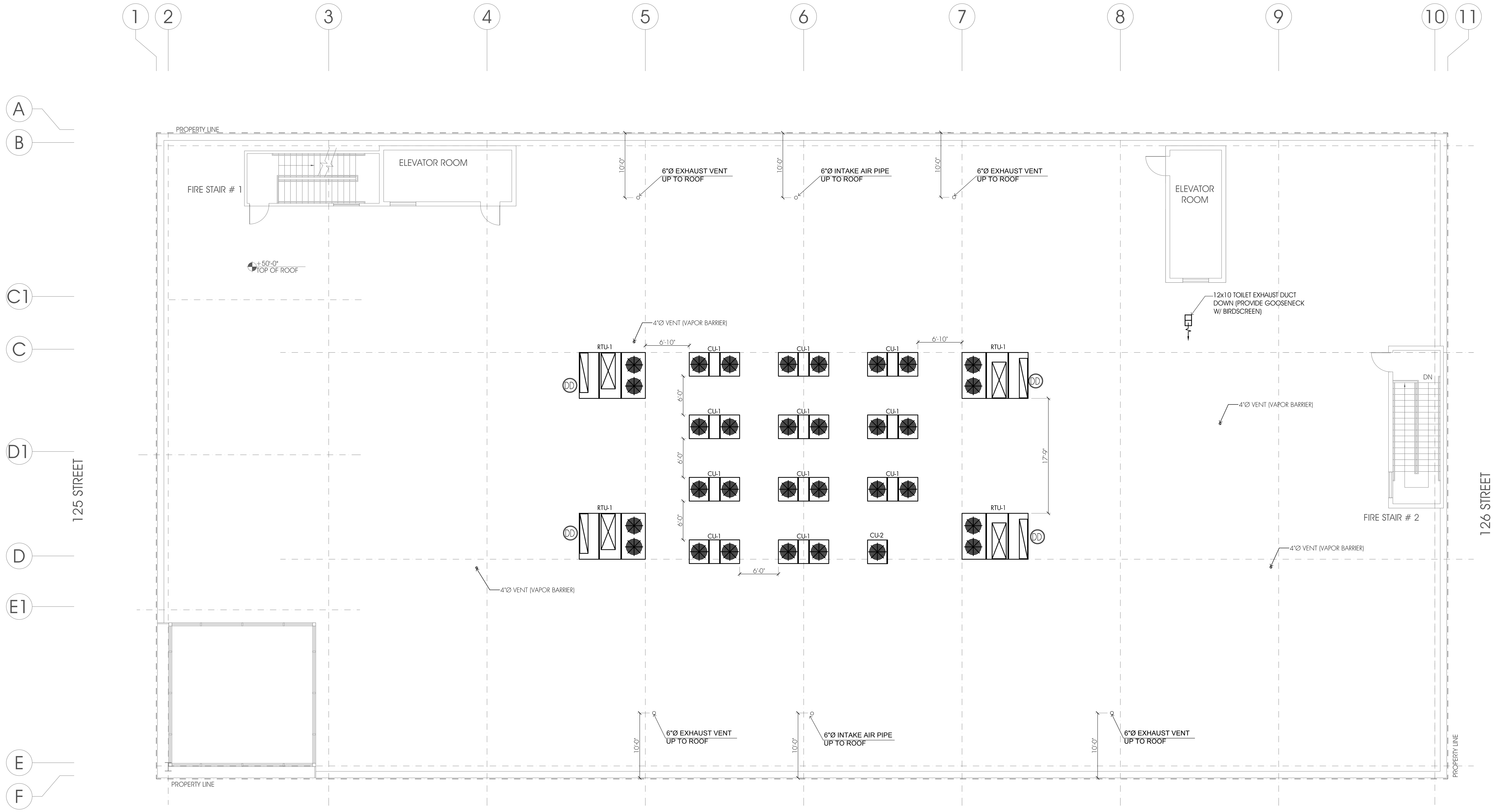
DWG TILE:
3rd FLOOR
HVAC LAYOUT

DATE: Jan. 28, 2011 | SC | PROJ. #: 01-1103

SCALE :

DWG. NO.
M-103.00

07 of 8



ROOF

FREDERICK DOUGLASS BOULEVARD

LEGENDS:

INTAKE AIR VENT

EXHAUST VENT

NEW RETAIL CENTER

301 WEST 125th STREET
NEW YORK, NY 10027

SRA
Architecture + Engineering, P.C.

115 West 30th St. Suite 1201, New York NY 10001
Tel (212) 505-1986 Fax (212) 505-2794

Rev	Description	Date
01	DEP REVIEW	08.25.11
	-	-
	-	-

SEAL:

STATE OF NEW YORK SPENCER GOROFF 063771 LICENSED PROFESSIONAL ENGINEER

120616057
DEPT. OF BLDGS
DOC # 01

This plan approved only for work indicated on drawings or the Plan/Work Approval Application. All other matters shown are not to be relied upon, or to be considered as either being approved or in accordance with applicable codes.

DWG TILE: MECHANICAL ROOF LAYOUT

DATE: Jan. 28, 2011 SC PROJ. #: 01-1103

SCALE :

DWG. NO. M-104.00

APPENDIX E

Window Specifications and Acoustical Laboratory Test Report

ACOUSTILOG INC.
19 Mercer Street, NY, NY 10013 (212) 925-1365 Fax: (212) 966-4216 www.acoustilog.com

May 12, 2011

Maurizio Marezio Bertini, Ph.D.
Section Chief - Air and Noise Section
E - Designations Program
Mayor's Office of Environmental Remediation
253 Broadway, 14th Floor
New York, NY 10007

RE: Sound Level Analysis for 2329 Frederick Douglass Boulevard
Block 1952
Lot 29
Map 8D
Zoning R8

Dear Maurizio,

I have done the Noise Control calculations for the above premises, which consists of first floor retail store space, and retail and offices on the upper floors. I first spoke with Mr. Shaminder Chawla, who referred me to you.

DISCUSSION

Originally, the notice from the City asked us to provide “windows of OITC 35”.

The CEQR Environmental Designations says that this block and lot requires “Window Wall Attenuation and Alternate Ventilation”.

Upon further investigation, the 125th Street Corridor Rezoning and Related Actions EIS, New York City Department of City Planning documentation shows a requirement for OITC 40/30, which means:

OITC 30 for the side facing Frederick Douglass Boulevard,

and

OITC 40 for the south facade facing 125th Street.

You explained that we can knock down that requirement by 5 OITC rating points for commercial use, which results in:

OITC 25 for the side facing Frederick Douglass Boulevard,

and

OITC 35 for the south facade facing 125th Street.

DOORS

The doors to the first floor retail store space and lobby space will be opening all the time. When doors open, they provide no soundproofing. Thus the sound rating of the doors is obviously irrelevant for this busy first floor retail store space and lobby space.

I have provided the enclosed first floor calculations with the doors closed and open, but since people will be exposed to street sound with the doors opening all the time anyway, the sound levels inside these areas is clearly irrelevant. This is shown by the calculations; the inside rating is OITC 27 on both facades, but is reduced to OITC 13 when the doors are open. Clearly, any soundproofing, not matter how good, will be reduced to approximately OITC 13 when the doors are open. Therefore, it is not important to provide expensive soundproof doors on the 1st floor.

WINDOWS

I have provided the window calculations for the two facades.

All of the windows in these two facades are non-operable. An alternate means of ventilation will be provided, which is shown on the plans.

You explained that OER is most concerned with the sound levels in office spaces. Therefore, I have provided the enclosed upper floor calculations with the required ratings for each of the two facades.

1st floor - Since there are no office spaces on the 1st floor, and because any soundproofing will be reduced to approximately OITC 13 when the doors are open, I request an exemption of the OITC requirements for that floor.

2nd and 3rd floor - Even though the 2nd and 3rd floor areas will be a combination of retail and office, I have assumed it all to be office space, with the office requirements of OITC 25 for Frederick Douglass Boulevard, and OITC 35 for 125th Street.

The calculations show a final window/wall attenuation of OITC 28 for Frederick Douglass Boulevard, and OITC 37 for 125th Street, which meets the requirements.

In the calculations, *“750 OG Acoustical Test with Standard Insulated Unit”* represents 1" insulated glass with ¼" annealed exterior, ½” airspace, and ¼” annealed interior glass from YCW Model 750 OG. This has a rating of OITC 26.

In the calculations, *“Lam. 1/4" glass .030, 1/2" airspace*, lam. ¼” glass *.090”* represents ¼” laminated glass with a .030 interlayer, ½” airspace, and ¼” laminated glass with a .090 interlayer, from Solutia, "Laminated Glass with Saflex interlayer". This has a rating of OITC 35.

NON- OCCUPIABLE SPACE

There are several areas of non-occupiable space on this property.

There are several large areas on the 2nd and 3rd floors that are not glass, but masonry behind signage. These areas are non-occupiable and are for store displays only.

The glass tower is non-occupiable and is for store displays only.

See the enclosed rendering and elevation.

CALCULATION

The transmission loss of the doors and windows is equal to 10 times the log of 1/t, t being the transmission coefficient per square foot. The transmission coefficient is determined in turn by the transmission loss in decibels divided by 10 and taking the antilog of the result. I have performed this calculation to determine the overall OITC rating of the window/wall. This calculation considers the contribution of the exact area of doors, windows and walls, as provided by the architect.

The glass, brick and door data is based on laboratory tests. The manufacturer's data is attached at the end of this report.

The 80 Hz data (where it is marked "80 Hz estimated") was derived by extrapolating downwards from the 100-125 Hertz data. The data is conservative.

The calculations are displayed in the tables below.

CONCLUSION

The data shows that the window/wall combination of the walls, windows and doors are sufficient to exceed the required OITC rating.

Please grant approval of the submittal as soon as possible.

If I can be of further assistance, please call.

Yours Truly,

Alan Fierstein
President
af1@acoustilog.com

All readings re: .0002 microbar. Readings taken with Bruel & Kjaer 2260/2270 Analyzer, Bruel & Kjaer 4135, 4145, or 4165 Microphone, Acoustilog 232A Reverberation Timer. Calibrated to Bruel & Kjaer 4220 Sound Source or Quest CA-15.

APPENDIX E

Window Specifications

In the calculations, *"750 OG Acoustical Test with Standard Insulated Unit"* represents 1" insulated glass with ¼" annealed exterior, ½" airspace, and ¼" annealed interior glass from YCW Model 750 OG. This has a rating of OITC 26.

In the calculations, *"Lam. ¼"" glass .030, ½" airspace, lam. ¼" glass .090"* represents ¼" laminated glass with a .030 interlayer, ½" airspace, and ¼" laminated glass with a .090 interlayer, from Solutia, "Laminated Glass with Saflex interlayer". This has a rating of OITC 35.

APPENDIX F

Acoustical Laboratory Test Report

See YCW Model 750 OG Test Data

Also see Solutia, "Laminated Glass with Saflex interlayer Test data

Door glass TL ratings are shown in the Oldcastle Glass data sheet. As discussed above, doors are not critical.

Masonry Block with sheetrock TL ratings are shown in the test data below.

APPENDIX G

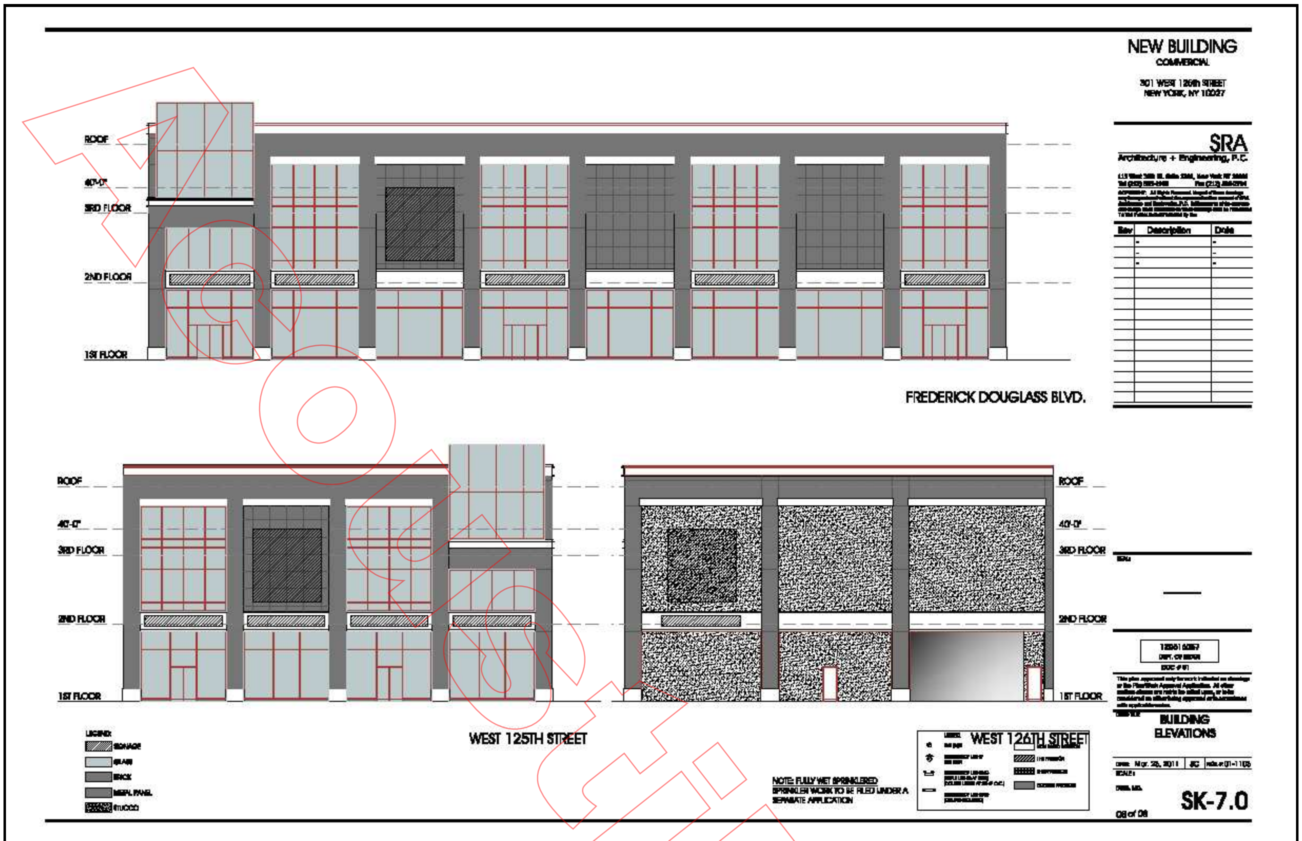
Data sheet from the Testing Lab and/or Manufacturer

As above, see Glass, Brick and Door data

APPENDIX H

Sound Attenuation Ratings for Façade Elements

Calculation results printed below. Actual Proprietary Acoustilog Spreadsheet with all calculations provided under separate email to Maurizio Bertini at OER under confidentiality agreement.


NEW BUILDING
COMMERCIAL
301 WEST 126th STREET
NEW YORK, NY 10027
SRA
Architecture + Engineering, P.C.
Rev
Description
Date
ROOF
40'-0"
3RD FLOOR
2ND FLOOR
1ST FLOOR
FREDERICK DOUGLASS BLVD.
WEST 125TH STREET
WEST 126TH STREET
NOTE: FULLY WET SPRINKLERED
SPRINKLER WORK TO BE FILED UNDER A
SEPARATE APPLICATION
LEGEND:
SIGNAGE
GLASS
BRICK
METAL PANEL
STUCCO
BUILDING
ELEVATIONS
SK-7.0


DSW
everybody blinks
more blink
less bling
VICTORIA'S SECRET
blink
DIGITART3D.COM

Window Wall attenuation
125th Street Side
1st floor retail and lobby

	ENTRANCE		80 Hz estimated				STOREFRONT GLASS		Area fraction				NOT USED					
	DOORS CLOSED		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit OITC 26									WALL
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter		Transmission		OITC	Enter	Enter				OITC
FLOOR	TL	Area		Coefficient	Contribution	Sub-Calc	TL	Area		Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc
80	21	94.66	0.05	7.9E-03	4.2E-04	59.5	22	1207.98	0.67	6.3E-03	4.2E-03	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5
100	25	94.66	0.05	3.2E-03	1.7E-04	57.9	26	1207.98	0.67	2.5E-03	1.7E-03	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9
125	29	94.66	0.05	1.3E-03	6.6E-05	55.9	24	1207.98	0.67	4.0E-03	2.7E-03	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9
160	28	94.66	0.05	1.6E-03	8.3E-05	56.6	25	1207.98	0.67	3.2E-03	2.1E-03	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6
200	30	94.66	0.05	1.0E-03	5.3E-05	56.1	17	1207.98	0.67	2.0E-02	1.3E-02	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1
250	33	94.66	0.05	5.0E-04	2.6E-05	53.4	19	1207.98	0.67	1.3E-02	8.4E-03	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4
315	33	94.66	0.05	5.0E-04	2.6E-05	54.4	21	1207.98	0.67	7.9E-03	5.3E-03	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4
400	34	94.66	0.05	4.0E-04	2.1E-05	54.2	28	1207.98	0.67	1.6E-03	1.1E-03	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2
500	36	94.66	0.05	2.5E-04	1.3E-05	53.8	30	1207.98	0.67	1.0E-03	6.7E-04	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8
630	37	94.66	0.05	2.0E-04	1.0E-05	52.1	31	1207.98	0.67	7.9E-04	5.3E-04	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1
800	37	94.66	0.05	2.0E-04	1.0E-05	52.2	33	1207.98	0.67	5.0E-04	3.4E-04	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2
1000	37	94.66	0.05	2.0E-04	1.0E-05	52.0	35	1207.98	0.67	3.2E-04	2.1E-04	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0
1250	36	94.66	0.05	2.5E-04	1.3E-05	53.6	35	1207.98	0.67	3.2E-04	2.1E-04	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6
1600	37	94.66	0.05	2.0E-04	1.0E-05	52.0	34	1207.98	0.67	4.0E-04	2.7E-04	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0
2000	41	94.66	0.05	7.9E-05	4.2E-06	48.2	31	1207.98	0.67	7.9E-04	5.3E-04	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2
2500	45	94.66	0.05	3.2E-05	1.7E-06	43.3	31	1207.98	0.67	7.9E-04	5.3E-04	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3
3150	48	94.66	0.05	1.6E-05	8.3E-07	38.2	33	1207.98	0.67	5.0E-04	3.4E-04	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2
4000	51	94.66	0.05	7.9E-06	4.2E-07	34.0	35	1207.98	0.67	3.2E-04	2.1E-04	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0
					100	67					100	74					100	67
					OITC	**33**					OITC	**26**					OITC	**33**

80 Hz estimated						NOT USED															
Concrete block + 1 layer sheetrock												Total	Effective	Effective	OITC						
Enter	Enter	Area	Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
TL	Area	fraction	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
30	498.33	0.28	1.0E-03	2.8E-04	50.5	30	0	0.00	1.0E-03	0.0E+00	50.5	1800.97	4.9E-03	**23**	80	103	-22.5	80.5	23	57.42519	
29	498.33	0.28	1.3E-03	3.5E-04	53.9	33	0	0.00	5.0E-04	0.0E+00	49.9	1800.97	2.2E-03	**27**	100	102	-19.1	82.9	27	56.32299	
31	498.33	0.28	7.9E-04	2.2E-04	53.9	30	0	0.00	1.0E-03	0.0E+00	54.9	1800.97	3.0E-03	**25**	**125**	101	-16.1	84.9	25	59.60737	
36	498.33	0.28	2.5E-04	7.0E-05	48.6	30	0	0.00	1.0E-03	0.0E+00	54.6	1800.97	2.3E-03	**26**	160	98	-13.4	84.6	26	58.16765	
42	498.33	0.28	6.3E-05	1.7E-05	44.1	31	0	0.00	7.9E-04	0.0E+00	55.1	1800.97	1.3E-02	**19**	200	97	-10.9	86.1	19	67.3882	
46	498.33	0.28	2.5E-05	7.0E-06	40.4	27	0	0.00	2.0E-03	0.0E+00	59.4	1800.97	8.5E-03	**21**	**250**	95	-8.6	86.4	21	65.68262	
53	498.33	0.28	5.0E-06	1.4E-06	34.4	33	0	0.00	5.0E-04	0.0E+00	54.4	1800.97	5.4E-03	**23**	315	94	-6.6	87.4	23	64.68808	
54	498.33	0.28	4.0E-06	1.1E-06	34.2	33	0	0.00	5.0E-04	0.0E+00	55.2	1800.97	1.1E-03	**30**	400	93	-4.8	88.2	30	58.5546	
57	498.33	0.28	2.0E-06	5.5E-07	32.8	37	0	0.00	2.0E-04	0.0E+00	52.8	1800.97	6.8E-04	**32**	**500**	93	-3.2	89.8	32	58.15369	
58	498.33	0.28	1.6E-06	4.4E-07	31.1	39	0	0.00	1.3E-04	0.0E+00	50.1	1800.97	5.4E-04	**33**	630	91	-1.9	89.1	33	56.45369	
61	498.33	0.28	7.9E-07	2.2E-07	28.2	40	0	0.00	1.0E-04	0.0E+00	49.2	1800.97	3.5E-04	**35**	800	90	-0.8	89.2	35	54.6017	
63	498.33	0.28	5.0E-07	1.4E-07	26.0	41	0	0.00	7.9E-05	0.0E+00	48.0	1800.97	2.2E-04	**37**	**1000**	89	0	89	37	52.47783	
65	498.33	0.28	3.2E-07	8.8E-08	24.6	42	0	0.00	6.3E-05	0.0E+00	47.6	1800.97	2.3E-04	**36**	1250	89	0.6	89.6	36	53.12947	
66	498.33	0.28	2.5E-07	7.0E-08	23.0	43	0	0.00	5.0E-05	0.0E+00	46.0	1800.97	2.8E-04	**36**	1600	88	1	89	36	53.43392	
65	498.33	0.28	3.2E-07	8.8E-08	24.2	43	0	0.00	5.0E-05	0.0E+00	46.2	1800.97	5.4E-04	**33**	**2000**	88	1.2	89.2	33	56.50014	
66	498.33	0.28	2.5E-07	7.0E-08	22.3	46	0	0.00	2.5E-05	0.0E+00	42.3	1800.97	5.3E-04	**33**	2500	87	1.3	88.3	33	55.57962	
69	498.33	0.28	1.3E-07	3.5E-08	17.2	52	0	0.00	6.3E-06	0.0E+00	34.2	1800.97	3.4E-04	**35**	3150	85	1.2	86.2	35	51.47673	**OVERALL**
71	498.33	0.28	7.9E-08	2.2E-08	14.0	57	0	0.00	2.0E-06	0.0E+00	28.0	1800.97	2.1E-04	**37**	**4000**	84	1	85	37	48.27452	**OITC**
				100	59					100	65							100		73	**27**
				OITC	**42**					OITC	**35**										

125th Street Side
1st floor retail and lobby

	ENTRANCE						STOREFRONT GLASS						NOT USED					
	DOORS OPEN		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit									WALL
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter	YCW 750	Transmission		OITC	Enter	Enter				OITC
FLOOR	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc
80	0	94.66	0.05	1.0E+00	5.3E-02	80.5	22	1207.98	0.67	6.3E-03	4.2E-03	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5
100	0	94.66	0.05	1.0E+00	5.3E-02	82.9	26	1207.98	0.67	2.5E-03	1.7E-03	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9
125	0	94.66	0.05	1.0E+00	5.3E-02	84.9	24	1207.98	0.67	4.0E-03	2.7E-03	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9
160	0	94.66	0.05	1.0E+00	5.3E-02	84.6	25	1207.98	0.67	3.2E-03	2.1E-03	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6
200	0	94.66	0.05	1.0E+00	5.3E-02	86.1	17	1207.98	0.67	2.0E-02	1.3E-02	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1
250	0	94.66	0.05	1.0E+00	5.3E-02	86.4	19	1207.98	0.67	1.3E-02	8.4E-03	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4
315	0	94.66	0.05	1.0E+00	5.3E-02	87.4	21	1207.98	0.67	7.9E-03	5.3E-03	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4
400	0	94.66	0.05	1.0E+00	5.3E-02	88.2	28	1207.98	0.67	1.6E-03	1.1E-03	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2
500	0	94.66	0.05	1.0E+00	5.3E-02	89.8	30	1207.98	0.67	1.0E-03	6.7E-04	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8
630	0	94.66	0.05	1.0E+00	5.3E-02	89.1	31	1207.98	0.67	7.9E-04	5.3E-04	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1
800	0	94.66	0.05	1.0E+00	5.3E-02	89.2	33	1207.98	0.67	5.0E-04	3.4E-04	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2
1000	0	94.66	0.05	1.0E+00	5.3E-02	89.0	35	1207.98	0.67	3.2E-04	2.1E-04	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0
1250	0	94.66	0.05	1.0E+00	5.3E-02	89.6	35	1207.98	0.67	3.2E-04	2.1E-04	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6
1600	0	94.66	0.05	1.0E+00	5.3E-02	89.0	34	1207.98	0.67	4.0E-04	2.7E-04	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0
2000	0	94.66	0.05	1.0E+00	5.3E-02	89.2	31	1207.98	0.67	7.9E-04	5.3E-04	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2
2500	0	94.66	0.05	1.0E+00	5.3E-02	88.3	31	1207.98	0.67	7.9E-04	5.3E-04	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3
3150	0	94.66	0.05	1.0E+00	5.3E-02	86.2	33	1207.98	0.67	5.0E-04	3.4E-04	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2
4000	0	94.66	0.05	1.0E+00	5.3E-02	85.0	35	1207.98	0.67	3.2E-04	2.1E-04	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0
					100	100					100	74					100	67
					OITC	**0**					OITC	**26**					OITC	**33**

						NOT USED															
Concrete block + 1 layer sheetrock												Total	Effective	Effective	OITC						
Enter	Enter		Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
30	498.33	0.28	1.0E-03	2.8E-04	50.5	30	0	0.00	1.0E-03	0.0E+00	50.5	1800.97	5.7E-02	**12**	80	103	-22.5	80.5	12	68.06403	
29	498.33	0.28	1.3E-03	3.5E-04	53.9	33	0	0.00	5.0E-04	0.0E+00	49.9	1800.97	5.5E-02	**13**	100	102	-19.1	82.9	13	70.27143	
31	498.33	0.28	7.9E-04	2.2E-04	53.9	30	0	0.00	1.0E-03	0.0E+00	54.9	1800.97	5.5E-02	**13**	**125**	101	-16.1	84.9	13	72.33906	
36	498.33	0.28	2.5E-04	7.0E-05	48.6	30	0	0.00	1.0E-03	0.0E+00	54.6	1800.97	5.5E-02	**13**	160	98	-13.4	84.6	13	71.98393	
42	498.33	0.28	6.3E-05	1.7E-05	44.1	31	0	0.00	7.9E-04	0.0E+00	55.1	1800.97	6.6E-02	**12**	200	97	-10.9	86.1	12	74.29287	
46	498.33	0.28	2.5E-05	7.0E-06	40.4	27	0	0.00	2.0E-03	0.0E+00	59.4	1800.97	6.1E-02	**12**	**250**	95	-8.6	86.4	12	74.25413	
53	498.33	0.28	5.0E-06	1.4E-06	34.4	33	0	0.00	5.0E-04	0.0E+00	54.4	1800.97	5.8E-02	**12**	315	94	-6.6	87.4	12	75.02602	
54	498.33	0.28	4.0E-06	1.1E-06	34.2	33	0	0.00	5.0E-04	0.0E+00	55.2	1800.97	5.4E-02	**13**	400	93	-4.8	88.2	13	75.49365	
57	498.33	0.28	2.0E-06	5.5E-07	32.8	37	0	0.00	2.0E-04	0.0E+00	52.8	1800.97	5.3E-02	**13**	**500**	93	-3.2	89.8	13	77.06172	
58	498.33	0.28	1.6E-06	4.4E-07	31.1	39	0	0.00	1.3E-04	0.0E+00	50.1	1800.97	5.3E-02	**13**	630	91	-1.9	89.1	13	76.35044	
61	498.33	0.28	7.9E-07	2.2E-07	28.2	40	0	0.00	1.0E-04	0.0E+00	49.2	1800.97	5.3E-02	**13**	800	90	-0.8	89.2	13	76.43431	
63	498.33	0.28	5.0E-07	1.4E-07	26.0	41	0	0.00	7.9E-05	0.0E+00	48.0	1800.97	5.3E-02	**13**	**1000**	89	0	89	13	76.2241	
65	498.33	0.28	3.2E-07	8.8E-08	24.6	42	0	0.00	6.3E-05	0.0E+00	47.6	1800.97	5.3E-02	**13**	1250	89	0.6	89.6	13	76.8241	
66	498.33	0.28	2.5E-07	7.0E-08	23.0	43	0	0.00	5.0E-05	0.0E+00	46.0	1800.97	5.3E-02	**13**	1600	88	1	89	13	76.22861	
65	498.33	0.28	3.2E-07	8.8E-08	24.2	43	0	0.00	5.0E-05	0.0E+00	46.2	1800.97	5.3E-02	**13**	**2000**	88	1.2	89.2	13	76.45041	
66	498.33	0.28	2.5E-07	7.0E-08	22.3	46	0	0.00	2.5E-05	0.0E+00	42.3	1800.97	5.3E-02	**13**	2500	87	1.3	88.3	13	75.55041	
69	498.33	0.28	1.3E-07	3.5E-08	17.2	52	0	0.00	6.3E-06	0.0E+00	34.2	1800.97	5.3E-02	**13**	3150	85	1.2	86.2	13	73.43429	**OVERALL**
71	498.33	0.28	7.9E-08	2.2E-08	14.0	57	0	0.00	2.0E-06	0.0E+00	28.0	1800.97	5.3E-02	**13**	**4000**	84	1	85	13	72.22409	**OITC**
				100	59					100	65							100		87	**13**
				OITC	**42**					OITC	**35**										

Window Wall attenuation
Frederick Douglass Blvd Side
1st floor retail and lobby

	ENTRANCE						STOREFRONT GLASS						NOT USED					
	DOORS CLOSED		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit									WALL
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter	YCW 750	Transmission		OITC	Enter	Enter				OITC
FLOOR	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc
80	21	164.65	0.05	7.9E-03	3.6E-04	59.5	22	2506	0.70	6.3E-03	4.4E-03	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5
100	25	164.65	0.05	3.2E-03	1.4E-04	57.9	26	2506	0.70	2.5E-03	1.7E-03	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9
125	29	164.65	0.05	1.3E-03	5.8E-05	55.9	24	2506	0.70	4.0E-03	2.8E-03	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9
160	28	164.65	0.05	1.6E-03	7.2E-05	56.6	25	2506	0.70	3.2E-03	2.2E-03	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6
200	30	164.65	0.05	1.0E-03	4.6E-05	56.1	17	2506	0.70	2.0E-02	1.4E-02	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1
250	33	164.65	0.05	5.0E-04	2.3E-05	53.4	19	2506	0.70	1.3E-02	8.8E-03	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4
315	33	164.65	0.05	5.0E-04	2.3E-05	54.4	21	2506	0.70	7.9E-03	5.5E-03	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4
400	34	164.65	0.05	4.0E-04	1.8E-05	54.2	28	2506	0.70	1.6E-03	1.1E-03	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2
500	36	164.65	0.05	2.5E-04	1.1E-05	53.8	30	2506	0.70	1.0E-03	7.0E-04	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8
630	37	164.65	0.05	2.0E-04	9.1E-06	52.1	31	2506	0.70	7.9E-04	5.5E-04	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1
800	37	164.65	0.05	2.0E-04	9.1E-06	52.2	33	2506	0.70	5.0E-04	3.5E-04	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2
1000	37	164.65	0.05	2.0E-04	9.1E-06	52.0	35	2506	0.70	3.2E-04	2.2E-04	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0
1250	36	164.65	0.05	2.5E-04	1.1E-05	53.6	35	2506	0.70	3.2E-04	2.2E-04	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6
1600	37	164.65	0.05	2.0E-04	9.1E-06	52.0	34	2506	0.70	4.0E-04	2.8E-04	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0
2000	41	164.65	0.05	7.9E-05	3.6E-06	48.2	31	2506	0.70	7.9E-04	5.5E-04	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2
2500	45	164.65	0.05	3.2E-05	1.4E-06	43.3	31	2506	0.70	7.9E-04	5.5E-04	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3
3150	48	164.65	0.05	1.6E-05	7.2E-07	38.2	33	2506	0.70	5.0E-04	3.5E-04	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2
4000	51	164.65	0.05	7.9E-06	3.6E-07	34.0	35	2506	0.70	3.2E-04	2.2E-04	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0
					100	67					100	74					100	67
					OITC	**33**					OITC	**26**					OITC	**33**

						NOT USED															
Concrete block + 1 layer sheetrock												Total	Effective	Effective	OITC						
Enter	Enter		Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
30	930.35	0.26	1.0E-03	2.6E-04	50.5	30	0	0.00	1.0E-03	0.0E+00	50.5	3601	5.0E-03	**23**	80	103	-22.5	80.5	23	57.50054	
29	930.35	0.26	1.3E-03	3.3E-04	53.9	33	0	0.00	5.0E-04	0.0E+00	49.9	3601	2.2E-03	**27**	100	102	-19.1	82.9	27	56.35944	
31	930.35	0.26	7.9E-04	2.1E-04	53.9	30	0	0.00	1.0E-03	0.0E+00	54.9	3601	3.0E-03	**25**	**125**	101	-16.1	84.9	25	59.71913	
36	930.35	0.26	2.5E-04	6.5E-05	48.6	30	0	0.00	1.0E-03	0.0E+00	54.6	3601	2.3E-03	**26**	160	98	-13.4	84.6	26	58.28854	
42	930.35	0.26	6.3E-05	1.6E-05	44.1	31	0	0.00	7.9E-04	0.0E+00	55.1	3601	1.4E-02	**19**	200	97	-10.9	86.1	19	67.54494	
46	930.35	0.26	2.5E-05	6.5E-06	40.4	27	0	0.00	2.0E-03	0.0E+00	59.4	3601	8.8E-03	**21**	**250**	95	-8.6	86.4	21	65.84013	
53	930.35	0.26	5.0E-06	1.3E-06	34.4	33	0	0.00	5.0E-04	0.0E+00	54.4	3601	5.6E-03	**23**	315	94	-6.6	87.4	23	64.84456	
54	930.35	0.26	4.0E-06	1.0E-06	34.2	33	0	0.00	5.0E-04	0.0E+00	55.2	3601	1.1E-03	**29**	400	93	-4.8	88.2	29	58.70065	
57	930.35	0.26	2.0E-06	5.2E-07	32.8	37	0	0.00	2.0E-04	0.0E+00	52.8	3601	7.1E-04	**32**	**500**	93	-3.2	89.8	32	58.29983	
58	930.35	0.26	1.6E-06	4.1E-07	31.1	39	0	0.00	1.3E-04	0.0E+00	50.1	3601	5.6E-04	**33**	630	91	-1.9	89.1	33	56.59983	
61	930.35	0.26	7.9E-07	2.1E-07	28.2	40	0	0.00	1.0E-04	0.0E+00	49.2	3601	3.6E-04	**34**	800	90	-0.8	89.2	34	54.74021	
63	930.35	0.26	5.0E-07	1.3E-07	26.0	41	0	0.00	7.9E-05	0.0E+00	48.0	3601	2.3E-04	**36**	**1000**	89	0	89	36	52.60444	
65	930.35	0.26	3.2E-07	8.2E-08	24.6	42	0	0.00	6.3E-05	0.0E+00	47.6	3601	2.3E-04	**36**	1250	89	0.6	89.6	36	53.24805	
66	930.35	0.26	2.5E-07	6.5E-08	23.0	43	0	0.00	5.0E-05	0.0E+00	46.0	3601	2.9E-04	**35**	1600	88	1	89	35	53.56727	
65	930.35	0.26	3.2E-07	8.2E-08	24.2	43	0	0.00	5.0E-05	0.0E+00	46.2	3601	5.6E-04	**33**	**2000**	88	1.2	89.2	33	56.65466	
66	930.35	0.26	2.5E-07	6.5E-08	22.3	46	0	0.00	2.5E-05	0.0E+00	42.3	3601	5.5E-04	**33**	2500	87	1.3	88.3	33	55.73743	
69	930.35	0.26	1.3E-07	3.3E-08	17.2	52	0	0.00	6.3E-06	0.0E+00	34.2	3601	3.5E-04	**35**	3150	85	1.2	86.2	35	51.635	**OVERALL**
71	930.35	0.26	7.9E-08	2.1E-08	14.0	57	0	0.00	2.0E-06	0.0E+00	28.0	3601	2.2E-04	**37**	**4000**	84	1	85	37	48.43315	**OITC**
				100	59					100	65							100		73	**27**
				OITC	**42**					OITC	**35**										

Window Wall attenuation
Frederick Douglass Blvd Side
1st floor retail and lobby

	ENTRANCE						STOREFRONT GLASS						NOT USED					
	DOORS OPEN		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit									WALL
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter	YCW 750	Transmission		OITC	Enter	Enter				OITC
FLOOR	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc
80	0	164.65	0.05	1.0E+00	4.6E-02	80.5	22	2506	0.70	6.3E-03	4.4E-03	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5
100	0	164.65	0.05	1.0E+00	4.6E-02	82.9	26	2506	0.70	2.5E-03	1.7E-03	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9
125	0	164.65	0.05	1.0E+00	4.6E-02	84.9	24	2506	0.70	4.0E-03	2.8E-03	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9
160	0	164.65	0.05	1.0E+00	4.6E-02	84.6	25	2506	0.70	3.2E-03	2.2E-03	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6
200	0	164.65	0.05	1.0E+00	4.6E-02	86.1	17	2506	0.70	2.0E-02	1.4E-02	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1
250	0	164.65	0.05	1.0E+00	4.6E-02	86.4	19	2506	0.70	1.3E-02	8.8E-03	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4
315	0	164.65	0.05	1.0E+00	4.6E-02	87.4	21	2506	0.70	7.9E-03	5.5E-03	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4
400	0	164.65	0.05	1.0E+00	4.6E-02	88.2	28	2506	0.70	1.6E-03	1.1E-03	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2
500	0	164.65	0.05	1.0E+00	4.6E-02	89.8	30	2506	0.70	1.0E-03	7.0E-04	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8
630	0	164.65	0.05	1.0E+00	4.6E-02	89.1	31	2506	0.70	7.9E-04	5.5E-04	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1
800	0	164.65	0.05	1.0E+00	4.6E-02	89.2	33	2506	0.70	5.0E-04	3.5E-04	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2
1000	0	164.65	0.05	1.0E+00	4.6E-02	89.0	35	2506	0.70	3.2E-04	2.2E-04	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0
1250	0	164.65	0.05	1.0E+00	4.6E-02	89.6	35	2506	0.70	3.2E-04	2.2E-04	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6
1600	0	164.65	0.05	1.0E+00	4.6E-02	89.0	34	2506	0.70	4.0E-04	2.8E-04	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0
2000	0	164.65	0.05	1.0E+00	4.6E-02	89.2	31	2506	0.70	7.9E-04	5.5E-04	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2
2500	0	164.65	0.05	1.0E+00	4.6E-02	88.3	31	2506	0.70	7.9E-04	5.5E-04	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3
3150	0	164.65	0.05	1.0E+00	4.6E-02	86.2	33	2506	0.70	5.0E-04	3.5E-04	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2
4000	0	164.65	0.05	1.0E+00	4.6E-02	85.0	35	2506	0.70	3.2E-04	2.2E-04	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0
					100	100					100	74					100	67
					OITC	**0**					OITC	**26**					OITC	**33**

						NOT USED															
Concrete block + 1 layer sheetrock												Total	Effective	Effective	OITC						
Enter	Enter		Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
30	930.35	0.26	1.0E-03	2.6E-04	50.5	30	0	0.00	1.0E-03	0.0E+00	50.5	3601	5.0E-02	**13**	80	103	-22.5	80.5	13	67.52195	
29	930.35	0.26	1.3E-03	3.3E-04	53.9	33	0	0.00	5.0E-04	0.0E+00	49.9	3601	4.8E-02	**13**	100	102	-19.1	82.9	13	69.69398	
31	930.35	0.26	7.9E-04	2.1E-04	53.9	30	0	0.00	1.0E-03	0.0E+00	54.9	3601	4.9E-02	**13**	**125**	101	-16.1	84.9	13	71.77521	
36	930.35	0.26	2.5E-04	6.5E-05	48.6	30	0	0.00	1.0E-03	0.0E+00	54.6	3601	4.8E-02	**13**	160	98	-13.4	84.6	13	71.41142	
42	930.35	0.26	6.3E-05	1.6E-05	44.1	31	0	0.00	7.9E-04	0.0E+00	55.1	3601	6.0E-02	**12**	200	97	-10.9	86.1	12	73.85429	
46	930.35	0.26	2.5E-05	6.5E-06	40.4	27	0	0.00	2.0E-03	0.0E+00	59.4	3601	5.4E-02	**13**	**250**	95	-8.6	86.4	13	73.76325	
53	930.35	0.26	5.0E-06	1.3E-06	34.4	33	0	0.00	5.0E-04	0.0E+00	54.4	3601	5.1E-02	**13**	315	94	-6.6	87.4	13	74.49716	
54	930.35	0.26	4.0E-06	1.0E-06	34.2	33	0	0.00	5.0E-04	0.0E+00	55.2	3601	4.7E-02	**13**	400	93	-4.8	88.2	13	74.905	
57	930.35	0.26	2.0E-06	5.2E-07	32.8	37	0	0.00	2.0E-04	0.0E+00	52.8	3601	4.6E-02	**13**	**500**	93	-3.2	89.8	13	76.46704	
58	930.35	0.26	1.6E-06	4.1E-07	31.1	39	0	0.00	1.3E-04	0.0E+00	50.1	3601	4.6E-02	**13**	630	91	-1.9	89.1	13	75.75362	
61	930.35	0.26	7.9E-07	2.1E-07	28.2	40	0	0.00	1.0E-04	0.0E+00	49.2	3601	4.6E-02	**13**	800	90	-0.8	89.2	13	75.83441	
63	930.35	0.26	5.0E-07	1.3E-07	26.0	41	0	0.00	7.9E-05	0.0E+00	48.0	3601	4.6E-02	**13**	**1000**	89	0	89	13	75.62225	
65	930.35	0.26	3.2E-07	8.2E-08	24.6	42	0	0.00	6.3E-05	0.0E+00	47.6	3601	4.6E-02	**13**	1250	89	0.6	89.6	13	76.22225	
66	930.35	0.26	2.5E-07	6.5E-08	23.0	43	0	0.00	5.0E-05	0.0E+00	46.0	3601	4.6E-02	**13**	1600	88	1	89	13	75.62763	
65	930.35	0.26	3.2E-07	8.2E-08	24.2	43	0	0.00	5.0E-05	0.0E+00	46.2	3601	4.6E-02	**13**	**2000**	88	1.2	89.2	13	75.85358	
66	930.35	0.26	2.5E-07	6.5E-08	22.3	46	0	0.00	2.5E-05	0.0E+00	42.3	3601	4.6E-02	**13**	2500	87	1.3	88.3	13	74.95358	
69	930.35	0.26	1.3E-07	3.3E-08	17.2	52	0	0.00	6.3E-06	0.0E+00	34.2	3601	4.6E-02	**13**	3150	85	1.2	86.2	13	72.83439	**OVERALL**
71	930.35	0.26	7.9E-08	2.1E-08	14.0	57	0	0.00	2.0E-06	0.0E+00	28.0	3601	4.6E-02	**13**	**4000**	84	1	85	13	71.62224	**OITC**
				100	59					100	65							100		87	**13**
				OITC	**42**					OITC	**35**										

125th Street Side

2nd floor retail and offices

	ENTRANCE						STOREFRONT GLASS						NOT USED																											
	NOT USED		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit									WALL	Concrete block + 1 layer sheetrock						Lam. 1/4" glass .030, 1/2" airspace, lam. 1/4" glass .090						Total	Effective	Effective	OITC						
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter	YCW 750	Transmission		OITC	Enter	Enter				OITC	Enter	Enter		Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
FLOOR	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
80	21	0	0.00	7.9E-03	0.0E+00	59.5	22	0	0.00	6.3E-03	0.0E+00	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5	30	625	0.39	1.0E-03	3.9E-04	50.5	30	975	0.61	1.0E-03	6.1E-04	50.5	1600	1.0E-03	30	80	103	-22.5	80.5	30	50.5	
100	25	0	0.00	3.2E-03	0.0E+00	57.9	26	0	0.00	2.5E-03	0.0E+00	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9	29	625	0.39	1.3E-03	4.9E-04	53.9	33	975	0.61	5.0E-04	3.1E-04	49.9	1600	8.0E-04	31	100	102	-19.1	82.9	31	51.91556	
125	29	0	0.00	1.3E-03	0.0E+00	55.9	24	0	0.00	4.0E-03	0.0E+00	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9	31	625	0.39	7.9E-04	3.1E-04	53.9	30	975	0.61	1.0E-03	6.1E-04	54.9	1600	9.2E-04	30	125	101	-16.1	84.9	30	54.53627	
160	28	0	0.00	1.6E-03	0.0E+00	56.6	25	0	0.00	3.2E-03	0.0E+00	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6	36	625	0.39	2.5E-04	9.8E-05	48.6	30	975	0.61	1.0E-03	6.1E-04	54.6	1600	7.1E-04	32	160	98	-13.4	84.6	32	53.09724	
200	30	0	0.00	1.0E-03	0.0E+00	56.1	17	0	0.00	2.0E-02	0.0E+00	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1	42	625	0.39	6.3E-05	2.5E-05	44.1	31	975	0.61	7.9E-04	4.8E-04	55.1	1600	5.1E-04	33	200	97	-10.9	86.1	33	53.16454	
250	33	0	0.00	5.0E-04	0.0E+00	53.4	19	0	0.00	1.3E-02	0.0E+00	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4	46	625	0.39	2.5E-05	9.8E-06	40.4	27	975	0.61	2.0E-03	1.2E-03	59.4	1600	1.2E-03	29	250	95	-8.6	86.4	29	57.28375	
315	33	0	0.00	5.0E-04	0.0E+00	54.4	21	0	0.00	7.9E-03	0.0E+00	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4	53	625	0.39	5.0E-06	2.0E-06	34.4	33	975	0.61	5.0E-04	3.1E-04	54.4	1600	3.1E-04	35	315	94	-6.6	87.4	35	52.2766	
400	34	0	0.00	4.0E-04	0.0E+00	54.2	28	0	0.00	1.6E-03	0.0E+00	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2	54	625	0.39	4.0E-06	1.6E-06	34.2	33	975	0.61	5.0E-04	3.1E-04	55.2	1600	3.1E-04	35	400	93	-4.8	88.2	35	53.0709	
500	36	0	0.00	2.5E-04	0.0E+00	53.8	30	0	0.00	1.0E-03	0.0E+00	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8	57	625	0.39	2.0E-06	7.8E-07	32.8	37	975	0.61	2.0E-04	1.2E-04	52.8	1600	1.2E-04	39	500	93	-3.2	89.8	39	50.6766	
630	37	0	0.00	2.0E-04	0.0E+00	52.1	31	0	0.00	7.9E-04	0.0E+00	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1	58	625	0.39	1.6E-06	6.2E-07	31.1	39	975	0.61	1.3E-04	7.7E-05	50.1	1600	7.7E-05	41	630	91	-1.9	89.1	41	47.98375	
800	37	0	0.00	2.0E-04	0.0E+00	52.2	33	0	0.00	5.0E-04	0.0E+00	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2	61	625	0.39	7.9E-07	3.1E-07	28.2	40	975	0.61	1.0E-04	6.1E-05	49.2	1600	6.1E-05	42	800	90	-0.8	89.2	42	47.0709	
1000	37	0	0.00	2.0E-04	0.0E+00	52.0	35	0	0.00	3.2E-04	0.0E+00	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0	63	625	0.39	5.0E-07	2.0E-07	26.0	41	975	0.61	7.9E-05	4.8E-05	48.0	1600	4.9E-05	43	1000	89	0	89	43	45.86638	
1250	36	0	0.00	2.5E-04	0.0E+00	53.6	35	0	0.00	3.2E-04	0.0E+00	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6	65	625	0.39	3.2E-07	1.2E-07	24.6	42	975	0.61	6.3E-05	3.8E-05	47.6	1600	3.9E-05	44	1250	89	0.6	89.6	44	45.46278	
1600	37	0	0.00	2.0E-04	0.0E+00	52.0	34	0	0.00	4.0E-04	0.0E+00	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0	66	625	0.39	2.5E-07	9.8E-08	23.0	43	975	0.61	5.0E-05	3.1E-05	46.0	1600	3.1E-05	45	1600	88	1	89	45	43.86278	
2000	41	0	0.00	7.9E-05	0.0E+00	48.2	31	0	0.00	7.9E-04	0.0E+00	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2	65	625	0.39	3.2E-07	1.2E-07	24.2	43	975	0.61	5.0E-05	3.1E-05	46.2	1600	3.1E-05	45	2000	88	1.2	89.2	45	44.06638	
2500	45	0	0.00	3.2E-05	0.0E+00	43.3	31	0	0.00	7.9E-04	0.0E+00	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3	66	625	0.39	2.5E-07	9.8E-08	22.3	46	975	0.61	2.5E-05	1.5E-05	42.3	1600	1.5E-05	48	2500	87	1.3	88.3	48	40.1766	
3150	48	0	0.00	1.6E-05	0.0E+00	38.2	33	0	0.00	5.0E-04	0.0E+00	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2	69	625	0.39	1.3E-07	4.9E-08	17.2	52	975	0.61	6.3E-06	3.8E-06	34.2	1600	3.9E-06	54	3150	85	1.2	86.2	54	32.10404	OVERALL
4000	51	0	0.00	7.9E-06	0.0E+00	34.0	35	0	0.00	3.2E-04	0.0E+00	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0	71	625	0.39	7.9E-08	3.1E-08	14.0	57	975	0.61	2.0E-06	1.2E-06	28.0	1600	1.2E-06	59	4000	84	1	85	59	25.95829	OITC
					100	67					100	74					100	67					100	59					100	65							100		63	37
					OITC	33					OITC	26					OITC	33					OITC	42					OITC	35										

Frederick Douglass Blvd Side

2nd floor retail and offices

	ENTRANCE						STOREFRONT GLASS						NOT USED												NOT USED															
	NOT USED		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit									WALL	Concrete block + 1 layer sheetrock												Total	Effective	Effective	OITC						
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter	YCW 750	Transmission		OITC	Enter	Enter				OITC	Enter	Enter		Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
FLOOR	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
80	21	0	0.00	7.9E-03	0.0E+00	59.5	22	2065.5	0.65	6.3E-03	4.1E-03	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5	30	1134	0.35	1.0E-03	3.5E-04	50.5	30	0	0.00	1.0E-03	0.0E+00	50.5	3199.5	4.4E-03	24	80	103	-22.5	80.5	24	56.96178	
100	25	0	0.00	3.2E-03	0.0E+00	57.9	26	2065.5	0.65	2.5E-03	1.6E-03	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9	29	1134	0.35	1.3E-03	4.5E-04	53.9	33	0	0.00	5.0E-04	0.0E+00	49.9	3199.5	2.1E-03	27	100	102	-19.1	82.9	27	56.05508	
125	29	0	0.00	1.3E-03	0.0E+00	55.9	24	2065.5	0.65	4.0E-03	2.6E-03	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9	31	1134	0.35	7.9E-04	2.8E-04	53.9	30	0	0.00	1.0E-03	0.0E+00	54.9	3199.5	2.9E-03	25	125	101	-16.1	84.9	25	59.45088	
160	28	0	0.00	1.6E-03	0.0E+00	56.6	25	2065.5	0.65	3.2E-03	2.0E-03	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6	36	1134	0.35	2.5E-04	8.9E-05	48.6	30	0	0.00	1.0E-03	0.0E+00	54.6	3199.5	2.1E-03	27	160	98	-13.4	84.6	27	57.88481	
200	30	0	0.00	1.0E-03	0.0E+00	56.1	17	2065.5	0.65	2.0E-02	1.3E-02	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1	42	1134	0.35	6.3E-05	2.2E-05	44.1	31	0	0.00	7.9E-04	0.0E+00	55.1	3199.5	1.3E-02	19	200	97	-10.9	86.1	19	67.20696	
250	33	0	0.00	5.0E-04	0.0E+00	53.4	19	2065.5	0.65	1.3E-02	8.1E-03	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4	46	1134	0.35	2.5E-05	8.9E-06	40.4	27	0	0.00	2.0E-03	0.0E+00	59.4	3199.5	8.1E-03	21	250	95	-8.6	86.4	21	65.50419	
315	33	0	0.00	5.0E-04	0.0E+00	54.4	21	2065.5	0.65	7.9E-03	5.1E-03	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4	53	1134	0.35	5.0E-06	1.8E-06	34.4	33	0	0.00	5.0E-04	0.0E+00	54.4	3199.5	5.1E-03	23	315	94	-6.6	87.4	23	64.50094	
400	34	0	0.00	4.0E-04	0.0E+00	54.2	28	2065.5	0.65	1.6E-03	1.0E-03	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2	54	1134	0.35	4.0E-06	1.4E-06	34.2	33	0	0.00	5.0E-04	0.0E+00	55.2	3199.5	1.0E-03	30	400	93	-4.8	88.2	30	58.30542	
500	36	0	0.00	2.5E-04	0.0E+00	53.8	30	2065.5	0.65	1.0E-03	6.5E-04	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8	57	1134	0.35	2.0E-06	7.1E-07	32.8	37	0	0.00	2.0E-04	0.0E+00	52.8	3199.5	6.5E-04	32	500	93	-3.2	89.8	32	57.90419	
630	37	0	0.00	2.0E-04	0.0E+00	52.1	31	2065.5	0.65	7.9E-04	5.1E-04	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1	58	1134	0.35	1.6E-06	5.6E-07	31.1	39	0	0.00	1.3E-04	0.0E+00	50.1	3199.5	5.1E-04	33	630	91	-1.9	89.1	33	56.20419	
800	37	0	0.00	2.0E-04	0.0E+00	52.2	33	2065.5	0.65	5.0E-04	3.2E-04	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2	61	1134	0.35	7.9E-07	2.8E-07	28.2	40	0	0.00	1.0E-04	0.0E+00	49.2	3199.5	3.2E-04	35	800	90	-0.8	89.2	35	54.30321	
1000	37	0	0.00	2.0E-04	0.0E+00	52.0	35	2065.5	0.65	3.2E-04	2.0E-04	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0	63	1134	0.35	5.0E-07	1.8E-07	26.0	41	0	0.00	7.9E-05	0.0E+00	48.0	3199.5	2.0E-04	37	1000	89	0	89	37	52.10321	
1250	36	0	0.00	2.5E-04	0.0E+00	53.6	35	2065.5	0.65	3.2E-04	2.0E-04	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6	65	1134	0.35	3.2E-07	1.1E-07	24.6	42	0	0.00	6.3E-05	0.0E+00	47.6	3199.5	2.0E-04	37	1250	89	0.6	89.6	37	52.70181	
1600	37	0	0.00	2.0E-04	0.0E+00	52.0	34	2065.5	0.65	4.0E-04	2.6E-04	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0	66	1134	0.35	2.5E-07	8.9E-08	23.0	43	0	0.00	5.0E-05	0.0E+00	46.0	3199.5	2.6E-04	36	1600	88	1	89	36	53.10094	
2000	41	0	0.00	7.9E-05	0.0E+00	48.2	31	2065.5	0.65	7.9E-04	5.1E-04	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2	65	1134	0.35	3.2E-07	1.1E-07	24.2	43	0	0.00	5.0E-05	0.0E+00	46.2	3199.5	5.1E-04	33	2000	88	1.2	89.2	33	56.30038	
2500	45	0	0.00	3.2E-05	0.0E+00	43.3	31	2065.5	0.65	7.9E-04	5.1E-04	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3	66	1134	0.35	2.5E-07	8.9E-08	22.3	46	0	0.00	2.5E-05	0.0E+00	42.3	3199.5	5.1E-04	33	2500	87	1.3	88.3	33	55.40018	
3150	48	0	0.00	1.6E-05	0.0E+00	38.2	33	2065.5	0.65	5.0E-04	3.2E-04	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2	69	1134	0.35	1.3E-07	4.5E-08	17.2	52	0	0.00	6.3E-06	0.0E+00	34.2	3199.5	3.2E-04	35	3150	85	1.2	86.2	35	51.30003	OVERALL
4000	51	0	0.00	7.9E-06	0.0E+00	34.0	35	2065.5	0.65	3.2E-04	2.0E-04	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0	71	1134	0.35	7.9E-08	2.8E-08	14.0	57	0	0.00	2.0E-06	0.0E+00	28.0	3199.5	2.0E-04	37	4000	84	1	85	37	48.10003	OITC
					100	67					100	74					100	67					100	59					100	65							100		72	28
					OITC	33					OITC	26					OITC	33					OITC	42					OITC	35										

125th Street Side

3rd floor retail and offices

	ENTRANCE						STOREFRONT GLASS						NOT USED																											
	NOT USED		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit									WALL	Concrete block + 1 layer sheetrock						Lam. 1/4" glass .030, 1/2" airspace, lam. 1/4" glass .090						Total	Effective	Effective	OITC						
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter	YCW 750	Transmission		OITC	Enter	Enter				OITC	Enter	Enter		Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
FLOOR	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
80	21	0	0.00	7.9E-03	0.0E+00	59.5	22	0	0.00	6.3E-03	0.0E+00	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5	30	990.83	0.38	1.0E-03	3.8E-04	50.5	30	1633.2	0.62	1.0E-03	6.2E-04	50.5	2624.03	1.0E-03	30	80	103	-22.5	80.5	30	50.5	
100	25	0	0.00	3.2E-03	0.0E+00	57.9	26	0	0.00	2.5E-03	0.0E+00	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9	29	990.83	0.38	1.3E-03	4.8E-04	53.9	33	1633.2	0.62	5.0E-04	3.1E-04	49.9	2624.03	7.9E-04	31	100	102	-19.1	82.9	31	51.86145	
125	29	0	0.00	1.3E-03	0.0E+00	55.9	24	0	0.00	4.0E-03	0.0E+00	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9	31	990.83	0.38	7.9E-04	3.0E-04	53.9	30	1633.2	0.62	1.0E-03	6.2E-04	54.9	2624.03	9.2E-04	30	125	101	-16.1	84.9	30	54.5489	
160	28	0	0.00	1.6E-03	0.0E+00	56.6	25	0	0.00	3.2E-03	0.0E+00	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6	36	990.83	0.38	2.5E-04	9.5E-05	48.6	30	1633.2	0.62	1.0E-03	6.2E-04	54.6	2624.03	7.2E-04	31	160	98	-13.4	84.6	31	53.1567	
200	30	0	0.00	1.0E-03	0.0E+00	56.1	17	0	0.00	2.0E-02	0.0E+00	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1	42	990.83	0.38	6.3E-05	2.4E-05	44.1	31	1633.2	0.62	7.9E-04	4.9E-04	55.1	2624.03	5.2E-04	33	200	97	-10.9	86.1	33	53.24511	
250	33	0	0.00	5.0E-04	0.0E+00	53.4	19	0	0.00	1.3E-02	0.0E+00	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4	46	990.83	0.38	2.5E-05	9.5E-06	40.4	27	1633.2	0.62	2.0E-03	1.2E-03	59.4	2624.03	1.3E-03	29	250	95	-8.6	86.4	29	57.37375	
315	33	0	0.00	5.0E-04	0.0E+00	54.4	21	0	0.00	7.9E-03	0.0E+00	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4	53	990.83	0.38	5.0E-06	1.9E-06	34.4	33	1633.2	0.62	5.0E-04	3.1E-04	54.4	2624.03	3.1E-04	35	315	94	-6.6	87.4	35	52.36697	
400	34	0	0.00	4.0E-04	0.0E+00	54.2	28	0	0.00	1.6E-03	0.0E+00	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2	54	990.83	0.38	4.0E-06	1.5E-06	34.2	33	1633.2	0.62	5.0E-04	3.1E-04	55.2	2624.03	3.1E-04	35	400	93	-4.8	88.2	35	53.16158	
500	36	0	0.00	2.5E-04	0.0E+00	53.8	30	0	0.00	1.0E-03	0.0E+00	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8	57	990.83	0.38	2.0E-06	7.5E-07	32.8	37	1633.2	0.62	2.0E-04	1.2E-04	52.8	2624.03	1.2E-04	39	500	93	-3.2	89.8	39	50.76697	
630	37	0	0.00	2.0E-04	0.0E+00	52.1	31	0	0.00	7.9E-04	0.0E+00	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1	58	990.83	0.38	1.6E-06	6.0E-07	31.1	39	1633.2	0.62	1.3E-04	7.8E-05	50.1	2624.03	7.9E-05	41	630	91	-1.9	89.1	41	48.07375	
800	37	0	0.00	2.0E-04	0.0E+00	52.2	33	0	0.00	5.0E-04	0.0E+00	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2	61	990.83	0.38	7.9E-07	3.0E-07	28.2	40	1633.2	0.62	1.0E-04	6.2E-05	49.2	2624.03	6.3E-05	42	800	90	-0.8	89.2	42	47.16158	
1000	37	0	0.00	2.0E-04	0.0E+00	52.0	35	0	0.00	3.2E-04	0.0E+00	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0	63	990.83	0.38	5.0E-07	1.9E-07	26.0	41	1633.2	0.62	7.9E-05	4.9E-05	48.0	2624.03	5.0E-05	43	1000	89	0	89	43	45.9573	
1250	36	0	0.00	2.5E-04	0.0E+00	53.6	35	0	0.00	3.2E-04	0.0E+00	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6	65	990.83	0.38	3.2E-07	1.2E-07	24.6	42	1633.2	0.62	6.3E-05	3.9E-05	47.6	2624.03	3.9E-05	44	1250	89	0.6	89.6	44	45.55389	
1600	37	0	0.00	2.0E-04	0.0E+00	52.0	34	0	0.00	4.0E-04	0.0E+00	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0	66	990.83	0.38	2.5E-07	9.5E-08	23.0	43	1633.2	0.62	5.0E-05	3.1E-05	46.0	2624.03	3.1E-05	45	1600	88	1	89	45	43.95389	
2000	41	0	0.00	7.9E-05	0.0E+00	48.2	31	0	0.00	7.9E-04	0.0E+00	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2	65	990.83	0.38	3.2E-07	1.2E-07	24.2	43	1633.2	0.62	5.0E-05	3.1E-05	46.2	2624.03	3.1E-05	45	2000	88	1.2	89.2	45	44.1573	
2500	45	0	0.00	3.2E-05	0.0E+00	43.3	31	0	0.00	7.9E-04	0.0E+00	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3	66	990.83	0.38	2.5E-07	9.5E-08	22.3	46	1633.2	0.62	2.5E-05	1.6E-05	42.3	2624.03	1.6E-05	48	2500	87	1.3	88.3	48	40.26697	
3150	48	0	0.00	1.6E-05	0.0E+00	38.2	33	0	0.00	5.0E-04	0.0E+00	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2	69	990.83	0.38	1.3E-07	4.8E-08	17.2	52	1633.2	0.62	6.3E-06	3.9E-06	34.2	2624.03	4.0E-06	54	3150	85	1.2	86.2	54	32.19296	OVERALL
4000	51	0	0.00	7.9E-06	0.0E+00	34.0	35	0	0.00	3.2E-04	0.0E+00	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0	71	990.83	0.38	7.9E-08	3.0E-08	14.0	57	1633.2	0.62	2.0E-06	1.2E-06	28.0	2624.03	1.3E-06	59	4000	84	1	85	59	26.04435	OITC
					100	67					100	74					100	67					100	59					100	65							100		64	37
					OITC	33					OITC	26					OITC	33					OITC	42					OITC	35										

Frederick Douglass Blvd Side

3rd floor retail and offices

	ENTRANCE						STOREFRONT GLASS						NOT USED												NOT USED															
	NOT USED		Laminated 1/2" glass				WINDOW	Fixed	750 OG Acoustical Test with Standard Insulated Unit									WALL	Concrete block + 1 layer sheetrock												Total	Effective	Effective	OITC						
	Enter	Enter	1/4"-.030-1/4"			OITC	Enter	Enter	YCW 750	Transmission		OITC	Enter	Enter				OITC	Enter	Enter		Transmission		OITC	Enter	Enter	Area	Transmission		OITC	area	Transmissi	Composite	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
FLOOR	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area			Contribution	Sub-Calc	TL	Area	80 Hz estim	Coefficient	Contribution	Sub-Calc	TL	Area	fraction	Coefficient	Contribution	Sub-Calc		Coefficient	TL	Frequency	Reference	dBA Correc	Co. 2+3	Enter TL	Col. 4-5	
80	21	0	0.00	7.9E-03	0.0E+00	59.5	22	2154.54	0.57	6.3E-03	3.6E-03	58.5	21	0	0.00	7.9E-03	0.0E+00	59.5	30	1614.46	0.43	1.0E-03	4.3E-04	50.5	30	0	0.00	1.0E-03	0.0E+00	50.5	3769	4.0E-03	24	80	103	-22.5	80.5	24	56.55866	
100	25	0	0.00	3.2E-03	0.0E+00	57.9	26	2154.54	0.57	2.5E-03	1.4E-03	56.9	25	0	0.00	3.2E-03	0.0E+00	57.9	29	1614.46	0.43	1.3E-03	5.4E-04	53.9	33	0	0.00	5.0E-04	0.0E+00	49.9	3769	2.0E-03	27	100	102	-19.1	82.9	27	55.85606	
125	29	0	0.00	1.3E-03	0.0E+00	55.9	24	2154.54	0.57	4.0E-03	2.3E-03	60.9	29	0	0.00	1.3E-03	0.0E+00	55.9	31	1614.46	0.43	7.9E-04	3.4E-04	53.9	30	0	0.00	1.0E-03	0.0E+00	54.9	3769	2.6E-03	26	125	101	-16.1	84.9	26	59.07642	
160	28	0	0.00	1.6E-03	0.0E+00	56.6	25	2154.54	0.57	3.2E-03	1.8E-03	59.6	28	0	0.00	1.6E-03	0.0E+00	56.6	36	1614.46	0.43	2.5E-04	1.1E-04	48.6	30	0	0.00	1.0E-03	0.0E+00	54.6	3769	1.9E-03	27	160	98	-13.4	84.6	27	57.42238	
200	30	0	0.00	1.0E-03	0.0E+00	56.1	17	2154.54	0.57	2.0E-02	1.1E-02	69.1	30	0	0.00	1.0E-03	0.0E+00	56.1	42	1614.46	0.43	6.3E-05	2.7E-05	44.1	31	0	0.00	7.9E-04	0.0E+00	55.1	3769	1.1E-02	19	200	97	-10.9	86.1	19	66.68156	
250	33	0	0.00	5.0E-04	0.0E+00	53.4	19	2154.54	0.57	1.3E-02	7.2E-03	67.4	33	0	0.00	5.0E-04	0.0E+00	53.4	46	1614.46	0.43	2.5E-05	1.1E-05	40.4	27	0	0.00	2.0E-03	0.0E+00	59.4	3769	7.2E-03	21	250	95	-8.6	86.4	21	64.97777	
315	33	0	0.00	5.0E-04	0.0E+00	54.4	21	2154.54	0.57	7.9E-03	4.5E-03	66.4	33	0	0.00	5.0E-04	0.0E+00	54.4	53	1614.46	0.43	5.0E-06	2.1E-06	34.4	33	0	0.00	5.0E-04	0.0E+00	54.4	3769	4.5E-03	23	315	94	-6.6	87.4	23	63.97334	
400	34	0	0.00	4.0E-04	0.0E+00	54.2	28	2154.54	0.57	1.6E-03	9.1E-04	60.2	34	0	0.00	4.0E-04	0.0E+00	54.2	54	1614.46	0.43	4.0E-06	1.7E-06	34.2	33	0	0.00	5.0E-04	0.0E+00	55.2	3769	9.1E-04	30	400	93	-4.8	88.2	30	57.77945	
500	36	0	0.00	2.5E-04	0.0E+00	53.8	30	2154.54	0.57	1.0E-03	5.7E-04	59.8	36	0	0.00	2.5E-04	0.0E+00	53.8	57	1614.46	0.43	2.0E-06	8.5E-07	32.8	37	0	0.00	2.0E-04	0.0E+00	52.8	3769	5.7E-04	32	500	93	-3.2	89.8	32	57.37777	
630	37	0	0.00	2.0E-04	0.0E+00	52.1	31	2154.54	0.57	7.9E-04	4.5E-04	58.1	37	0	0.00	2.0E-04	0.0E+00	52.1	58	1614.46	0.43	1.6E-06	6.8E-07	31.1	39	0	0.00	1.3E-04	0.0E+00	50.1	3769	4.5E-04	33	630	91	-1.9	89.1	33	55.67777	
800	37	0	0.00	2.0E-04	0.0E+00	52.2	33	2154.54	0.57	5.0E-04	2.9E-04	56.2	37	0	0.00	2.0E-04	0.0E+00	52.2	61	1614.46	0.43	7.9E-07	3.4E-07	28.2	40	0	0.00	1.0E-04	0.0E+00	49.2	3769	2.9E-04	35	800	90	-0.8	89.2	35	53.77644	
1000	37	0	0.00	2.0E-04	0.0E+00	52.0	35	2154.54	0.57	3.2E-04	1.8E-04	54.0	37	0	0.00	2.0E-04	0.0E+00	52.0	63	1614.46	0.43	5.0E-07	2.1E-07	26.0	41	0	0.00	7.9E-05	0.0E+00	48.0	3769	1.8E-04	37	1000	89	0	89	37	51.57644	
1250	36	0	0.00	2.5E-04	0.0E+00	53.6	35	2154.54	0.57	3.2E-04	1.8E-04	54.6	36	0	0.00	2.5E-04	0.0E+00	53.6	65	1614.46	0.43	3.2E-07	1.4E-07	24.6	42	0	0.00	6.3E-05	0.0E+00	47.6	3769	1.8E-04	37	1250	89	0.6	89.6	37	52.17454	
1600	37	0	0.00	2.0E-04	0.0E+00	52.0	34	2154.54	0.57	4.0E-04	2.3E-04	55.0	37	0	0.00	2.0E-04	0.0E+00	52.0	66	1614.46	0.43	2.5E-07	1.1E-07	23.0	43	0	0.00	5.0E-05	0.0E+00	46.0	3769	2.3E-04	36	1600	88	1	89	36	52.57334	
2000	41	0	0.00	7.9E-05	0.0E+00	48.2	31	2154.54	0.57	7.9E-04	4.5E-04	58.2	41	0	0.00	7.9E-05	0.0E+00	48.2	65	1614.46	0.43	3.2E-07	1.4E-07	24.2	43	0	0.00	5.0E-05	0.0E+00	46.2	3769	4.5E-04	33	2000	88	1.2	89.2	33	55.77258	
2500	45	0	0.00	3.2E-05	0.0E+00	43.3	31	2154.54	0.57	7.9E-04	4.5E-04	57.3	45	0	0.00	3.2E-05	0.0E+00	43.3	66	1614.46	0.43	2.5E-07	1.1E-07	22.3	46	0	0.00	2.5E-05	0.0E+00	42.3	3769	4.5E-04	33	2500	87	1.3	88.3	33	54.87231	
3150	48	0	0.00	1.6E-05	0.0E+00	38.2	33	2154.54	0.57	5.0E-04	2.9E-04	53.2	48	0	0.00	1.6E-05	0.0E+00	38.2	69	1614.46	0.43	1.3E-07	5.4E-08	17.2	52	0	0.00	6.3E-06	0.0E+00	34.2	3769	2.9E-04	35	3150	85	1.2	86.2	35	50.7721	OVERALL
4000	51	0	0.00	7.9E-06	0.0E+00	34.0	35	2154.54	0.57	3.2E-04	1.8E-04	50.0	51	0	0.00	7.9E-06	0.0E+00	34.0	71	1614.46	0.43	7.9E-08	3.4E-08	14.0	57	0	0.00	2.0E-06	0.0E+00	28.0	3769	1.8E-04	37	4000	84	1	85	37	47.5721	OITC
					100	67					100	74					100	67					100	59					100	65							100		72	28

Architectural Testing

AAMA 1801 SOUND TRANSMISSION LOSS
TEST REPORT

Rendered to:

YKK AP AMERICA

SERIES/MODEL: YCW 750 OG

TYPE: Curtain Wall System

Summary of Test Results				
ATI Data File No.	**Glazing (Nominal Dimensions)**	**Air Infiltration**	**STC**	**OITC**
76099.01	1" IG (1/4" annealed exterior, 1/2" air space, 1/4" annealed interior)	0.05 cfm/ft^2	31	26

Reference should be made to ATI Report No. 76099.01-113-11 for complete test specimen description. The complete test results are listed in Appendix B.

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Architectural Testing

ACOUSTICAL PERFORMANCE TEST REPORT

Rendered to:

YKK AP AMERICA
332 Firetower Road
Dublin, Georgia 31021

Report No: 76099.01-113-11
Test Date: 08/31/07
Report Date: 10/16/07
Expiration Date: 08/31/11

Test Sample Identification:

Series/Model: YCW 750 OG

Type: Curtain Wall System

Overall Size: 79" by 78-3/4"

Glazing (Nominal Dimensions): 1" IG (1/4" Annealed Exterior, 1/2" Air Space, 1/4" Annealed Interior)

Project Scope: Architectural Testing, Inc. (ATI) was contracted by YKK AP America to conduct air leakage and sound transmission loss tests on a Series/Model YCW 750 OG, curtain wall system. A summary of the results is listed in the Test Results section and the complete test data is included as Appendix B of this report. The sample was provided by the client.

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Test Methods: The acoustical test was conducted in accordance with the following:

AAMA 1801-07, *Acoustical Rating of Windows, Doors, and Glazed Wall Sections.*

ASTM E 1425-91 (Re-approved 1999), *Standard Practice for Determining the Acoustical Performance of Exterior Windows and Doors.*

ASTM E 90-04, *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.*

ASTM E 413-04, *Classification for Rating Sound Insulation.*

ASTM E 1332-90 (Re-approved 2003), *Standard Classification for Determination of Outdoor-Indoor Transmission Class.*

ASTM E 283-04, *Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.*

ASTM E 2235-04, *Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods.*

Test Equipment: The equipment used to conduct this test meets the requirements of ASTM E 90. The microphones were calibrated before conducting the sound transmission loss test. The test equipment and test chamber descriptions are listed in Appendix A.

Sample Installation:

Sound transmission loss tests were initially performed on a filler wall that was designed to test 40" by 86" and 80" by 86" specimens. The filler wall achieved an STC rating of 63.

The 80" by 84" plug was removed from the filler wall assembly. A wood frame was used to reduce the size of the opening to 79-1/4" by 79-1/4". The curtain wall system was placed on a foam isolation pad in the test opening. Duct seal was used to seal the perimeter of the test specimen to the test opening on both sides. The interior side of the curtain wall frame, when installed, was approximately 1/4" from being flush with the receiving room side of the filler wall. A stethoscope was used to check for any abnormal air leaks around the test specimen prior to testing.

Test Procedure:

Air Leakage Test - A negative pressure of 6.24 psf was applied inside the chamber that was placed around the interior side of the curtain wall system. The total air leakage and extraneous air leakage measurements were used to calculate the specimen air leakage. Barometric pressure corrections were applied to the air leakage calculations.

Sound Transmission Loss Test - The sound transmission loss test consisted of the following measurements: one background noise sound pressure level and five sound absorption measurements were conducted at each of the five microphone positions. Two sound pressure level measurements were made simultaneously in both rooms at each of the five microphone positions. The air temperature and relative humidity conditions were monitored and recorded during the background, absorption, source, and receive room measurements.

Sample Descriptions:

Frame Construction:

	Frame
Size	79" by 78-3/4"
Thickness	7-1/2"
Corners	Butted
Fasteners	Screws
Seal Method	Sealant
Material	Thermally improved aluminum
Thermal improvement method	Wood and EPDM gasket
Reinforcement	N/A
Daylight Opening Size (X2)	35-5/8" by 73-3/4"

Sample Descriptions: (Continued)

Glazing:

Measured Overall Insulation Glass Unit Thickness	0.972"
Spacer Type	Aluminum

	Exterior Sheet	Gap	Interior Sheet
Measured Thickness	0.221"	0.530"	0.221"
Muntin Pattern	N/A	N/A	N/A
Material	Annealed	Air*	Annealed
Laminate Material	N/A	N/A	N/A

Glazing Method	Exterior pressure glazed
Glazing Material	Flexible wedge gasket
Glazing Bead Material	Aluminum pressure plates

Components:

TYPE	QUANTITY	LOCATION
Weatherstrip		
No weatherstrip		
Hardware		
No hardware		
Drainage		
No drainage		

* - *Stated per Client/Manufacturer, N/A-Non Applicable*

Comments: The weight of the test sample was 341 lbs. The design drawings (included in Appendix C) supplied by the client, accurately describe the Series/Model YCW 750 OG, curtain wall system. The dimensions on the drawings that are circled and/or checked were verified against the test specimen. The curtain wall system was disassembled, and the components will be retained by ATI for four years.

Test Results: The STC (Sound Transmission Class) rating was calculated in accordance with ASTM E 413. The OITC (Outdoor-Indoor Transmission Class) was calculated in accordance with ASTM E 1332. A summary of the sound transmission loss test results on the Series/Model YCW 750 OG curtain wall system is listed below.

Summary of Test Results				
ATI Data File No.	**Glazing (Nominal Dimensions)**	**Air Infiltration**	**STC**	**OITC**
76099.01	1" IG (1/4" annealed exterior, 1/2" air space, 1/4" annealed interior)	0.05 cfm/ft^2	31	26

The complete test results are listed in Appendix B. Flanking limit tests and reference specimen tests are available upon request.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire. Results obtained are tested values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC:

Brandon C Ward
Digitally Signed by: Brandon C. Ward

Brandon C. Ward
Technician - Acoustical Testing

Todd D. Kister
Digitally Signed by: Todd D. Kister

Todd D. Kister
Laboratory Supervisor - Acoustical Testing

BCW:crc

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Equipment description (1)
Appendix-B: Complete test results (3)
Appendix-C: Drawings (1)

NVLAP® NVLAP LAB CODE 200361	Architectural Testing, Inc is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program for the specific test methods listed under lab code 200361. The laboratory's accreditation or test report in no way constitutes or implies product certification, approval, or endorsement by NIST. This test report applies only to the specimen that was tested.

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	10/16/07	N/A	Original test report

Architectural Testing

Appendix A

Instrumentation:

Instrument	Manufacturer	Model	Description	ATI Number
Analyzer	Agilent Technologies	35670A	Dynamic signal analyzer	Y002929
Receive Room Microphone	G.R.A.S.	40AR	1/2", pressure type, condenser microphone	Y003246
Source Room Microphone	G.R.A.S.	40AR	1/2", pressure type, condenser microphone	Y003245
Receive Room Preamp	G.R.A.S.	26AK	1/2" preamplifier	Y003249
Source Room Preamp	G.R.A.S.	26AK	1/2" preamplifier	Y003248
Microphone Calibrator	Bruel & Kjaer	4228	Pistonphone calibrator	Y002816
Noise Source	Delta Electronics	SNG-1	Two, non-coherelated "Pink" noise signals	Y002181
Equalizer	Rane	RPE228	Programmable EQ	Y002180
Power Amplifiers	Renkus-Heinz	P2000	2 - Amplifiers	Y002179 Y001779
Receive Room Loudspeakers	Renkus-Heinz	Trap Jr/9"	2 - Loudspeakers	Y001784 Y001785
Source Room Loudspeakers	Renkus-Heinz	Trap Jr/9"	2 - Loudspeakers	Y002649 Y002650

Test Chamber:

	Volume	Description
Receiving Room	8291.3 ft^3 (234 m^3)	Rotating vane and stationary diffusers. Temperature and humidity controlled. Isolation pads under the floor.
Source Room	7296.3 ft^3 (206.6 m^3)	Stationary diffusers only. Temperature and humidity controlled.

	Maximum Size	Description
TL Test Opening	14 ft wide by 10 ft high	Vibration break between source and receive rooms.

Architectural Testing

76099.01-113-11

Appendix B

Complete Test Results

SOUND TRANSMISSION LOSS

ASTM E90

Architectural Testing

ATI No.	76099.01	**Date**	09/05/07
Client	YKK AP America		
Specimen	Series/Model YCW 750 OG curtain wall system with 1" IG (1/4" annealed, 1/2" air space, 1/4" annealed)		
Specimen Area	43.20 Sq Ft		
Filler Area	96.80 Sq Ft		
Operator	Brandon C. Ward		

	Bkgrd	Absorp	Source	Receive	Filler	Specimen
Temp F	72.3	73.9	71.9	72.8	73.8	72.7
RH %	40.3	38.1	45.0	39.6	62.0	40.7

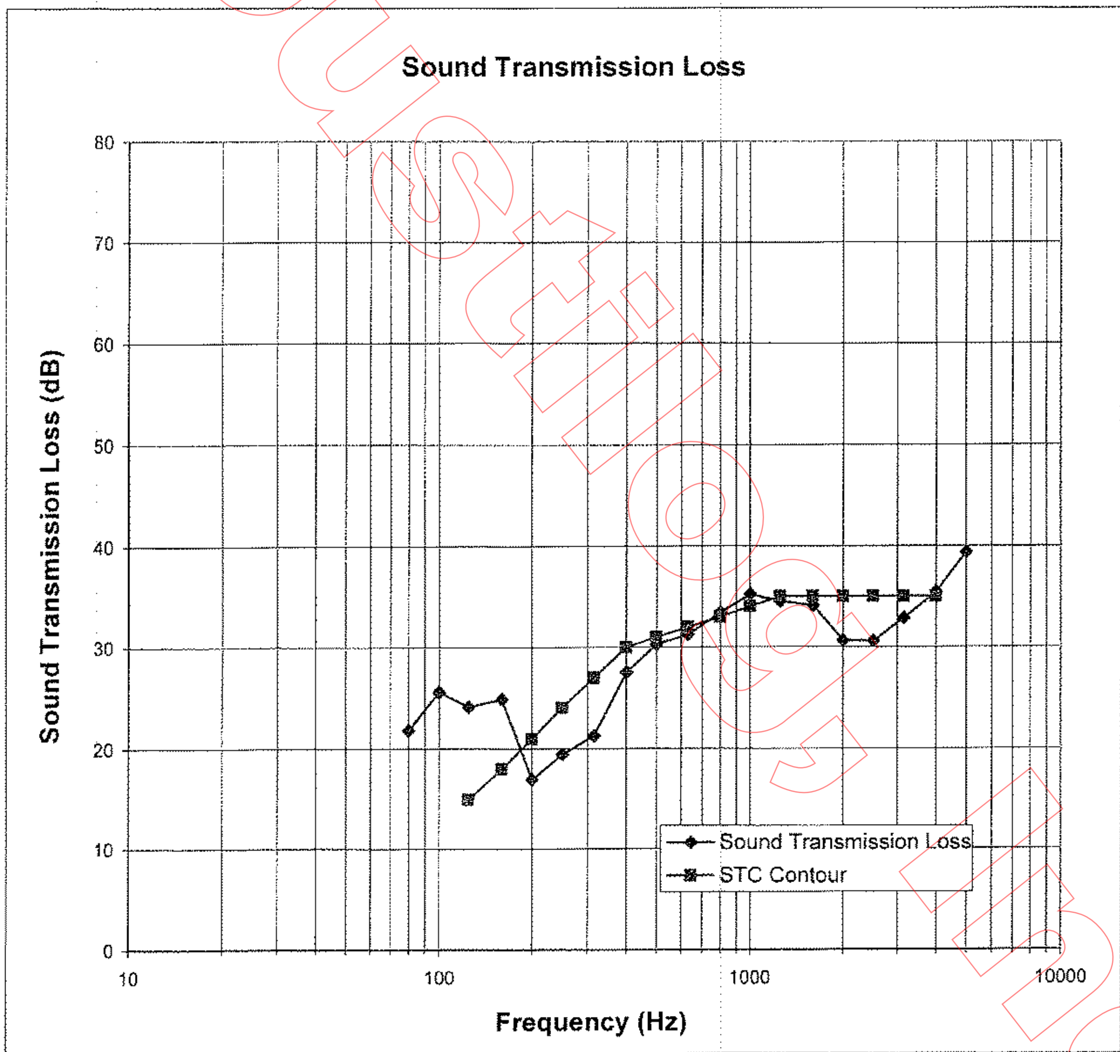
Freq (Hz)	Bkgrd SPL (dB)	Absorp (Sabines /Sq Ft)	Source SPL (dB)	Receive SPL (dB)	Filler TL (dB)	Specimen TL (dB)	95% Conf Limit	No. of Defici-encies	Trans Coef Diff
80	43.4	51.6	84.2	62.5	31.9	22	5.44	0	7.4
100	40.9	53.7	86.7	61.0	35.8	26	4.97	0	7.5
125	43.3	50.2	92.1	67.3	43.1	24	2.82	0	15.5
160	47.3	55.9	94.1	68.1	46.3	25	1.11	0	17.9
200	46.6	55.6	99.7	81.6	51.3	17	1.04	4	30.9
250	39.6	59.5	100.5	79.6	51.5	19	2.14	5	28.5
315	38.7	61.9	98.3	75.5	56.6	21	0.80	6	31.8
400	38.9	62.8	97.9	68.8	60.0	28	0.45	2	29.0
500	37.0	60.8	100.2	68.4	59.0	30	0.71	1	25.2
630	31.2	63.2	102.7	69.8	63.1	31	0.30	1	28.4
800	30.8	63.5	102.0	66.9	65.0	33	0.27	0	28.1
1000	29.4	62.6	101.6	64.8	66.7	35	0.72	0	28.0
1250	28.9	66.8	105.2	68.8	73.8	35	0.42	0	35.8
1600	23.5	73.0	111.6	75.2	75.9	34	0.31	1	38.3
2000	18.1	78.5	107.2	73.9	75.7	31	0.38	4	41.5
2500	10.9	92.3	105.7	71.8	75.4	31	0.29	4	41.3
3150	9.5	110.2	106.6	69.7	76.9	33	0.39	2	40.6
4000	7.8	140.4	105.5	65.0	78.6	35	0.48	0	39.6
5000	7.4	184.6	103.6	57.9	80.5	39	0.34	0	37.6

STC Rating = **31** *(Sound Transmission Class)*
Deficiencies = **30** *(Number of deficiencies versus contour curve)*
OITC Rating = **26** *(Outdoor/Indoor Transmission Class)*

Note: *The acoustical chambers are qualified for measurements down to 80 hertz. Data reported below 80 hertz is for reference only.*

Architectural Testing

ATI No.	76099.01	**Date**	09/05/07
Client	YKK AP America		
Specimen	Series/Model YCW 750 OG curtain wall system with 1" IG (1/4" annealed, 1/2" air space, 1/4" annealed)		
Specimen Area	43.20 Sq Ft		
Filler Area	96.80 Sq Ft		
Operator	Brandon C. Ward		



NVLAP LAB CODE 200361

Architectural Testing, Inc is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program for the specific test methods listed under lab code 200361. The laboratory's accreditation or test report in no way constitutes or implies product certification, approval, or endorsement by NIST. This test report applies only to the specimen that was tested.

AAMA 1801 Data Sheet

Architectural Testing

ATI Job Number :	76099.01
Client Name :	YKK AP America
Test Date :	9/3/2007
Tests Performed by:	BCW
Specimen Type :	Curtain wall mock up
Series/Model Number :	YCW 750 OG
Sample Size :	79" by 78-3/4"

Air Leakage per ASTM test method ASTM E283

Total Air flow (ft^3/min) : 28.0
Extraneous Leakage (ft3/min) : 26
Temperature (^{o}F) at Specimen: 72
Barometric Pressure at Specimen (in mbar): 1017 (Inches of Hg) : 30.03
Specimen Area in square feet : 43.20
Density of air at reference standard conditions (lb/ft^3) 0.075

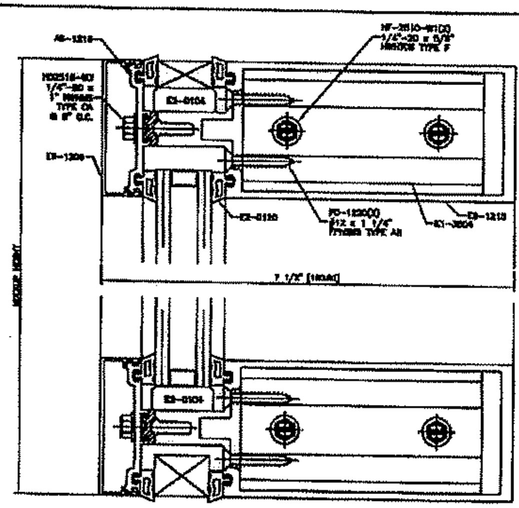
Total air flow w/ air density correction (ft3/min)	Extraneous leakage with air density correction (ft3/min)	Air leakage through the specimen with air density correction (ft3/min)	Rate of air leakage per unit area (ft3/min)/sq.ft.
27.973	25.975	1.998	0.05

Architectural Testing

76099.01-113-11

Appendix C

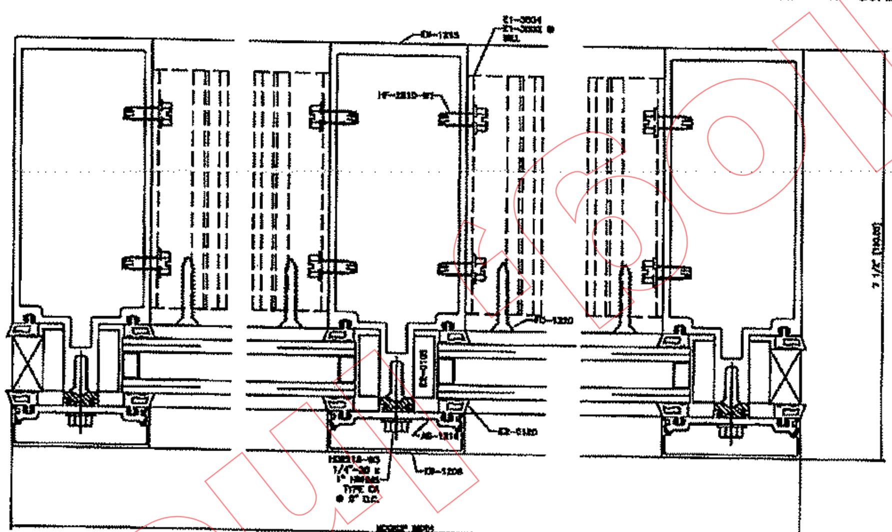
Design Drawings



DETAIL 1

DETAIL 2

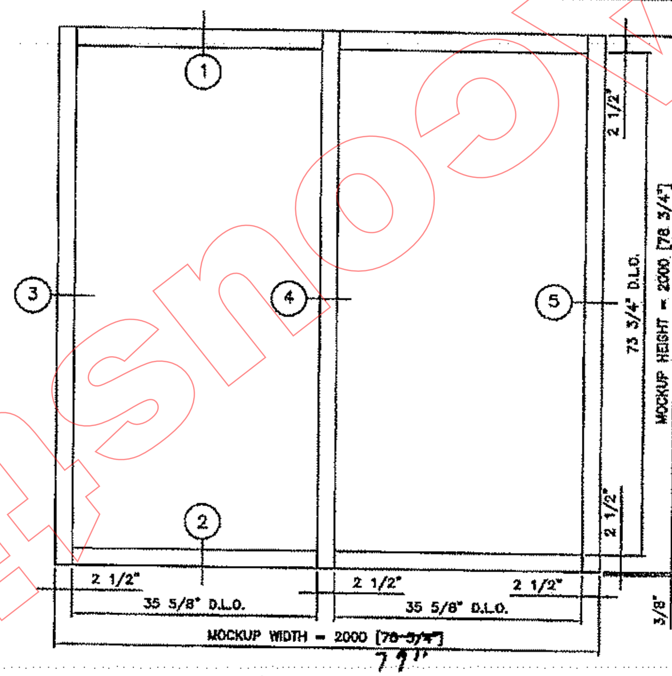
ALL DETAILS: HALF SCALE



DETAIL 3

DETAIL 4

DETAIL 5



ELEVATION: 3/4" = 1"

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 76099.01-113-11

Date 10-15-07 Tech BCW

TEST MOCKUP FOR AAMA 1503-98

GLASS SIZE: (2) 36 5/8" X 74 3/4"

GLASS TYPE: 1" (1/4" clr ann, 1/2" air, 1/4" clr ann)

Ti-AC40 3rd Surface

YKK AP

YKK AP AMERICA INC.

DESCRIPTION: THERMAL ELEVATION/DETAILS

SYSTEM: YCW 750 OG

DATE: 04/02/07

Architectual Technical Applications Center
Advanced Interlayers

Laminated Glass with Saflex® interlayer

Acoustical Performance Data

The configuration detailed in this test report is a Dbl. Lam IGU glazing.

Configuration:

Metric (mm):	3.0-0.76 Saflex®-3.0[12.7 AS]3.0-2.29 Saflex®-3.0
US Standard units (inch)	1/8-0.030 Saflex®-1/8[1/2 AS]1/8-0.090 Saflex®-1/8

Interlayer:

Saflex® interlayer by Solutia Inc.

The following details are specific to the identified configuration:

Test Number: RAL: TL96-358

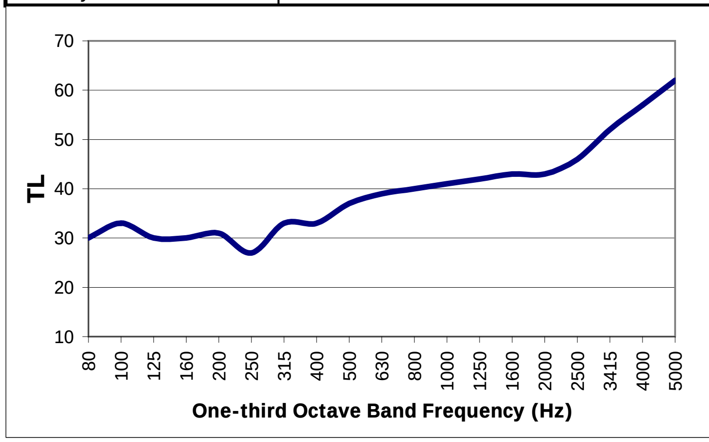
Single Number Ratings:

STC*	40	**STC Deficiencies** 28
OITC*	35	
Rw*	40	
RA	-1	**dBA Reduction**
RA, Tr	-4	**DR_3**
C	39	199
CTr	36	

Characteristics	**SI**	**US Std.**
Test Number:	RAL: TL96-358	
Test Standard:	ASTM E90-90; E413-87	
Test Date:	17-Dec-96	
Glazing Type:	Dbl. Lam IGU	
Panel Size:	914.4 x 2133.6 mm	35.75 x 83.75 inches
Unit Area:	1.66 mm2	18 ft2
Aspect Ratio:	2.34	
Unit Weight:	34 kg/sqm	7 lbs/sqft
Unit Thickness:	25.4 mm	1.12 inches
Spacer Type:	AL	
Insulating Unit:	Sealed	
Temperature at Test:	20 °C	68 °F
Humidity at Test:	60%	

Sound Transmission Loss Data

Frequency	**TL Data**
80	30
100	33
125	30
160	30
200	31
250	27
315	33
400	33
500	37
630	39
800	40
1000	41
1250	42
1600	43
2000	43
2500	46
3415	52
4000	57
5000	62



* typical test deviation ± 1 unit.

Acoustical Testing Performed on Glass only at: Riverbank Acoustical Testing Laboratory, Geneva, Illinois, USA

This configuration incorporates Saflex Q series interlayer - a high performance acoustical interlayer for laminated glass.

JCS40672V1

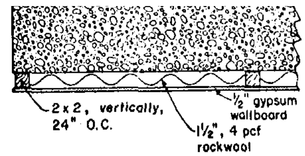
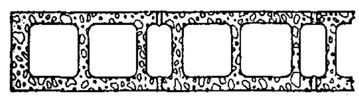
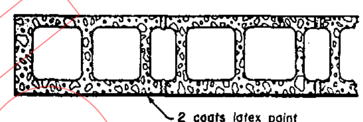
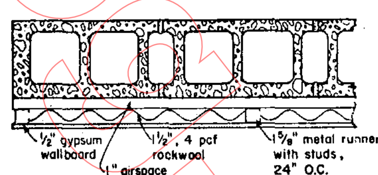
730 Worcester Street, Springfield, MA 01151
413.730.3413 (T)
508.861.0127 (F)

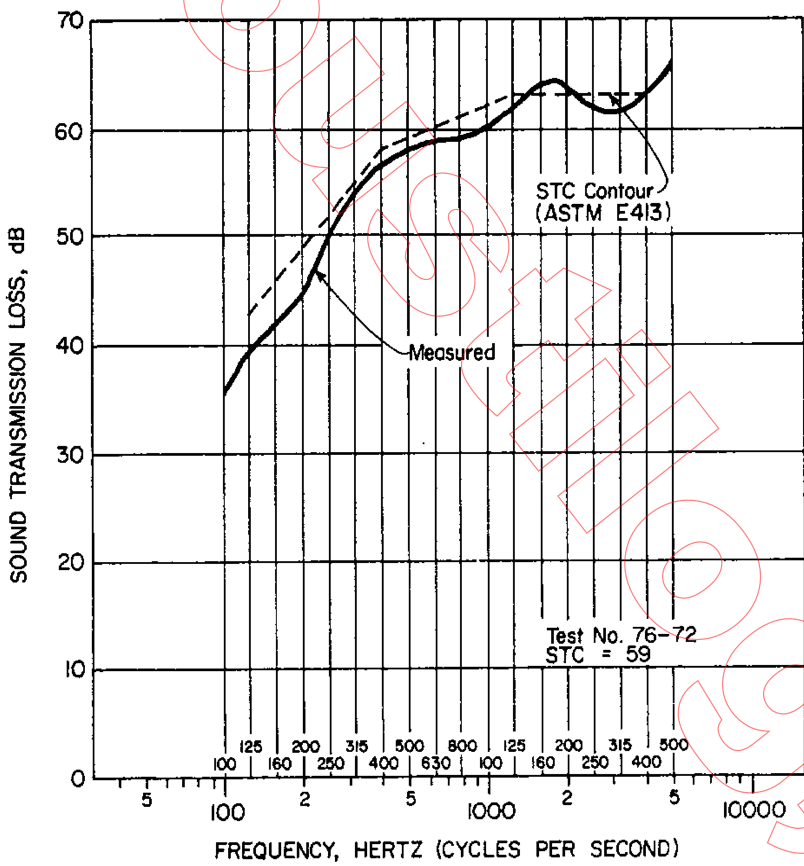
d Glass

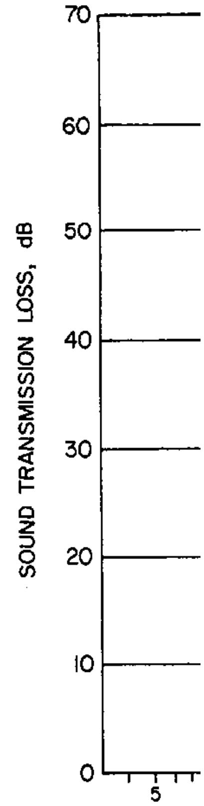
Laminated Glass: Sound Transmission Loss Data(1)

1/3 Octaveband (HZ)	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	STC	OITC	Rw
1/4" RAL-TL85-169	23	25	25	24	28	26	29	31	33	34	34	35	34	30	27	32	37	41	31	29	32
1/2" RAL-TL85-198	26	30	26	30	33	33	34	36	37	35	32	32	36	40	43	46	50	51	36	33	37
Lami-0.030"-Lami RAL-TL85-218	24	26	27	27	28	29	30	32	34	35	36	36	36	35	35	39	43	46	35	31	35
1/8"-0.030"-1/8' RAL-TL85-170	25	26	28	27	29	29	30	32	34	35	35	36	36	35	35	38	43	46	35	31	35
1/8"-0.060"-1/8' RAL-TL85-224	25	26	27	28	28	29	30	33	34	35	36	37	37	37	36	38	42	46	35	32	35
1/8"-0.045"-1/8' RAL-TL85-234	24	27	27	28	28	29	30	32	34	35	36	36	37	36	35	38	43	46	35	31	35
3/16"-0.030"-3/16' RAL-TL85-200	27	27	27	30	31	31	33	34	35	36	36	35	34	37	41	45	49	52	36	33	36
1/4"-0.030"-1/8' RAL-TL85-229	27	27	28	31	30	31	32	34	35	36	36	36	35	36	40	44	48	52	36	33	36
1/4"-0.060"-1/8' RAL-TL85-223	27	28	27	30	31	31	33	35	36	37	37	37	36	37	41	44	48	51	37	33	37
1/4"-0.030"-1/4" RAL-TL85-225	25	29	28	30	33	33	34	36	37	37	37	36	37	41	45	48	51	53	38	34	38
1/4"-0.045"-1/4' RAL-TL85-232	26	30	27	30	33	33	34	36	37	38	37	36	37	41	45	48	51	54	38	34	38
1/4"-0.060"-1/4' RAL-TL85-228	26	29	28	30	33	33	35	36	37	38	38	37	38	41	44	47	51	54	39	34	39
3/8"-0.030"-1/4' RAL-TL85-222	29	30	28	32	34	35	36	38	38	38	36	38	42	46	49	52	55	57	40	36	40
1/2"-0.060"-1/4" RAL-TL85-230	29	30	29	32	35	35	37	38	38	38	37	41	44	48	50	53	56	56	41	36	41

DOORS

76-99	Plain	2 x 2 in. wood furring plus 1½ in. 4 pcf rock-wool plus ½ in. gypsum board		97.2	63
8 in. lightweight concrete block walls				32.0	44
76-75	Plain	Plain			
76-76	Plain	2 coats acrylic latex paint		32.0	48
76-72	Plain	1 in. air space plus 1⅝ in. metal runner with studs with 1½ in. 4 pcf rock-wool plus ½ in. gypsum board		35.0	59


SOUND TRANSMISSION LOSS, dB
70
60
50
40
30
20
10
0
STC Contour
(ASTM E413)
Measured
Test No. 76-72
STC = 59
100 125 160 200 250 315 400 500 630 800 100 125 160 200 250 315 400 500
5
100
2
5
1000
2
5
10000
FREQUENCY, HERTZ (CYCLES PER SECOND)


SOUND TRANSMISSION LOSS, dB
70
60
50
40
30
20
10
0
5

Addendum 7

Certified Vapor Barrier and Active Sub-Slab Depressurization System (SSDS) Design

Hydro Tech Environmental, Corp.

Main Office
77 Arkay Drive, Suite G
Hauppauge, New York 11788
T (631) 462-5866 • F (631) 462-5877

NYC Office
15 Ocean Avenue, 2nd Floor
Brooklyn, New York 11225
T (718) 636-0800 • F (718) 636-0900

WWW.HYDROTECHENVIRONMENTAL.COM

VAPOR BARRIER AND ACTIVE DEPRESSURIZATION SYSTEM DESIGN SPECIFICATIONS

PROJECT SITE:

2329 Frederick Douglas Boulevard
Block 1952, Lot 29
New York, New York

OER Project #11EHAN220M
NYC BCP #12CBCP020M

Prepared For: 301-303 West 125th Street, LLC.
400 West 14th Street, 3rd Floor
New York, NY 10014

Prepared By: Hydro Tech Environmental, Corp.
15 Ocean Avenue, 2nd Floor
Brooklyn, New York 11225

August 24, 2011

VAPOR BARRIER AND ACTIVE DEPRESSURIZATION SYSTEM DESIGN SPECIFICATIONS

2329 Frederick Douglas Boulevard
Block 1952, Lot 29
New York, New York

OER Project #11EHAN220M
NYC BCP #12CBCP020M

August 24, 2011

Hydro Tech Environmental, Corp. appreciates the opportunity to work for 301-303 West 125th Street, LLC. at the property located at 2329 Frederick Douglas Boulevard (Block 1952, Lot 29) in Manhattan, New York.

Should you require any additional information or have any comments regarding the contents of this report, please feel free to contact our office at your convenience.

Very Truly Yours,
Hydro Tech Environmental, Corp.

Paul I. Matli

X____________________________
Paul I. Matli
Senior Project Manager

X____________________________
Rachel Ataman
V.P. Technical Operations

X____________________________
Mark E. Robbins, C.P.G., C.E.I.
Senior Vice President

X____________________________
Shaik A. Saad, P.E.
Professional Engineer

TABLE OF CONTENTS

Page Number

Figures

Attachments

1.0 EXECUTIVE SUMMARY

The Vapor Barrier and active Sub-Slab Depressurization System Design Specifications have been prepared by Hydro Tech Environmental, Corp. (Hydro Tech) as a part of the Remedial Action Work Plan (RAWP) for the property located at 2329 Frederick Douglas Boulevard (Block 1952, Lots 29), Manhattan, New York. These systems have been designed to mitigate potential soil intrusions of organic and chlorinated vapors and semi-organic compounds present beneath the Site. The Site has been assigned a New York City Mayor's Office of Environmental Remediation (OER) case **#11EHAN220M** a New York City Brownfield Cleanup Program ID # **12CBCP020M.**

The proposed development plan at this property includes the development of a 3-story commercial building with a single level cellar. The building will be developed throughout the entire property. The northwest corner of the site will be excavated to a depth of 4 feet and within this portion the building will be built with a slab on grade. The proposed building slab will be approximately 6 inches in thickness. The bottom of cellar slab will be approximately 16 feet below grade. The depth to water beneath the Site is approximately 21 feet 6 inches. In order to prevent subsurface vapors from impacting the interior air of the buildings at the Site, a vapor barrier system consisting of a 30-mil High Density Polyethylene (HDPE) Geomembrane and an active sub-slab depressurization system will be installed beneath the cellar slab/foundations of the building. The vapor barrier will be extended up to grade level by attaching it to the outside of the foundation walls utilizing 4000 Bithutene membrane.

These systems will be installed under the direct oversight of a Hydro Tech Environmental, Corp. (Hydro Tech) Engineer. Following the completion of all site construction, Hydro Tech will prepare a Remedial Closure Report for submittal to the New York Office Mayor Office of Environmental Remediation (OER) under separate cover. This Closure Report will provide documentation of all aspects of the project above and will be signed/stamped by a NYS-licensed Professional Engineer.

2.0 INTRODUCTION

The Vapor Barrier (VB) system and active Sub-Slab Depressurization System (SSDS) will be installed in accordance with the manufacturer's specifications in order to sustain long-term exposure to organic and chlorinated vapors and semi-organic compounds present beneath the property situated at 2329 Frederick Douglas Boulevard (Block 1952; Lot 29), Manhattan, New York.

These written specifications and accompanying engineering plans for the proposed VB and active SSDS complement and supplement each other. Therefore, the Contractor shall review both of them for sizing their proper installation.

These specifications consist of the following Sections:

1. Important Note for Site Work – discusses safety issues that are specific to this Site.
2. Standards – lists applicable standards for vapor barrier system construction.
3. System Description – provides a brief overview of the vapor barrier system.

2.1 Important Notes for Site Work

Open flames and smoking are prohibited in the work area.

During construction of the proposed VB and active SSDS system, the Contractor shall take all protective measures to ensure the health and safety of all site personnel from potential exposure to organic and chlorinated vapors. Care should be taken to eliminate exposure to metal and semi-volatile compounds detected in the soil.

2.2 Standards

The American Society for Testing and Materials (ASTM) Standard D2321-89 (re-approved 1995), "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications," is included here by reference. Unless otherwise stated below, the Contractor shall follow ASTM Standard D2321 during trenching, backfilling and piping construction. This specification is only needed in areas requiring trenching work.

In addition to the above standards, the Contractor shall follow all applicable Federal, State and Local codes, regulations and ordinances pertaining to construction and safety.

The Contractor shall consult with and follow the Engineer's instructions in case any conflicts between these plans and specifications and any of the above standards may arise.

3.0 VAPOR MITIGATION EFFORTS

1. Based on the information provided by the Client, the proposed remedial construction activities at the Site include the construction of 3-story, 19,983 square foot, commercial building with a cellar. The cellar will also consist of a commercial space and will be developed over 17,858 square foot of the property. The northwest corner of the property will not contain a cellar but will be excavated to a depth 4 feet for the layout of a building slab on grade. The building slab will be approximately 6 inches in thickness and the bottom of the cellar slab will be approximately 16 feet below grade. At localized locations column footings will be installed to depth ranging from 18 feet 6 inches to 20 feet below grade and elevator and escalator pits will be installed to approximately 21 feet below grade. **Figure 1** provides a Site excavation plan.

2. The VB designed beneath the cellar slab/foundation will consist of a 30-mil GSE High Density Polyethylene (HDPE) Geomembrane and Grace 4000 Bithutene membrane around the foundation walls. The VB designs are depicted in the attached drawings and described in these written specifications. The VB has been designed specifically based on a specific modular concept for the proposed building footprints, cellar and foundation walls. The concept of VB design may be easily extended to other different-sized footprints; however, the Design Engineer’s prior approval must be obtained in such cases.

3. The active SSDS prevents elevated soil gas levels inside buildings by creating a negative pressure zone beneath the slab. To create this negative pressure zone, a sub-slab perforated pipe is installed in aggregate under the slab. The sub-slab network of pipes is then connected to four suction fans mounted on the roof of the building and connected to four stack vents that exhaust air from beneath the slab to the outdoors.

4.0 DESIGN AND CONSTRUCTION PROCEDURES OF THE VAPOR BARRIER AND SSDS SYSTEMS

4.1 Installation of Vapor Barrier System

The essential guidelines for designing and installing the vapor barrier system are listed below:

- A 30-mil GSE HDPE Geomembrane will be installed underneath the building slab and footings of foundation walls. The membrane will then be attached to Grace 4000 Bithutene membrane, which will be installed on the outside of foundation walls and extended up linearly to grade as per manufacturer's specifications.

- The HDPE Geomembrane is to be pitched upward from the center of the building towards its perimeter at a rate of approximately 1/2" per foot in length direction and 1/4" per foot in width direction to ensure that the membrane will not be inadvertently pitched downward during construction thus ensuring that there will be no pockets of trapped gases under the membrane, and also to provide an additional buoyant pathway for the gases to travel away from the center towards the building perimeter.

- The HDPE membrane will be protected by a geo-textile non-woven fabric (8 oz./sq. yd.) on both sides to prevent tears, and the entire assembly is additionally protected by minimum 4"-thick layers of fine Mason Sand on both sides.

- The HDPE membrane shall be continuous in order to be effective. The membrane shall completely cover the entire building area. Any joints/seams, both lateral and butt should be overlapped 6" and sealed properly in accordance to manufacturer's spec sheets.

- When installing the HDPE Geomembrane, sufficient slack shall be provided in the membrane on all sides when it is underneath the proposed slab so that it will yield at least 2" without tearing if and when any settlement of the slab occurs. Contractor shall follow manufacturer's instructions for proper installation.

- Extreme care shall be taken to ensure that all punctures, penetrations or tears in the material shall be sealed and covered with liquid bituthene as necessary prior to pouring concrete.

- Bithutene 4000 membrane will be protected on the outer side by Hydroduct 200 drainage composite product or plywood to prevent any potential tears or punctures.

4.2 Installation of Active Sub-Slab Depressurization System

In order to create a negative pressure zone beneath the slab, a 4"-dia., Sch. 80 Polyvinyl Chloride (PVC) perforated pipe will be installed throughout the perimeter of the building area and laterally beneath the entire cellar area, as shown in the plans. The perforated piping will collect vapors deflected by the membrane traveling from the center to the perimeter and collect vapors traveling towards the building from the periphery. The essential guidelines for installing the SSDS are listed below:

- The perforated pipe will have the following specifications:

  - Rectangular slots will be located throughout the pipe to serve as perforations.
  - Slots shall be in four (4) rows, oriented along the pipe circumference, with a 0.125" slot width, a 0.25" on center separation between adjacent slots, a 90-degree separation to centers of the two rows, and shall have 48 sq. in. of open

area per foot of pipe. The angle of separation between the two rows may vary from the above specifications, provided all other specifications are met.

- Appropriately sized fittings (tees, elbows, etc.) will be used as required for installing the pipe. Follow ASTM D2321 and manufacturers' instructions for pipe installation, joint sealing and other installation tasks.

o The underground perforated vent pipes should be embedded in high permeability gravel and protected by a geotextile non-woven liner (8 oz./sq. yd) in order to prevent it from becoming clogged by migrating fine sand particles.

o The underground perforated piping network under the slab is then connected to four (4) non-perforated, 4"-dia., pipes attached to the exterior walls of the building. Each of these 4 pipes will then be connected to outdoor Radon Away G-501 model fans capable of a suction pressure of 4 inches of H_2O. The fan will also be connected to an individual outdoor exhaust stack extending 4 feet above the roof of the building. The fan will create a negative pressure in the sub-slab environment beneath the building. Based on manufacturer specification, this type of fan can provide coverage up to 2,000 square feet in applications where sub-slab material is compact and communication is poor. At a static suction of 4 inches of H_2O, this fan can generate a flow of less than 5 cubic feet per minute (CFM). With a proposed discharge stack of at least 4 feet above the roof top with a maximum flow rate of less 5 CFM, no pollution control will be required for the SSD systems.

o Starting at the floor slab, any openings between the vent pipe and the floor slab should be sealed with a high adhesive sealant like polyurethane. All piping joints shall be sealed. The visible vent pipes shall be labeled as "soil gas vent" and the labels made visible for occupants.

o The fans will be mounted on the roof of the building and will be operated via a hand-off-auto switch located on the main control panels. The fans will also be interlocked to individual alarm systems to prevent systems malfunctioning in the event of mechanical or electrical failure.

Figure 2 provides Plan & Elevation. **Figure 3** provides Section Details. **Appendix 1** provides specifications sheets of Geomembrane, geo-textile fabric and liquid Bithutene. **Attachment 2** provides the Radon Away G-501 Specifications.

4.3 Interaction with Underground Conduits

Examples of utility penetrations through the building slab include water and sewer lines, utility lines to unit ventilators and radiators, electrical service entries, sub-slab conduits, air conditioner condensate drains and roof drains. The openings around these slab penetrations shall be sealed with polyurethane caulk. All unpressurized water and wastewater lines connected to the buildings shall be equipped with house traps (P-traps) to prevent the migration of gases through them into the building. These lines shall be equipped with vents on the outside of the building, such that the P-traps are located between these vents and the building to which they are connected. These measures are not needed for city water supply lines.

4.4 Other Considerations

1. If any trench construction or excavation is involved in the construction of the VB and SSDS, follow trench excavation instructions in ASTM D2321 and other applicable codes, regulations, and standards, including instructions for trench support and sloping as needed. Trench locations shall be clearly separated from the rest of the property with temporary fences, and access to the trench(s) shall be limited to only the workers and related equipment and shall be denied to all others. Construction shall be scheduled such that at the end of each day of work, all trench excavations during that day are

backfilled and consolidated, such that the possibility of any human, animal, or equipment falling into the trench(s) or sinking into a loosely backfilled trench is eliminated. The safety practices of the Contractor shall not be limited to those described or specified above; the Contractor shall also take all safety measures and precautions that are necessary for this project depending on project specific conditions. The Contractor is responsible for ensuring the safety of workers, as well as all other people, animals or equipment on Site during all construction activities related to this project, including trench construction.

2. All soil material used as backfill ("fill") will be imported from an approved facility/source. Hydro Tech will collect one (1) sample of the fill material for every 250 cubic yards of material. Each sample will be analyzed for Target Compound List (TCL) VOCs, SVOCs, Pesticides/PCBs and Target Analyte List Metals by an ELAP-certified laboratory. The analytical results will then be compared to Soil Cleanup Objectives (SCOs) as specified in 6 NYCRR Subpart 375 Section 6. The analytical data will be compared to the more stringent of SCOs for VOCs, SVOCs, PCBs/Pesticides, and TAL Metals between the Protection of Groundwater and the Protection of Public Health: Restricted-Residential. The tabulated results, compared to the appropriate SCOs, will be sent to OER for review and approval prior to importing the material/soil as clean fill.

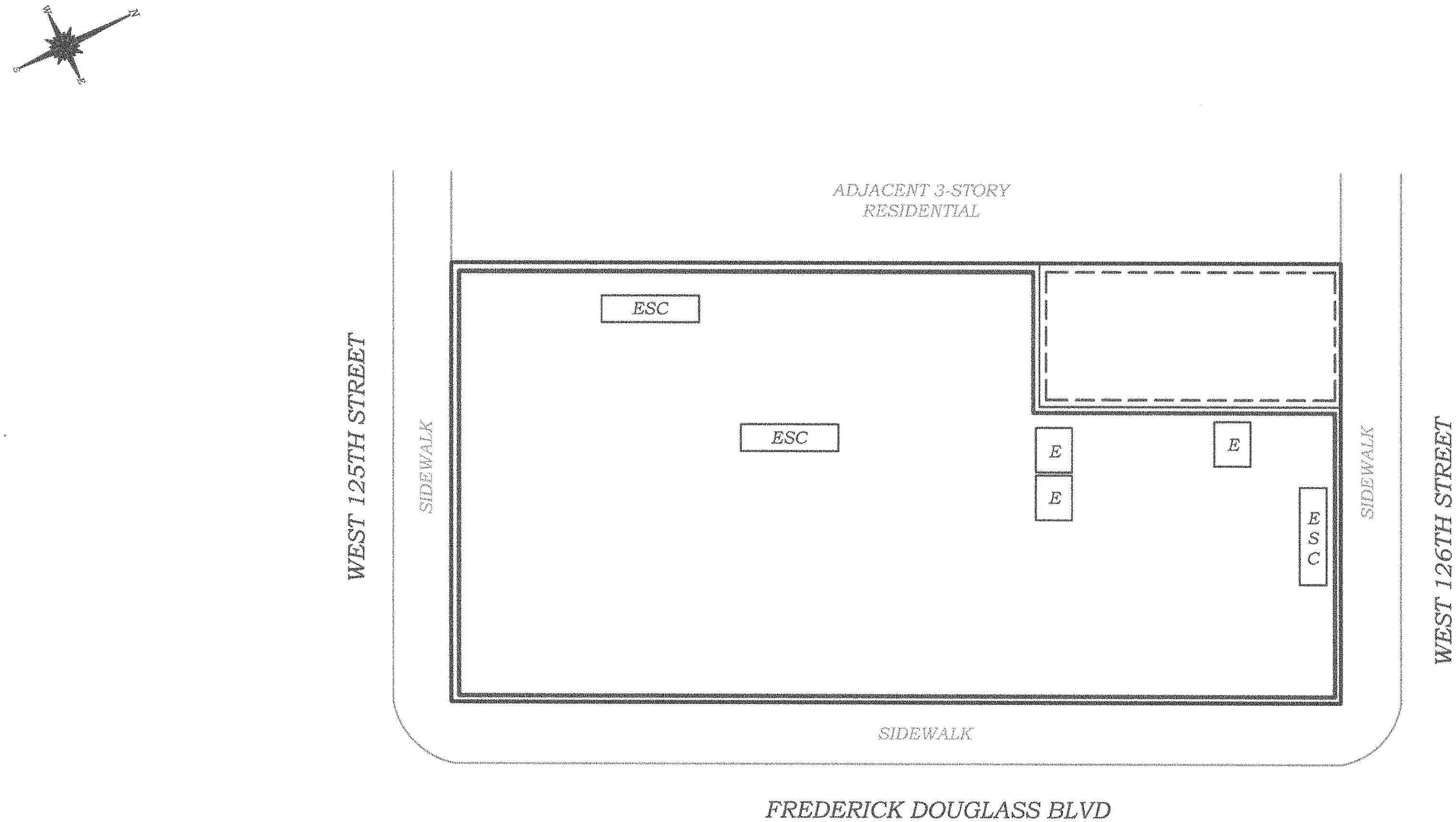
3. All soil material used as backfill ("fill") shall be completely free of organic material and free of all extraneous materials such as roots, tree stumps, construction spoils or any other material that would eventually degrade and cause a change in soil volume. Backfill shall also be free of rocks, bricks, nails or any other hard, sharp material that could damage the vapor barrier system and gas collection piping.

4. Backfill shall not contain any frozen material and shall not be placed on frozen ground because of significant damage that can occur when the material thaws. Backfill shall be mixed and deposited in a manner as to produce reasonable uniformity throughout the mass.

5. Backfill shall be carefully deposited into the excavation and compacted to form a uniformly, dense and stable mass. Before a new layer of backfill is deposited on a freshly compacted layer, the surface of the compacted layer shall be scarified to enhance mechanical bonding between the surfaces of the two layers.

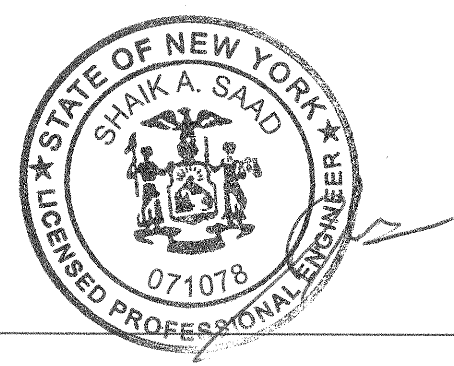
6. Field inspections must be conducted while construction is in progress.

FIGURES



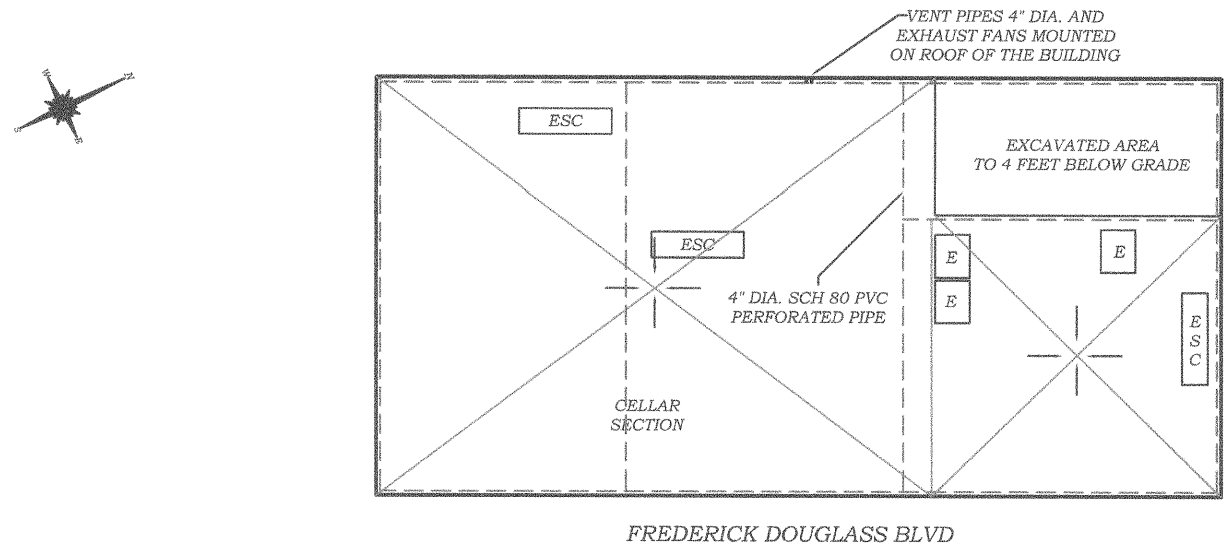
LEGEND:

- PROPOSED EXCAVATION
- PROPERTY LINE
- E ELEVATOR
- ESC ESCALATOR
- — — EXCAVATED AREA TO 4 FEET BELOW GRADE



0' 20' 40' 60'
SCALE IN FEET (FT.)

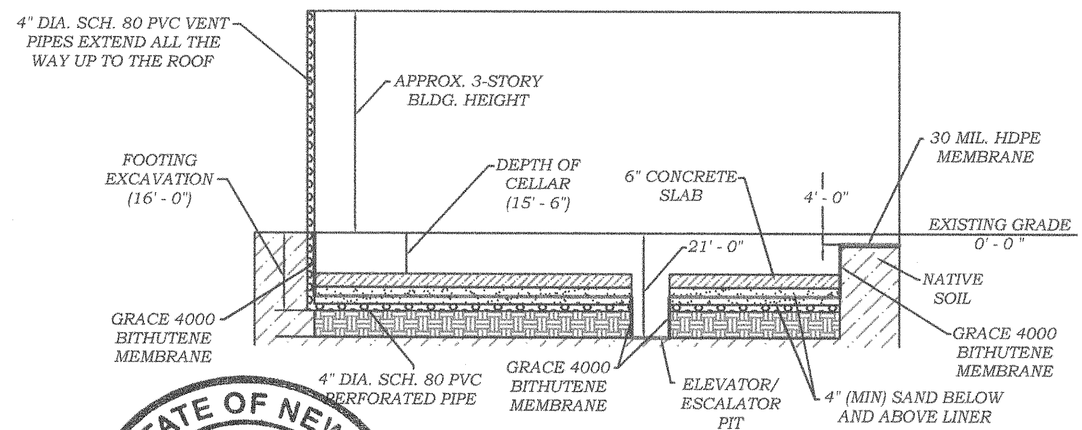
HYDRO TECH ENVIRONMENTAL CORP. MAIN OFFICE: 77 ARKAY DRIVE, SUITE G, HAUPPAUGE, NEW YORK 11788, T (631)462-5866 F (631)462-5877 NYC OFFICE: 15 OCEAN AVENUE, 2nd Floor, BROOKLYN, NEW YORK 11225, T (718)636-0800 F (718)636-0900 www.hydrotechenvironmental.com	2329 Frederick Douglass Blvd New York, NY. HTE Job # 110028	Drawn By: C.Q Reviewed By: M.R Approved By: M.S Date: 08/16/11 Scale: AS NOTED	TITLE: FIGURE 1: SITE EXCAVATION PLAN



PLAN VIEW

NOTES:

1. ALL ELEVATIONS ARE RELATIVE TO EXISTING GRADE, WHICH IS ARBITRARILY ASSUMED TO BE AT 0'-0" EL.
2. THE VAPOR BARRIER DESIGN IS INDEPENDENT OF THE ACTUAL TYPE OF FOUNDATION CONSTRUCTED AT THE SITE. ANY OBJECTS THAT BISECT THE LINER SUCH AS PIERS OF PILES MUST BE CUT THROUGH THE LINER AND CONTACT BETWEEN THE BARRIER AND OBJECT MUST BE SEALED AS PER THE MANUFACTURER'S RECOMMENDATION.
3. BUILDING HEIGHT AND THE SHAPE OF THE ROOF ARE APPROXIMATE.
4. TOP OF PIPE TO BE IMMEDIATELY UNDERNEATH THE LINER ASSEMBLY.
5. THE PERFORATED VENT PIPES SHALL BE CAREFULLY INSTALLED MANUALLY IN A SECURE COMPACTED BED OF ROUND GRAVEL TO PROVIDE GOOD SUPPORT WITHOUT DAMAGE TO PIPING.
6. THE LOCATION OF THE PERFORATED PIPES CAN BE FIELD ADJUSTED TO AVOID POSSIBLE DAMAGE TO THE PIPES DUE TO ANY UP-COMING LOADS.
7. INSTALL 4" DIA. VERTICAL RAISER VENT PIPES AND EXHAUST FANS ON ROOF OF BUILDING AWAY FROM ANY AIR INTAKE PIPES AND AT ELEVATION IDENTICAL TO GAS RISER EXHAUSTS.



ELEVATION

STATE OF NEW YORK
SHAIK A. SAAD
071078
LICENSED PROFESSIONAL ENGINEER

HYDRO TECH ENVIRONMENTAL CORP.

MAIN OFFICE:	NYC OFFICE:
77 ARKAY DRIVE, SUITE G	15 OCEAN AVENUE, 2nd Floor
HAUPPAUGE, NEW YORK 11788	BROOKLYN, NEW YORK 11225
T (631)462-5866 F (631)462-5877	T (718)636-0800 F (718)636-0900

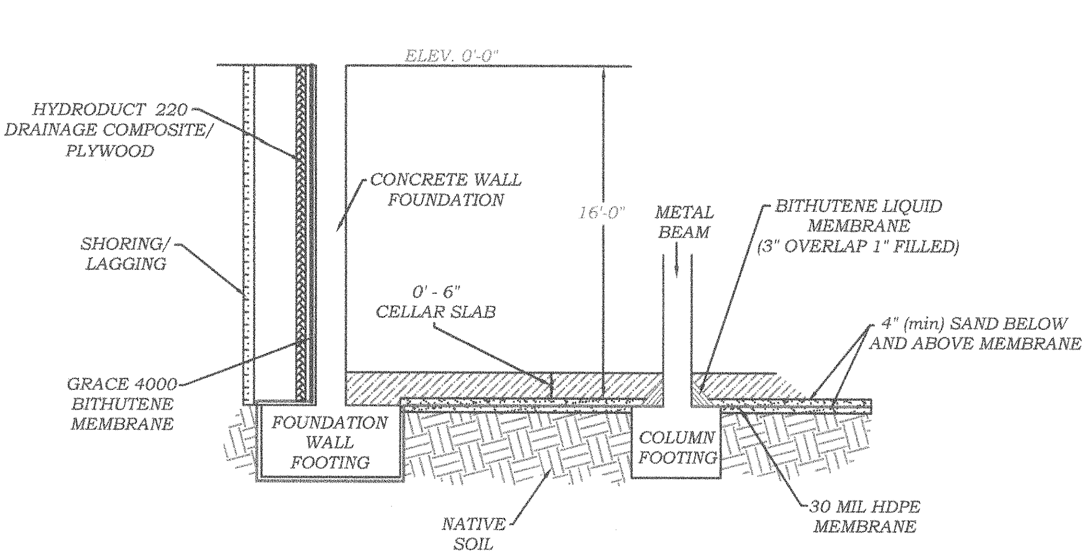
www.hydrotechenvironmental.com

2329 Frederick Douglass Blvd
New York, NY.
HTE Job # 110028

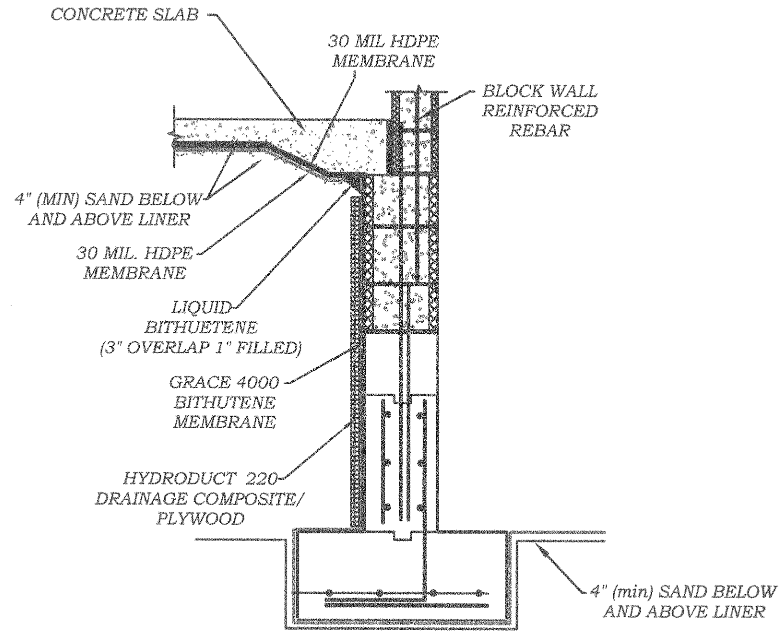
Drawn By:	
Reviewed By:	M.S
Approved By:	M.S
Date:	08/16/1[illegible]
Scale:	AS NOTED

TITLE:

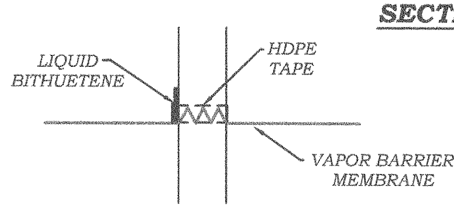
FIGURE 2: PLAN & ELEVATION



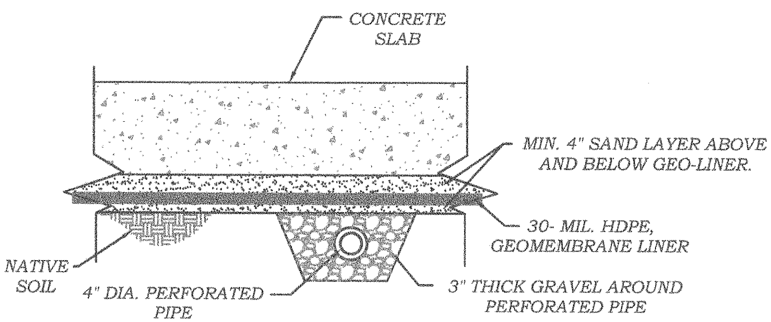
FOOTING TO WALL & COLUMNS DETAILS



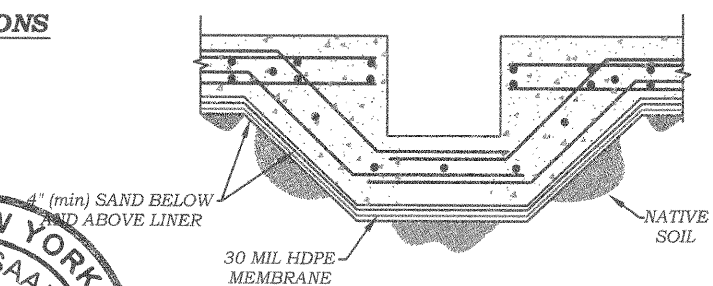
SECTION ELEVATOR / ESCALATOR PIT



SECTION PIPE TO SLAB/WALL PENETRATIONS



CROSS SECTION OF UNDERGROUND SSD PIPE



ELEVATOR SUMP PIT SECTION

STATE OF NEW YORK ★ SHAIK A. SAAD ★ 071078 LICENSED PROFESSIONAL ENGINEER

HYDRO TECH ENVIRONMENTAL CORP. MAIN OFFICE: 77 ARKAY DRIVE, SUITE G HAUPPAUGE, NEW YORK 11788 T (631)462-5866 F (631)462-5877 NYC OFFICE: 15 OCEAN AVENUE, 2nd Floor BROOKLYN, NEW YORK 11225 T (718)636-0800 F (718)636-0900 www.hydrotechenvironmental.com	2329 Frederick Douglass Blvd New York, NY. HTE Job # 110028	Drawn By: C.Q Reviewed By: M.R Approved By: M.S Date: 08/16/11 Scale: AS NOTED	TITLE: FIGURE 3: SCHEMATIC VIEW OF SECTION DETAILS

ATTACHMENT 1

VAPOR BARRIER SPECIFICATIONS

GSE®

Geomembranes

GSE HD • GSE HD Textured • GSE White • GSE White Textured • GSE Conductive • GSE Conductive Textured • GSE Conductive White
GSE Green Textured • GSE HD Weld Edge Textured • GSE UltraFlex • GSE UltraFlex Textured • GSE UltraFlex White • GSE Ultraflex White Textured

Installation Quality Assurance Manual

www.gseworld.com

Table of Contents

1.0 Overview

This manual is a guide of the duties and responsibilities for a GSE QA technician.

ASTM Practices that this guide lists include the following and are included separately:

ASTM D-6392 Standard Test Methods For Determining The Integrity Of NonReinforced Geomembrane Seams Produced Using Thermo Fusion Methods

ASTM D-5820 Standard Practice For Pressurized Air Channel Evaluation of Dual Seamed Geomembranes

ASTM D-5641 Standard Practice For Geomembrane Seam Evaluation By Vacuum Chamber

ASTM D-6497 Standard Guide For Mechanical Attachment of Geomembrane to Penetrations or Structures

GRI Standard GM13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

GRI Standard GM14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes

GRI Standard GM17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

GRI Standard GM19 Standard Specification for Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

2.0 Material Delivery

2.01 Upon arrival on site, the GSE QA will do an inventory of materials on the job site.

2.02 Roll numbers of liner, textile, geonet and composite will be logged on the Inventory Check List and cross-referenced with bills of lading (Materials Supplied by GSE).

2.03 Copies of the Inventory Check List and signed Bill of Ladings should be sent to the home office with the QA retaining the originals.

2.04 Any visible damage to roll materials should be noted on the roll and Inventory Check List.

3.0 Earthwork

3.01 The General Contractor is responsible for preparing and maintaining the subgrade. The subgrade should be prepared and maintained per the individual job specifications.

3.02 Subgrade Surface Acceptance Certificate - The GSE Site Manager shall be responsible for assuring that the subgrade surface has been properly prepared for deployment of geosynthetics. If GSE is required to sign a Subgrade Surface Acceptance Certificate, please use the form provided by GSE. Under no circumstances sign off on subgrade that is not suitable for deployment of geosynthetics. Sign the Subgrade Acceptance Certificate only on areas to be covered in one day, preferably after deployment.

3.03 If the subgrade is unacceptable and the GC/Owner directs GSE to deploy over, the GSE Site Manager must have the Owner's representative sign the Deployment by Owner's Direction Over Unsuitable Subgrade Certificate which will take the place of the Subgrade acceptance Certificate for the particular area being covered.

3.04 Prior to material installation, whenever possible, the QA should measure the area to be covered and compare it to the area used for the bid. An outline of the area including anchor trenches, top of slopes and toe of slopes will be provided by GSE's Drafting department. Use this outline to log actual on-site conditions, i.e....distances between anchor trenches, length of anchor trenches, top of berms, length of slopes and/or any other relevant distances.

Note: Whenever possible distances will be included on the blank outlines. If actual field dimensions have changed or do not match the GSE outline the QA should notify their Supervisor and then the Project Manager, so that quantities can be reassessed to determine the proper amount of material needed for installation. It is important to establish the limits of deployment with all parties. Any changes must be noted and signed off by the Customer’s Representative.

4.0 Panel Placement

4.01 Each panel will be assigned a number as detailed below.

4.01a When there is only one layer, panels may be designated with a number only, i.e.... 1, 2, 3, 4 etc.

4.01b When two or more layers are required use a letter and number, i.e....
Secondary Liner S1, S2, S3, S4 etc...
Primary Liner P1, P2, P3, P4 etc...
Tertiary Liner T1, T2, T3, T4 etc...

4.02 This numbering system should be used whenever possible. Agreement to a panel numbering system should be made at the pre-construction meeting if possible. However, it is essential that GSE's system and the Owner's Representative/Third Party QA agree. Do not use different systems.

4.03 Panel numbers shall be written in large block letters in the center of each deployed panel. The roll number, date of deployment and length (gross) should be noted below the panel number. All noting should be made so that they are easily visible from a distance. On long panels it is beneficial to write information at both ends.

4.04 Panel Numbers shall be logged on the GSE Panel Placement Log along with the roll number and gross length.

4.05 If there is a partial roll left after deployment it is important to write the last four digits of the roll number several times for future identification, along with the estimated length.

4.06 Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

4.06a Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).

4.06b Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.

4.06c Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.

4.06d Do not allow heavy vehicular traffic directly on geomembrane. Rubber tired/tracked ATV's and trucks are acceptable if wheel contact is less than 8 psi.

4.06e Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

4.06f Driver shall check for sharp edges, embedded rocks, or other foreign material stuck into or protruding out from tires/tracks prior to driving on any geosynthetic layer.

4.06g Path driven on geosynthetics shall be as straight as possible with no sharp turns, sudden stops, or quick starts.

4.06h Areas where driving occurs shall be continuously and thoroughly inspected throughout the deployment process by the contractor and the third party CQA.

5.0 Trial Welds

5.01 Seaming apparatus shall be allowed to warm up a minimum of 15 minutes before performing trial welds.

5.02 Each seaming apparatus along with GSE Welding Tech will pass a trial weld prior to use. Trial welds to be performed in the morning and afternoon, as a minimum, as well as whenever there is a power shutdown.

5.03 Fusion or wedge welds will always be performed or conducted on samples at least 6' long. Extrusion welds will be done on samples at least 3' long.

Note: Always perform trial welds in the same conditions that exist on the job. Run the trial welds on the ground, not the installed liner. Do not use a wind break unless you are using one on the job.

5.04 Sampling Procedure

5.04a Cut 4 - 1" wide specimens from the trial weld sample. Operating temperatures should be monitored while welding.

5.04b Specimens will always be cut using a 1" die cutter so the peel values may be used for qualitative analysis.

5.04c When cutting coupons from the trial weld samples, the inside and outside tracks on the coupon should be identified to assist in troubleshooting problems in case the weld fails. The outside track will be defined as the track which would be peeled if pulling the overlap exposed in a typical installation, or the seam which is closest to the edge of the top sheet. The inside track is the seam closest to the edge of the bottom sheet.

5.04d Place a small mark on the exposed (Top) overlap to denote the outside track prior to testing trial welds.

5.05 Die Cutter

5.05a Only cut one sample at a time to avoid damaging the die cutter.

5.05b Samples should be free of sand and grit prior to cutting sample.

5.05c Inspect the die edge weekly for nicks, dents or signs of dullness. Dullness of the cutting edge may damage the units.

5.05d Remove die when edge has been dulled and lightly reshape it with a medium hand file. When wear is excessive return it for a replacement die.

5.05e When the cutting board becomes deeply scored and/or interferes with coupon cutting it should be replaced.

5.05d To adjust the depth of the die cut into the cutting board, after replacing the cutting board or sharpening the die, 0.015" washer shims can be added or removed between the cutting ram and the ram extension. Only add shims when cutting is difficult due to lack of depth of cut.

5.06 Trial Weld Testing

5.06a Allow coupons to cool prior to testing. Avoid separating the coupons while hot as failure of the sheet may be initiated and false readings indicated.

5.06b In extreme heat the coupons may need to be cooled, using water or an insulated cooler prior to peel testing. Lab conditions specify 70 degrees (plus or minus 4 degrees) Fahrenheit. Coupon temperatures greater than 70 degrees may result in lowered strengths.

5.06c Visually inspect the coupons for squeeze-out, footprint, pressure and general appearance.

5.06d Each of the 4 coupons will be tested in peel on the field tensiometer at a separation rate of 2" per minute (for HDPE). Shear tests, in addition to the peel tests, will be performed if required by a site-specific QA. Plan.

5.07 Pass/Fail Criteria

5.07a Criteria for passing trial welds will be as follows:

1) Seam must exhibit film tear bond (FTB). Trial welds should have no incursion into the weld.
2) Peel and shear values shall meet or exceed the values listed below for HDPE smooth or textured sheet (@ 2"/min.):

Material (Mil)	Shear Strength (PPI)	Fusion Peel (PPI)	Extrusion Peel (PPI)
40	81	65	52
60	121	98	78
80	162	130	104
100	203	162	130

3) Peel and shear values shall meet or exceed the values listed below for LLDPE smooth or textured sheet (@ 20"/min.):

Material (Mil)	Shear Strength (PPI)	Fusion Peel (PPI)	Extrusion Peel (PPI)
40	60	50	48
60	90	75	72
80	120	100	96
100	150	125	120

5.07b Both tracks of fusion welded samples must pass for the trial weld to be considered acceptable. If any of the four coupons fail either due to seam incursion (no FTB) or low strength values, the trial weld must be re-done.

5.07c The GSE QA will give approval to proceed with welding after observing and recording all trial welds.

5.08 Trial Weld Documentation

5.08a All trial weld data will be logged on the GSE Trial Weld log

5.08b When logging fusion welded peel values on the GSE Trial Weld log indicate the values for the outside track first, followed by the inside track

5.08c Speed and temperature settings will be recorded for each machine's trial weld

6.0 Geomembrane Field Seaming

6.01 The seam number takes the identity of the panels on each side. The seam between panels 1 & 2 becomes Seam 1/2. These lengths and seam numbers shall be recorded in the GSE Seam Log.

6.02 Welding Technicians will mark their initials/employee number, machine number, date and time at the start of every seam. Technician should also periodically mark temperatures along the seam and at the end of the seam.

6.03 Approved processes for field seaming and repairing are extrusion welding and fusion welding. All welding equipment shall have accurate temperature monitoring devices installed and working to ensure proper measurement.

6.04 Extrusion welding shall be used primarily for repairs, patching and special detail fabricating and may be used for seaming. The GSE Site Manager shall verify that:

1) equipment in use is functioning properly
2) welding personnel are purging the machine of heat degraded extrudate prior to actual use
3) all work is performed on clean surfaces and done in a professional manner
4) no seaming will be performed in adverse weather conditions

6.05 Fusion welding, shall be used for seaming panels together and is not used for patching or detail work. The GSE Site Manager shall verify that:

1) the equipment used is functioning properly
2) seaming personnel are working in a professional manner and are attentive to their duties
3) no seaming will be performed in adverse weather conditions

6.06 Seam preparation, the welding technician shall verify that:

1) prior to seaming, the seaming area is free of moisture, dust, dirt, sand or debris of any nature
2) the seam is overlapped properly for fusion welding
3) the seam is overlapped or extended beyond damaged areas at least 4" when extrusion welding
4) the seam is properly heat tacked and abraded when extrusion welding
5) seams are welded with fewest number of unmatched wrinkles or "fishmouths"

6.07 No seaming will be performed in ambient air temperatures or adverse weather conditions that would jeopardize the integrity of the liner installation.

7.0 Field Destructive Testing

7.01 Destructive seam tests shall be performed to evaluate bonded seam strength. The frequency of sample removal shall be one sample per 500' of seam, unless specific site specifications differ. Location of the destructive samples will be selected and marked by the QA Technician or third party QA. Field testing should take place as soon as possible after seam is completed.

7.02 Samples should be labeled in numerical order, I.e. DS-1, DS-2 etc….This should carry thru any layers and or multiple ponds, do not start numbering from 1 again. (This is the preferred method)

7.03 The size of samples and distribution should be approximately 12" x 39"(size may vary dependent on Job requirements) and distributed as follows:

7.03a 12" x 12" piece given to QA Technician for field testing.

7.03b 12" x 12" piece sent to Home Office for testing, if required.
7.03c 12" x 12" piece given to third party for independent testing, or archiving.

NOTE: All samples will be labeled showing test number, seam number, machine number, job number, date welded and welding tech number.

7.04 The sample given to the QA Technician in the field shall have ten coupons cut and be tested with a tensiometer adjusted to a pull rate as shown below. The strength of four out of five specimens should meet or exceed the values below, and the fifth specimen must meet or exceed 80% of the value below.

1) Seam must exhibit film tear bond (FTB). Welds should have ≤25% incursion into the weld.
2) Peel and shear values shall meet or exceed the values listed below for HDPE smooth or textured sheet (@ 2"/min.):

Material (Mil)	Shear Strength (PPI)	Fusion Peel (PPI)	Extrusion Peel (PPI)
40	81	65	52
60	121	98	78
80	162	130	104
100	203	162	130

3) Peel and shear values shall meet or exceed the values listed below for LLDPE smooth or textured sheet (@ 20"/min.):

Material (Mil)	Shear Strength (PPI)	Fusion Peel (PPI)	Extrusion Peel (PPI)
40	60	50	48
60	90	75	72
80	120	100	96
100	150	125	120

7.05 All weld destructive test data will be logged on the GSE Destructive test log.

7.06 When logging fusion welded peel values on the GSE Destructive Test Log, indicate the values for the outside track first, followed by the inside track.

7.08 Test results will be noted in the GSE Destructive Test Log as P (pass) or F (fail).

7.09 If test fails, additional samples will be cut, approximately 10' on each side of the failed test, and retested. These will be labeled A (after) & B (before). This procedure will repeat itself until a sample passes. Then the area of failed seam between the two tests that pass will be capped or reconstructed.

7.10 In lieu of taking an excessive number of samples, the GSE Site Manager may opt to extrusion weld the flap or cap the entire seam and then non-destructively test according to Section 8.0.

8.0 Non-Destructive Testing

8.01 GSE shall non-destructively test all seams their full length using an air pressure or vacuum test. The purpose of this test is to check the continuity of the seam.

8.02 Air testing; the following procedures are applicable to those seams welded with a double-seam fusion welder.

8.02a The equipment used shall consist of an air tank or pump capable of producing a minimum 35 psi and a sharp needle with a pressure gauge attached to insert into the air chamber.

8.02b Seal both ends of the seam by heating and then squeezing together. Insert the needle with the gauge into the air channel, it may be necessary to heat the liner to make this easier. Pressurize the air channel to 30psi. Note time test starts and wait a minimum of 5 minutes to check. If pressure after five minutes has dropped less than 2 psi then the test is successful (Thickness of material may cause variance).

8.02c Cut opposite seam end and listen for pressure release to verify full seam has been tested.

8.02d If the test fails, follow these procedures.

a) While channel is under pressure walk the length of the seam listening for a leak.
b) While channel is under pressure apply a soapy solution to the seam edge and look for bubbles formed by air escaping.
c) Re-test the seam in smaller increments until the leak is found.

8.02e Once the leak is found using one of the proceedures above, cut out the leak area and retest the portions of the seams between the leak areas as per 8.02a to 8.02c above. Continue this proceedure until all sections of the seam pass the pressure test.

8.02f Repair the leak with a patch and vacuum test again.

8.02g All non-destructive tests will be noted in the GSE Non-Destructive Test/Repair log.

8.03 Vacuum testing; the following procedures are applicable to those seams welded with a extrusion welder.

8.03a The equipment used shall consist of an vacuum pumping device, a vacuum box and a foaming agent in solution.

8.03b Wet a section with the foaming agent, place vacuum box over wetted area. Evacuate air from the vacuum box to a pressure suitable to affect a seal between the box and geomembrane. Observe the seam through the viewing window for the presence of soap bubbles emitting from the seam.

8.03c If no bubbles are observed, move box to the next area for testing. If bubbles are observed, mark the area of the leak for repair as per Section 10.0 and retest as per Section 8.03.

Note: If vacuum testing fusion welded seams, the overlap flap must be cut off to perform the tests.

9.0 Defects and Repairs

9.01 Identification; all seams and non-seam areas of the geomembrane lining system shall be examined for defects in the seam and sheet.

9.02 Identification of the defect should be made using the following procedures:

9.02a For any defect in the seam or sheet that is an actual breach (hole) in the liner, installation personnel shall circle the defect and mark with the letter "P" along side the circle. The letter "P" indicates a patch is required.

9.02b For any defect that is not an actual hole, installation personnel shall only circle the defect indicating that the repair method may be only an extruded bead and that a patch is not required.

9.02c Each suspect area that has been identified as needing repair shall be repaired in accordance with this section and Non-Destructively tested as per Section 8.0. After all work is complete, the GSE Site Manager will conduct a final walk-through to confirm all repairs have been completed and debris removed. Only after this final evaluation by GSE's Site Manager and Owner/Agent shall any material be placed over the installed liner.

10.0 Repair Procedures

10.01 Any Portion of the Geomembrane liner system exhibiting a defect which has been marked for repair may be repaired with any one or combination of the following procedures:

1) Patching - used to repair holes, tears, undispersed raw materials in the sheet and dented areas.
2) Grind and Reweld - used to repair small sections of extruded seams.
3) Spot Welding - Used to repair small minor, localized flaws.
4) Flap Welding - Used to extrusion weld the flap of a fusion weld in lieu of a full cap.
5) Capping - Used to repair failed seams.
6) Topping - Application of extrudate bead directly to existing seams.

10.02 The following conditions shall apply to the above methods:

1) surfaces of the geomembrane which are to be repaired shall be roughened
2) all surfaces must be clean and dry at the time of the repair
3) all seaming equipment used in repairing procedures shall be qualified
4) all patches and caps shall extend at least 4" beyond the edge of the defect, and all patches must have rounded corners
5) all cut out holes in liner must have rounded corners, 3" min. radius

11.0 As-Built Drawing Procedures

11.01 Liner Layout

11.01a Submitted As-built Drawings should always be on blank outlines supplied by GSE's Drafting Department. (Phone 281-230-2518 Don Sharkey). When outlines are not available plain paper may be used, but only after permission from GSE's Drafting Department.

11.01b Accuracy to the way seams fit or join.

11.01c Using different colors makes information easier to see. Drawings may be done in ink or pencil, but writing must be neat.

11.01d Do not write so small that it is hard to read.

11.01e Suggested scale is 1" = 40' (Other scales may be used if required).

11.02 Anchor Trenches

11.02a The amount of liner actually in the trench should be noted on the drawing. If amount differs, show all differences and approximate locations.

11.02b If anchor trench is larger than shown on GSE's construction drawings then a written approval should be obtained from the Owner/Agent representative. This should be included in the as-built package.

11.03 Panel & Roll Numbers

11.03a Each panel will be assigned a number as detailed below. When there is only one layer panels may be designate with a number only, i.e.... 1, 2, 3, 4 etc.

11.03b When two or more layers are required use a letter and number, i.e....

Secondary Liner S1, S2, S3, S4 etc...
Primary Liner P1, P2, P3, P4 etc...
Tertiary Liner T1, T2, T3, T4 etc...

11.03c This numbering system should be used whenever possible. Agreement to a panel numbering system should be made at the pre-construction meeting if possible. However, it is essential that GSE's system and the Owner's Representative/Third Party QA agree. Do not use different systems.

11.03d Panel numbers shall be written in large block letters in the center of each deployed panel. The roll number, date of deployment and gross length should be noted below the panel number. All notations should be made so that they are easily visible from a distance. On long panels it is beneficial to write information at both ends.

11.03e Panel Numbers shall be logged on the Daily Report Forms along with the roll number and gross length.

11.03f Whenever possible, roll numbers should be placed next to panel numbers on the field copies of the as-built drawing.

11.04 Seam Lengths

11.04a Every seam length that is not a cross-seam must be noted. This includes rectangles, squares, pies and any other shape (See Fig. A).

11.04b GSE assumes that all regular cross-seams are either 22' or 34' wide, unless they are not full width panels they do not have to be noted on the drawing. Panel widths are measured perpendicularly across the panels.

11.04c All dimensions should be called out in tenths of a foot.

11.05 Tests

11.05a All test markings should conform to the "Legend" on the blank outline.

11.05b It can be assumed that all seam junctions will have a patch, therefore, it is only necessary to note if they don't.

11.06 Seam Numbers

11.06a Since the seam number is drawn from the adjoining panels (I.e. 1/2, 10/11 etc.) there is no need to call out seam numbers on the drawings.

11.06b Each seam must be logged in the Daily Report.

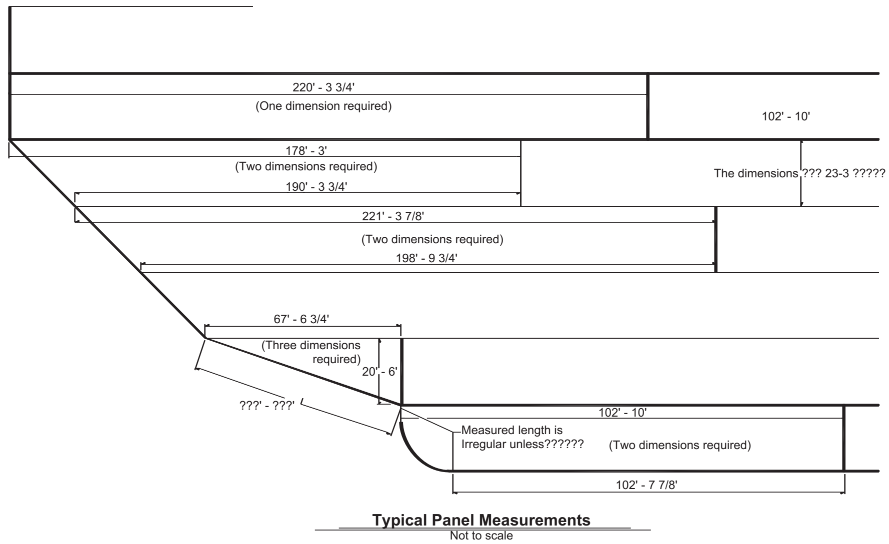


Fig A

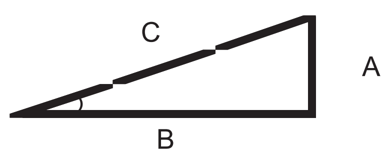
11.07 Miscellaneous

11.07a QA's name should be on all drawings and paperwork.

11.07b Any questions arising in the field about reporting issues may be handled by calling Don Sharkey at 800-435-2008, ext 2518 or 281-230-2518.

12.0 Formulas

12.01 Here are some procedures using trig formulas to enable you to deal with slope corrections concerning seam lengths on as-built drawings in order to do these calculations you will need a calculator that performs trigonomic functions.



A = Rise
B = Base
C = Slope

12.02 Useful Formulas

12.02a rise divided by base = Tangent of the angle

12.02b base divided by cosign of the angle = slope

12.02c slope multiplied by cosign of the angle = base

12.02d rise divided by Tangent of the angle = base

12.03 Slope factors

12.03a Slope factors can be used as a quick method of calculating seam lengths in a flat plan, such as an as-built drawing. Most of the time when field drawings do not fit the outline provided by the Drafting Department it is because actual seam lengths were used instead of lengths calculated with a slope factor. Once you determine the slope factor (a percentage of the actual length) it will probably make field drawings fit the outlines better. As usual, there are always exceptions to this theory.

12.03b To determine a slope factor simply divide the base length by the slope length. Lets use a 3:1 slope as an example. With a base of 100' and a rise of 33.34' the angle of the slope becomes 18.435 degrees. 100' divided by the cosign of 18.435 degrees equals 105.41'. Thus, if you divide 100' by 105.41' you get a slope factor of .9487 or rounded to the nearest one hundredth 0.95.

Now, if you multiply your slope lengths by .95 you will get the actual plan view or paper view length of a seam.

12.04 Typical Slope factors

Slope	Slope Factor	Degrees
2 to 1	0.895	26.565
3 to 1	0.949	18.435
4 to 1	0.970	14.036
5 to1	0.981	11.310
2.5 to 1	0.928	21.802

GSE Panel Placement Log

Project Name: ____________________ Site Manager: ____________________

Location: ____________________ Material: ____________________

Job Number: ____________________ Sheet Thickness: ____________________

Q.A. Technician: ____________________ Smooth: ________ Textured: ________

Panel Number	Roll Number	Deployment Date	Width (Feet)	Length (Feet)	Square Feet Smooth	Square Feet Textured

GSE Seam Log

Project Name: ____________________ Site Manager: ____________________

Location: ____________________ Material: ____________________

Job Number: ____________________ Sheet Thickness: ____________________

Q.A. Techncian: ____________________ Smooth: ______ Textured: ________

Seam Number	Time of Weld	Date of Weld	Type of Weld	Length of Seam	Machine Number	Technician ID Number

GSE Destructive Test Log

		Fusion (ppi)	Extrusion (ppi)
Project Name:	Site Manager:		
Location:	Material:	Min. Peel	Min. Peel
Job Number:	Sheet Thickness:	Min. Shear	Min. Shear
Q.A. Technician:	Smooth: Textured:		

Sample No.	Date Welded	Seam Number	Technician ID Number	Machine Type & No.	Location	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	FTB Y / N	Pass/ Fail

GSE Non-Destuctive Test / Repair Log

Project Name: ____________________ Site Manager: ____________________

Location: ____________________ Material: ____________________

Job Number: ____________________ Sheet Thickness: ____________________

Q.A. Technician: ____________________

Seam Number	Test Date	Technician ID Number	Test Type (A or V)	Air Pressure Test psi start	Air Pressure Test psi finish	Test Result (P or F)	Repair Locations

GSE Trial Weld Log

Project Name: ______________________ Site Manager: ______________________

Location: ______________________ Material: ______________________

Job Number: ______________________ Sheet Thickness: ______________________

Q.A. Technician: ______________________ Smooth: __________ Textured: ______________

Trial No.	Date of Trial	Time of Trial	Technicians ID Number	Machine Number	Ambient Temp.	Wedge Mass	Speed Preheat	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	FTB Y / N	Pass Fail

Subgrade Surface Acceptance

Date: ____________

Project: ______________________ **Site Manager:** ________________

Project #: ______________________

Location: ______________________ **Partial:** ____________ **Final:** ____________

This document only applies to the acceptability of surface conditions for installation of geosynthetic products. GSE does not accept responsibility for compaction, elevation or moisture content, nor for the surface maintenance during deployment. Structural integrity of the subgrade and maintenance of these conditions are the responsibility of the owner or earthwork contrator.

____

____

____

____

____

For GSE Lining Technology, Inc.: ______________________

For Owner / Contractor: ______________________

Acceptance Number: ____________ Area Accepted: ____________ s.f. Total Area Accepted to date: ____________ s.f.

Spark Test Log

Project Name: ____________________ Site Manager: ____________________

Location: ____________________ Material: ____________________

Job Number: ____________________ Sheet Thickness: ____________________

Q.A. Technician: ____________________

Seam or Panel No.	Time of Test	Date of Test	Technician ID Number	Location of Repairs

GSE Lining Technology, Inc.
19103 Gundle Road
Houston, Texas 77073-3598
800-435-2008
281-443-8564
281-875-6010 Fax

Job No.: ______________________
Project: ______________________
Client: ______________________
Bill To: ______________________
____
____
Job Description: ______________________
% Complete of Total Job: ______________

Certificate of Acceptance

Material	Estimated Square feet	Final Quantity/Description

I, the undersigned, duly representative of:
Do hereby take over and accept the work described above from the date hereof and confirm to the best of my knowledge the work has been completed in accordance with the specifications and the terms and conditions of the contract.

Name	Signature	Title	Date

Certificate accepted by GSE Lining Technology, Inc Representative.

Name	Signature	Title	Date

GSE Inventory Check List

Date: ____________

Project: ____________ **Site Manager:** ____________

Project #: ____________ **QA Technician:** ____________ **Page:** ______ of ______

Material	Roll #	Date Used	Material	Roll #	Date Used	Material	Roll #	Date Used	Material	Roll #	Date Used

GRI Standard GM 13*

STANDARD SPECIFICATION FOR TEST PROPERTIES, TESTING FREQUENCY AND RECOMMENDED WARRANTY FOR HIGH DENSITY POLYETHYLENE (HDPE) SMOOTH AND TEXTURED GEOMEMBRANES

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1.0 Scope

1.1 This specification covers high density polyethylene (HDPE) geomembranes with a formulated sheet density of 0.940 g/ml, or higher, in the thickness range of 0.75 mm (30 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good quality and performance of HDPE geomembranes in general applications, but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive values for test indicated, may be necessary under conditions of a particular application.

1.5 This specification also presents a recommended warrant which is focused on the geomembrane material itself.

1.6 The recommended warrant attached to this specification does not cover installation considerations which is independent of the manufacturing of the geomembrane.

Note 2: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

2. Referenced Documents

2.1 ASTM Standards:

D 638 Test Method for Tensile Properties of Plastics

D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement

D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting

D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique

D 1603 Test Method for Carbon Black in Olefm Plastics

D 3895 Test Method for Oxidative Induction Time of Polyolefms by Thermal Analysis

D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique

D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products

D5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

D 5397 Procedure to Perform a Single Point Notched Constant Tensile Load -(SP-NCTL) Test: Appendix

D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefm Geosynthetics

D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes

D 5885 Test method for Oxidative Induction Time of Polyolefm Geosynthetics by High Pressure Differential Scanning Calorimetry

D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes

2.2 GRI Standards:

GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet

GM 11 Accelerated Weathering of Geomembranes using a Fluorescent UVA-Condensation Exposure Device

GM 12 Measurement of the Asperity Height ofTextured Geomembranes Using a Depth Gage

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3.0 Definitions

Manufacturing Quality Control (MQC) – A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications. ret. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) – A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project. ref. EPA/600/R-93/182

Formulation, n – The mixture of a unique combination of ingredients identified by type, properties and quantity. For HDPE polyethylene geomembranes, a formulation is defined as the exact percentages and types ofresin(s), additives and carbon black.

4.0 Material Classification and Formulation

4.1 This specification covers high density polyethylene geomembranes with a formulated sheet density of 0.940 g/ml, or higher. Density can be measured by ASTM D1505 or ASTM D792. If the latter. Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.932 g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar HDPE as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5.0 Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth HOPE geomembranes and Table 2 is for single and double sided textured HDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

Note 3: There are several tests often included in other HDPE specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693)
- Wide Width Tensile
- Water Vapor Transmission
- Water Absorption
- Ozone Resistance
- Modulus of Elasticity
- Hydrostatic Resistance
- Tensile Impact
- Field Seam Strength
- Multi-Axial Burst
- Various Toxicity Tests

Note 4: There are several tests which are included in this standard (that are not customarily required in other HDPE specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height ofTextured Sheet

Note 5: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Puncture Resistance
- Stress Crack Resistance
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

Note 6: There are several GRI tests currently included in this standard. Since these topics are not covered in ASTM standards, this is necessary. They are the following:

- UV Fluorescent Light Exposure
- Asperity Height Measurement

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The properties of the HDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

Note 7: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

11. Warranty

11.1 Upon request of the purchaser in the contract or order, a manufacturer's warrant of the quality of the material shall be furnished at the completion of the terms of the contract.

11.2 A recommended warranty for smooth and textured HDPE geomembranes manufactured and tested in accordance with this specification is given in Appendix A.

11.3 The warranty in Appendix A is for the geomembrane itself. It does not cover subgrade preparation, installation, seaming, or backfilling. These are separate operations that are often beyond the control, or sphere of influence, of the geomembrane manufacturer.

Note 8: If a warrant is required for installation, it is to be developed between the installation contractor and the party requesting such a document.

ENGLISH UNITS

Table 1(a) – High Density Polyethylene (HDPE) Geomembrane -Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness (min. ave.)	D5199	nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Per roll
• lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density mg/l (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,00 lb
Tensile Properties *(1)* (min. ave.)	D 6693								20,000 lb
• yield strength	Type IV	63 lb/in.	84 lb/in.	105 lb/in.	126 lb/in.	168 lb/in.	210 lb/in.	252 lb/in.	
• break strength		114 lb/in.	152 lb/in.	190 lb/in.	228 lb/in.	304 lb/in.	380 lb/in.	456 lb/in.	
• yield elongation		12%	12%	12%	12%	12%	12%	12%	
• break elongation		700%	700%	700%	700%	700%	700%	700%	
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	54 lb	72 lb	90 lb	108 lb	144 lb	180 lb	216 lb	45,000 lb
Stress Crack Resistance *(2)*	D5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI-GM10
Carbon Black Content (range)	D 1603 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	20,000 lb
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(5)*									200,000 lb
(a) Standard OIT	D 3895	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	
— or —									
(b) High Pressure OIT	D 5885	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	
Oven Aging at 85°C *(5), (6)*	D 5721								
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	55%	55%	55%	55%	55%	55%	55%	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	80%	80%	80%	80%	80%	80%	80%	
UV Resistance *(7)*	GM 11								
(a) Standard OIT (min. ave.)	D 3895	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 5885	50%	50%	50%	50%	50%	50%	50%	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 in.
(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC) UNITS

Table 1(b) – High Density Polyethylene (HPDE) Geomembrane - Smooth

Properties	Test Method	Test Value 0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	Testing Frequency (minimum)
Thickness - mils (min. ave.) • lowest individual of 10 values	D5199	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	per roll
Density (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties *(1)* (min. ave.) • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	11 kN/m 20kN/m 12% 700%	15 kN/m 27 kN/m 12% 700%	18 kN/m 33 kN/m 12% 700%	22 kN/m 40 kN/m 12% 700%	29 kN/m 53 kN/m 12% 700%	37 kN/m 67 kN/m 12% 700%	44 kN/m 80 kN/m 12% 700%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	240 N	320 N	400 N	480 N	640 N	800 N	960 N	20,000 kg
Stress Crack Resistance *(2)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM-10
Carbon Black Content - %	D 1603 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	9,000 kg
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 3895 D 5885	N. R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm
(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

ENGLISH UNITS

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	GM 12	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,000 lb
Tensile Properties (min. ave.) *(3)* • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	63 lb/in. 45 lb/in. 12% 100%	84 lb/in. 60 lb/in. 12% 100%	105 lb/in. 75 lb/in. 12% 100%	126 lb/in. 90 lb/in. 12% 100%	168 lb/in. 120 lb/in. 12% 100%	210 lb/in. 150 lb/in. 12% 100%	252 lb/in. 180 lb/in. 12% 100%	20,000 lb
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	45 lb	60 lb	75 lb	90 lb	120 lb	150 lb	180 lb	45,000 lb
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM10
Carbon Black Content (range)	D 1603 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	20,000 lb
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(7)* (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	200,000 lb
Oven Aging at 85°C *(7), (8)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	per each formulation
UV Resistance *(9)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	GM11 D 3895 D 5885	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	per each formulation

(1) Of 10 readings; 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils
(2) Alternate the measurement side for double sided textured sheet
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches
(4) P-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(5) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC UNITS)

Table 2(b) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	GM 12	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties (min. ave.) *(3)* • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	11 kN/m 8 kN/m 12% 100%	15 kN/m 10 kN/m 12% 100%	18 kN/m 13 kN/m 12% 100%	22 kN/m 16 kN/m 12% 100%	29 kN/m 21 kN/m 12% 100%	37 kN/m 26 kN/m 12% 100%	44 kN/m 32 kN/m 12% 100%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	200N	267 N	333 N	400 N	534 N	667 N	800 N	20,000 kg
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM10
Carbon Black Content (range)	D 1603 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	9,000 kg
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(7)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(7), (8)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	per each formulation
UV Resistance *(9)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	GM11 D 3895 D 5885	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	per each formulation

(1) Of 10 readings; 8 out of 10 must be ≥ 0.18 mm, and lowest individual reading must be ≥ 0.13 mm
(2) Alternate the measurement side for double sided textured sheet
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm
(4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(5) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

APPENDIX “A”

TYPICAL HDPE GEOMEMBRANE WARRANTY

ADOPTION AND REVISION SCHEDULE FOR HDPE SPECIFICATION PER GRI-GM13

"Test Properties, Testing Frequency and Recommended Warrant for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

Adopted:	June 17, 1997
Revision 1:	November 20, 1998; changed CB dispersion from allowing 2 views to be in Category 3 to requiring all 10 views to be in Category 1 or 2. Also reduced UV percent retained from 60% to 50%.
Revision 2:	April 29, 1999: added to Note 5 after the listing of Carbon Black Dispersion the following: "(In the viewing and subsequent quantitative interpretation of ASTM D5596 only near spherical agglomerates shall be included in the assessment)" and to Note (4) in the property tables.
Revision 3:	June 28, 2000: added a new Section 5.2 that the numeric table values are neither MARV or MaxARV. They are to be interpreted per the the designated test method.
Revision 4:	December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to "strength" and "elongation".
Revision 5:	May 15, 2003: Increased minimum acceptable stress crack resistance time from 200 hrs to 300 hrs.
Revision 6:	June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 2.

GRI Standard GM14

SELECTING VARIABLE INTERVALS FOR TAKING GEOMEMBRANE DESTRUCTIVE SEAM SAMPLES

1. Scope

1.1 This guide is focused on selecting the spacing interval for taking destructive seam samples of field deployed geomembranes as a particular job progresses based on an installers ongoing record of pass - or - fail testing.

Note 1 - While subjective at this time, the guide is most applicable to large geomembrane seaming projects, which require more than 100 destructive seam samples based upon the typical sampling strategy of 1 destructive sample per 150 m (500 ft).

1.2 This guide is essentially applicable to production seams. Caution should be exercised in using the guide for projects that involve complex geometries, multiple penetrations, or extreme weather conditions.

1.3 The primary target audiences for this guide are construction quality assurance (CQA) organizations, construction quality control (CQC) organizations, facility owner/operators and agency regulators having permitting authority.

1.4 The outcome of using the guide rewards good seaming performance resulting from a record of passing destructive seam tests. It also penalizes poor seaming performance resulting from a record of excessively failing seam tests.

1.5 This guide does not address the actual seam testing procedures that are used for acceptance or failure of the geomembrane seam test specimens themselves. Depending on the type of geomembrane being deployed one should use ASTM D4437, D3083, D751 and D413 for testing details in this regard. The project-specific CQA plan should define the particular criteria used in acceptance or failure.

1.6 An appendix is offered using control charts, which is intended to be of assistance to geomembrane installers, i.e., construction quality control (CQC) organizations, to identify salient aspects of good and poor seaming performance.

2. Referenced Documents

2.1 ASTM Standards:

D4437 Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes

D3083 Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining

D751 Method of Testing Coated Fabrics

D413 Test Methods for Rubber Property - Adhesion to Flexible Substrate

2.2 Other Standards:

ANSI/ASQC Z1.4 [1993]

Sampling Procedures and Tables for Inspection by Attributes

3. Summary of Guide

3.1 Use of this guide requires the establishment of an anticipated geomembrane seam failure percentage (ranging from 1 to 8%) and an initial, or start-up, sampling interval.

Note 2 - The value of anticipated failure percentage is an important consideration. It dictates each decision as to a possible increase or decrease in interval spacing from the preceding value. The percentage itself comes from historical data of the construction quality assurance (CQA) organization or regulatory agency. It is related to a number of factors including criticality of installation, type of geomembrane, type of seaming method and local ambient conditions.

The actual value is admittedly subjective and should be made known in advance to the geomembrane installer before bidding the project. Use of an unrealistically low value of anticipated failure percentage, e.g., < 1.0%, will likely result in field difficulties insofar as decreased sampling intervals are concerned. Conversely, use of an unrealistically high value of anticipated failure percentage, e.g., > 8.0%, will likely result in very large sampling intervals and quite possibly sacrifice the overall quality of the seaming effort.

3.2 The guide then gives the procedure for establishing the initial number of samples needed for a possible modification to the start-up sampling interval. This is called the initial batch. Based upon the number of failed samples in the initial batch, the spacing is increased (for good seaming), kept the same, or decreased (for poor seaming).

3.3 A second batch size is then determined and the process is continued. Depending on the project size, i.e., the total length of seaming, a number of decision cycles can occur until the project is finished.

3.4 It is seen that the number of samples required for the entire project is either fewer than the start-up frequency (for good seaming); the same as the start-up frequency (for matching the initial anticipated failure percentage); or more than the start-up frequency (for poor seaming).

4. Significance and Use

4.1 Construction quality assurance (CQA) and construction quality control (CQC) organizations, as well as owner/operators and agency regulators can use this guide to vary the sampling interval of geomembrane seam samples (i.e., the taking of field samples for destructive shear and peel testing) from an initial, or start-up, interval. This initial interval is often 1 destructive seam sample in every 150 m (500 ft) of seam length.

4.2 The guide leads to increasing the sampling interval for good seaming practice (hence fewer destructive samples) and to decreasing the sampling interval for poor seaming practice (hence additional destructive samples).

4.3 Use of the guide should provide an incentive for geomembrane installers to upgrade the quality and performance of their field seaming activities. In so doing, the cutting of fewer destructive samples will lead to overall better quality of the entire liner project, since the patching of previously taken destructive samples is invariably of poorer quality than the original seam itself.

Note 3 - It is generally accepted that field patching of areas where destructive samples had been taken using extrusion fillet seaming is less desirable than the original seam, which was made by hot wedge welding.

4.4 Control charts are illustrated in Appendix A, which can be used by geomembrane installers and their construction quality control (CQC) personnel for improvement in overall job quality and identification of poorly performing seaming personnel and/or equipment.

5. Suggested Methodology

Using the concepts embodied in the method of attributes, the following procedure is based on adjustments to sequential sampling.

5.1 Typical Field Situation - In order to begin the process, a project-specific total seam length must be obtained from the installers panel (roll) layout plan. Also, an initial, or start-up, sampling interval must be decided upon. From this information the total number of samples that are required based on the start-up sampling interval can be obtained.

Example 1 - A given project has 54,000 m (180,000 ft) of field seaming. The start-up sampling frequency is 1 sample per 150 m (500 ft). Therefore, the total number of samples required if the start-up interval is kept constant will be:

$$\frac{54,000}{150} = 360 \text{ Samples}$$

5.2 Determination of Initial Batch Size - Using the table shown below, the initial batch size from which to possibly modify the start-up sampling interval is obtained.

TABLE 1. BATCH SIZE DETERMINATION, AFTER ANSI/ASQC Z1.4 [1993]

No. Of Required Samples Based on Initial	No. Of samples Needed (Batch Size)
Or Modified Sampling Interval	To Determine Subsequent Sampling Interval
2-8	2
9-15	3
16-25	5
26-50	8
51-90	13
91-150	20
151-280	32
281-500	50
501-1200	80
1201-3200	125

Example 1 (cont.) - For 360 samples, a batch size of 50 is necessary. As production seaming progresses, these 50 samples are tested (either as they are taken or in a batch) and the number of failures is determined.

5.3 Verification of Start-Up Sampling Interval - A sampling table is now used which separates the number of failures within this initial batch size into three categories: a relatively low number of failures (where the sampling interval can be increased), the anticipated number of failures (where the sampling interval is maintained), or a relatively high number of failures (where the sampling interval should be decreased). Table 2 provides this information that is based upon the operation characteristic (OC) curves of Appendix B.

Example 1 (cont.) - Assuming an anticipated failure percentage of 2% (recall Note - 2), Table 2 results in the three categories shown below:

- 0 or 1 failure out of 50; the sampling interval can be increased
- 2 or 3 failures out of 50; the sampling frequency should remain at 1 sample per 150 m (500 ft)
- 4 or more failures out of 50; the sampling interval should be decreased

TABLE 2. SAMPLING TABLE CONTAINING THE NUMBER OF FAILED SAMPLES TO BE USED FOR INTERVAL

Sampling Interval Modification, see Appendix B for details

No. Of Required Samples Based on Initial or Modified Sampling Interval	No. Of Samples Needed (Batch Size) to Determine Subsequent Sampling Interval	Anticipated Failure Percentage*							
		1%		2%		3%		4%	
		I	D	I	D	I	D	I	D
2-8	2	0	1	0	1	0	1	0	1
9-15	3	0	1	0	1	0	2	0	2
16-25	5	0	1	0	1	0	2	0	2
26-50	8	0	1	0	1	0	2	0	2
51-90	13	0	1	0	2	0	2	0	3
91-150	20	0	2	0	3	1	3	1	4
151-280	32	0	2	1	3	1	4	2	5
281-500	50	0	3	1	4	2	5	3	6
504-1200	80	1	4	2	6	3	7	5	9
1201-3200	125	2	5	4	7	5	9	7	11

No. Of Required Samples Based on Initial or Modified Sampling Interval	No. Of Samples Needed (Batch Size) to Determine Subsequent Sampling Interval	Anticipated Failure Percentage*							
		5%		6%		7%		8%	
		I	D	I	D	I	D	I	D
2-8	2	0	1	0	1	0	2	0	2
9-15	3	0	2	0	1	0	2	0	2
16-25	5	0	2	0	1	0	3	0	3
26-50	8	0	3	0	1	1	3	1	4
51-90	13	1	4	1	2	1	4	1	5
91-150	20	1	5	2	3	2	5	2	6
151-280	32	2	6	3	3	3	7	4	7
281-500	50	4	7	4	4	5	9	6	10
504-1200	80	6	10	7	6	8	12	9	14
1201-3200	125	9	13	10	7	12	17	13	19

No: *To be selected by CQA, owner or regulatory organizations
I = Increase the sampling interval if the number of failed samples found in the batch does not exceed the tabulated value.
D = Decrease the sampling interval if the number of failed samples found in the batch equals or exceeds the tabulated value.

5.4 Modification of Start-Up Sampling Interval - Depending upon the outcome of the previous section, the start-up sampling interval may be modified to a new value which will then require a new batch size to verify the modification. The process is then continued until the project is finished. Two examples will be provided using the above sampling tables both with anticipated failure percentages of 2.0%: Example 2 illustrates good seaming, and Example 3 illustrates poor seaming.

Example 2 - Using the same project seam length and start-up sampling frequency as in the previous example assume that the start-up batch of 50 samples in the previous example had 2-failures. The decision is then to continue at a 1 destructive sample in 150 m (500 ft) sampling interval. Thus the second batch size from Table 1 is again 50 samples, see Table 3. Table 3(a) is in S.I. units and Table 3(b) is in English units. Now assume in the second batch there are no failures. This allows the sampling interval to be increased, e.g., to 1 sample in 180 m (600 ft). From Table 1, the third batch size is then decreased to 32 samples. The process is continued in this manner until the project is concluded. For this hypothetical situation Table 3(a) illustrates that 265 samples (or 266 samples when using the English units in Table 3(b)) are necessary. Note that by using a constant interval of 1 sample in 150 m (500 ft), 360 samples would have been necessary. Also note that the maximum sampling interval was fixed at 310 m (1000 ft).

Note 4 - This example, and the following one, use a changing sampling interval of +/- 20% from the previous value. That is, when good seaming allows for an increase in sampling interval; the progression being from 150, 180, 215, 260 to 310 m (500, 600, 720, 850 to 1000 ft), respectively. A maximum interval of 310 m (1000 ft) is recommended, but clearly this value is at the discretion of the organizations involved. Conversely, poor seaming requires a decrease in sampling interval, the progression being from 150, 120, 100, 80 to 65 m (500, 400, 320, 250 to 200 ft), respectively. A minimum interval of 65 m (200 ft) is recommended, but clearly this decision is also at the discretion of the organizations involved

Table 3(a) - Results of Example 2 (in S.I. Units) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Good" Quality Installer

Batch Number	Sampling Interval (m)	No. Of Remaining Samples Required	Batch Size	Cumulative Distance (m)	Number of Failures	Decision Made
1	150	360	50	7500	2	Stay
2	150	310	50	15000	0	Increase
3	180	217	32	20760	0	Increase
4	215	155	32	27640	2	Stay
5	215	123	20	31940	1	Stay
6	215	103	20	36240	0	Increase
7	260	68	13	39620	1	Stay
8	260	55	13	43000	0	Increase
9	310	35	8	45480	0	Stay
10	310	27	8	47960	0	Stay
11	310	19	5	49510	0	Stay
12	310	14	3	50440	0	Stay
13	310	11	3	51370	0	Stay
14	310	8	2	51990	0	Stay
15	310	6	2	52610	0	Stay
16	310	4	2	53230	0	Stay
17	310	2	2	53850	0	Done

Total Number of tests per 54,000 m of seam project = 265

Table 3(a) - Results of Example 2 (in English Units) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Good" Quality Installer

Batch Number	Sampling Interval (Ft)	No. Of Remaining Samples Required	Batch Size	Cumulative Distance (Ft)	Number of Failures	Decision Made
1	500	360	50	25000	2	Stay
2	500	310	50	50000	0	Increase
3	600	217	32	69200	0	Increase
4	720	155	32	92240	2	Stay
5	720	123	20	106640	1	Stay
6	720	103	20	121040	0	Increase
7	850	68	13	132090	1	Stay
8	850	55	13	143140	0	Increase
9	1000	35	8	151140	0	Stay
10	1000	27	8	159140	0	Stay
11	1000	19	5	164140	0	Stay
12	1000	14	3	169140	0	Stay
13	1000	11	3	172140	0	Stay
14	1000	8	2	174140	0	Stay
15	1000	6	2	176140	0	Stay
16	1000	4	2	178140	0	Stay
17	1000	2	2	179140	0	Done

Total Number of tests per 180,000 ft of seam project = 266

Example 3 - Using the same project seam length and start-up sampling frequency as Example 1, assume that the start-up batch of 50 samples had 3- failures. The decision is then to continue at a 1 destructive sample in 150 m (500 ft) sampling interval. Thus the second batch size is again 50 samples as it was with Example 2, see Table 4. Table 4(a) is in S.I. units and Table 4(b) is in English units. Now assume in the second batch there are 2-failures. The decision is to again continue at a 1 destructive sample in 150 m (500 ft) sampling interval. From Table 1, the third batch size is then decreased to 32 samples. The process is continued in this manner until the project is concluded. For this hypothetical situation Table 4 illustrates that 412 samples are necessary. Note that by a constant interval of 1 sample in 150 m (500 ft), 360 samples would have been necessary. Furthermore, a good seamer (as illustrated in Example 2) would only have had to take 265 samples.

Table 4(a) - 150Results of Example 3 (in S.I. Units) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Poor" Quality Installer

Batch Number	Sampling Interval (m)	No. Of Remaining Samples Required	Batch Size	Cumulative Distance (m)	Number of Failures	Decision Made
1	150	360	50	7500	3	Stay
2	150	310	50	15000	2	Stay
3	150	260	32	19800	2	Stay
4	150	228	32	24600	3	Decrease
5	150	245	32	28440	3	Decrease
6	150	256	32	31640	1	Increase
7	150	186	32	35480	1	Increase
8	150	123	20	38480	2	Stay
9	150	103	20	41480	1	Stay
10	150	83	13	43430	2	Decrease
11	150	88	13	44990	2	Decrease
12	150	90	13	46290	1	Stay
13	150	77	13	47590	1	Stay
14	150	64	13	48890	1	Stay
15	150	51	13	50490	0	Increase
16	150	32	8	51150	1	Stay
17	150	24	5	51750	1	Decrease
18	150	23	5	52250	0	Increase
19	150	15	3	52610	0	Increase
20	150	9	2	52910	1	Decrease
21	150	9	2	53150	1	Decrease
22	150	11	3	53210	0	Increase
23	150	7	2	53390	0	Increase
24	150	5	2	53510	0	Increase
25	150	3	2	53750	0	Done

Total Number of tests per 54,000 m of seam project = 412

Table 4(b) - Results of Example 3 (in English Units) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Poor" Quality Installer

Batch Number	Sampling Interval (Ft)	No. Of Remaining Samples Required	Batch Size	Cumulative Distance (Ft)	Number of Failures	Decision Made
1	500	360	50	25000	3	Stay
2	500	310	50	50000	2	Stay
3	500	260	32	66000	2	Stay
4	500	228	32	82000	3	Decrease
5	400	245	32	94800	3	Decrease
6	320	266	32	105040	1	Increase
7	400	187	32	117840	1	Increase
8	500	124	20	127840	2	Stay
9	500	104	20	137840	1	Stay
10	500	84	13	144340	2	Decrease
11	400	89	13	149540	2	Decrease
12	320	95	13	153700	1	Stay
13	320	82	13	157860	1	Stay
14	320	69	13	162020	1	Stay
15	320	56	13	166180	0	Increase
16	400	35	8	169380	1	Stay
17	400	27	5	171380	1	Decrease
18	320	27	5	172980	0	Increase
19	400	18	3	174180	0	Increase
20	500	12	2	175180	1	Decrease
21	400	12	2	175980	1	Decrease
22	320	13	3	176140	0	Increase
23	400	10	2	176780	0	Increase
24	500	6	2	177140	0	Increase
25	600	5	2	177980	0	Done

Total Number of tests per 54,000 m of seam project = 412

5.5 Summary

This guide illustrates by means of hypothetical examples how a CQA and/or CQC organization can modify the sampling interval for taking destructive samples from a geomembrane-seaming project. It is based on the method of attributes that are common to statistical control methods. The methodology uses sequential sampling to proceed from one decision to the next until the project is complete.

The result in using this guide for the above purpose is to reward good seaming performance by taking fewer destructive samples, and to penalize poor seaming performance by taking additional destructive samples. In the example illustrations, good seaming resulted in taking 265 samples (versus 360), or a decrease of 26% from the originally set constant interval of 1 sample per 150 m (500 ft). Conversely, poor seaming resulted in taking 412 samples (versus 360), or a 14% increase in the originally set constant interval of 1 sample per 150 m (500 ft.) of seam length.

Appendix A - General Principles of Control Charts

In order to control a production process, like the field seaming of geomembranes, it is necessary to identify and quantify characteristics that reflect the quality of the product. Such quality characteristics can be either discrete or continuous variables. For example, the number of pinholes in a sheet of geomembrane is a discrete variable. Variation in the thickness of a sheet of geomembrane, however, is considered to be a continuous variable.

Whether quality characteristics are discrete or continuous, variability in the observed values is unavoidable. In the theory of control charts, this variation is considered due to either random (common) or assignable (special) causes, Wadsworth (1989) and Deming (1982). Random causes are generally smaller, uncontrollable influences that cannot be removed from the process without fundamental changes in the process itself. An assignable cause, however, is an influence considered to be significant, unusual, and capable of being removed form the process. Such causes may be due to human error, variation in raw materials, or the need for machine adjustment.

An important tool used to reduce process variation is the use of control charts. When using control charts, control limits are used to determine whether the variability of the statistic over time appears to be due to random variation only, or if an assignable cause is present. In other words, the purpose of control charts is to establish a "statistical control" of the assignable causes of variation within of a process.

The control chart generally used to monitor conforming or non-conforming data, called attributes, is the p-chart, where "p" stands for the proportion of non-conforming items in the entire population. In the case of inspecting the quality of the seams of field-deployed geomembranes, the p-value would be the historic failure percentage of the installer.

Suppose we have m subgroups (e.g., m different operators, or m different welding machines, or m working days, etc.) of varying sample sizes n_1, n_2, ..., nm. The number of non-conforming (failed) samples in the ith subgroup is Di, i =1, 2, ..., m, so the proportion of non-conforming items (failure rate) in the ith subgroup is as follows:

$$\hat{P}_i = \frac{D_i}{n_i} \quad 1 = 1,2,...,m \tag{A1}$$

For the p-chart, the values of pi are plotted against the subgroup number with a control limit, CL, set at the following:

$$CL = p + 3 \left[\frac{p(1-p)}{n} \right]^{1/2} \tag{A2}$$

Where $\bar{n} = \frac{1}{m}\sum_{i=1}^{m} n_i$ = average sample size.

Two examples follow:

Example A1 - Assume that a seaming project is expected to take 25-days for completion, i.e., m=25. The installer has a historic data indicating that the company's average failure percentage is 2.0%. As the work progresses, the number of destructive seam samples and the respective numbers of failures are listed in tabular form as shown in the following table. Note that the daily failure rates, i.e., , are also shown in the table. The control chart of this project can now be developed.

Subgroup No. (days)	No. Of destructive samples	No. Of failures in subgroup	Failure Percentage P
1	12	0	0.000
2	14	0	0.000
3	9	0	0.000
4	7	0	0.000
5	13	1	0.077
6	15	0	0.000
7	19	1	0.053
8	13	0	0.000
9	14	1	0.071
10	9	0	0.000
11	17	1	0.059
12	16	0	0.000
13	7	0	0.000
14	22	1	0.045
15	18	0	0.000
16	16	0	0.000
17	15	0	0.000
18	16	0	0.000
19	14	0	0.000
20	16	0	0.000
21	22	1	0.045
22	18	0	0.000
23	16	0	0.000
24	9	0	0.000
25	13	1	0.077

Solution: From Equation (B2), the control limit is calculated as follows:

$$CL=0.02+3\left[\frac{0.02(1-0.02)}{360/25}\right]^{1/2}=0.13$$

The control chart can now be obtained by plotting the subgroup failure rate against the subgroup number (i.e., days) along with the control limit, CL = 0.13. The results are shown in the following figure, note that the 2.0% historic failure rate is also shown.

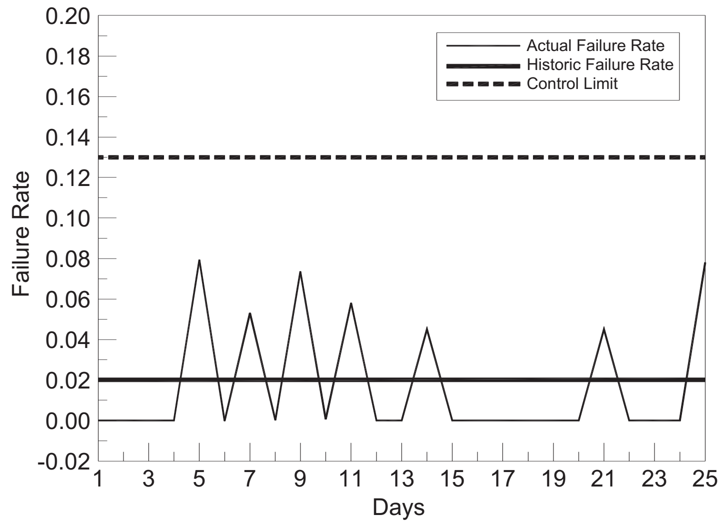


Figure A1 – The Resulted Control Chart of Example A-1.

As seen in the above control chart, the entire 25-day record of the failure rate of this project falls below the control limit set on the basis of the installer's 2.0% historic failure rate. That is to say, the variations in the daily failure record were due to random causes only and no assignable cause was identified. The above control chart indicates that no corrective action is necessary. This is an example of good seaming control.

Example A2 - For a similar size seaming project and historic record (i.e., 2% failure rate) as presented in Example A-1, a second installer has a poorer destructive seam record as shown in the following table. The control chart of this particular situation can also be developed.

Subgroup No. (days)	No. Of destructive samples	No. Of failures in subgroup	Failure Percentage
1	12	1	0.083
2	14	0	0.000
3	9	1	0.111
4	7	0	0.000
5	13	1	0.077
6	15	1	0.067
7	19	3	0.158
8	13	2	0.154
9	14	1	0.071
10	9	0	0.000
11	17	0	0.000
12	16	1	0.063
13	7	1	0.143
14	22	2	0.091
15	18	1	0.056
16	16	2	0.125
17	15	0	0.000
18	16	1	0.063
19	14	0	0.000
20	16	1	0.063
21	22	2	0.091
22	18	1	0.056
23	16	3	0.188
24	9	0	0.000
25	13	1	0.077

Solution: Since the historic failure rate is the same as shown in Example A-1.A new control chart can now be obtained by plotting the subgroup failure rate against the subgroup number (i.e., days) along with the control limit, CL = 0.13. The results are shown in the following figure. Again, the 2.0% historic failure rate is also shown.

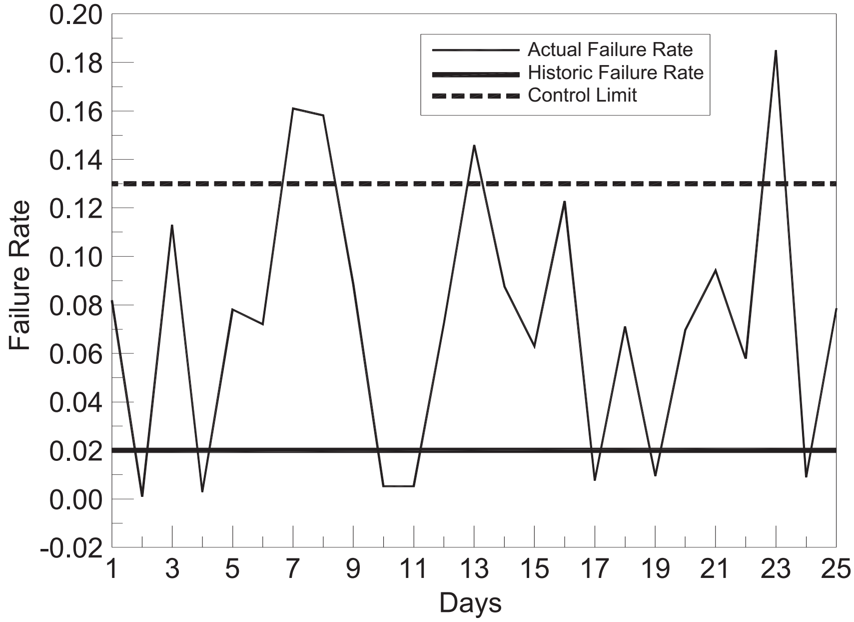


Figure A2 - The Resulted Control Chart of Example A-2.

As seen in the above control chart, the daily failure rates at day 7, 8, 13 and 23 exceed the control limit set on the basis of the installer's 2.0% historic failure rate. That is to say, there are possible assignable causes on those days. From the standpoint of construction quality control, the installer should check the record on those days, identify the cause(s) of such variations, and take necessary corrective actions. This is an example of poor seaming.

GM 14 - Appendix B - The Selection of the "I" and "D" Values

In this appendix, the procedure used for selecting the "I" and "D" values listed in Table 2 is presented. The required background, e.g., the concept of sampling risk and the operating characteristics (OC) curves, are briefly discussed.

Sampling Risk

Sampling involves a degree of risk that the actual samples do not adequately reflect the conditions of the lot. For example, when using the sampling plan recommended in this guide, there are two common risks [see Juran and Gryna (1980) and Juran el. al (1974) for details]:

1. A good seaming practice might be penalized. This is generally referred as the installer's risk and denoted as the risk.
2. A poor seaming practice might go undetected. This is generally referred as an owner/regulators risk and denoted as the risk.

The effects (impacts) of the relative degree of these two risks are summarized in Table B1.

TABLE B1 - THE EFFECTS OF THE RELATIVE DEGREE OF AND RISKS.

Relative	Types of Risks	
Degree	Installers (α) Risk	Owner/Regulators (β) Risk
Low	Loose CQA control; low testing cost	Tight CQA control; high testing cost
High	Tight CQA control; high testing cost	Loose CQA control; low testing cost

Operating Characteristics (OC) Curves

Both of the risks can be quantified by sampling-plan-specific operating characteristics (OC) curves. The OC curve for a sampling plan is a graph that plots the probability that the sampling plan will accept a lot (i.e., the Pa value) versus the percent defective samples in that particular lot. Note that the term "sampling plan" used here corresponds to a batch of "n" destructive testing samples and the criteria for adjusting the sampling interval. Recall Table 2 in the main body of this guide. Figure B1 illustrates the concept of OC curves. In Figure B1, the dashed curve represents an "ideal" OC curve. Here it is desired to accept all lots having less or equal than 2% and reject all lots having greater than 2% failures. In reality, all sampling plans have risks that a "good" lot will be rejected or a "bad" lot will be accepted. This is illustrated by the solid S-shaped curve shown in Figure B1. It is seen that this particular sampling plan will have a 5% risk (100% - 95%) of rejecting a lot having only 1% defects (i.e., a "good" lot) and a 10% risk of accepting a lot having 5% defects (i.e., a "bad" lot).

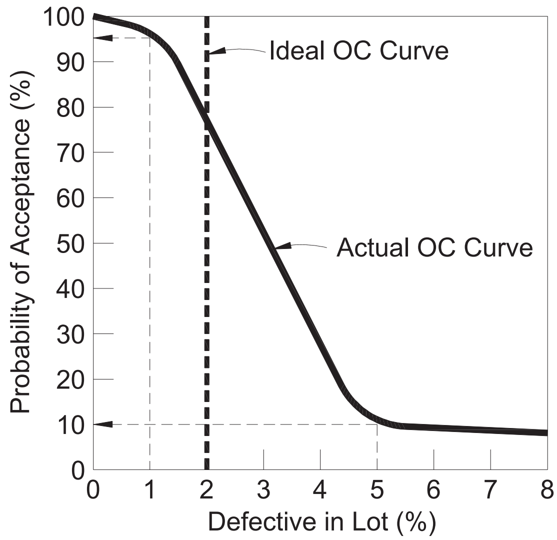


Figure B1 - Ideal and Actual Operating Characteristics Curves for a Sampling Plan

An OC curve can be developed by determining the probability of acceptance for several values of the percent defects. To do so, a statistical distribution of the acceptance probability has to be assumed first. There are three distributions that can be used: hypergeometric, binomial and Poisson distribution. The Poisson distribution is generally preferable due to the ease of calculation. It is used in this guide. The Poisson distribution function to be applied to an acceptance-sampling plan is as follows:

$$P\left(\begin{array}{l}\text{exactly "c" defects}\\ \text{in a batch of size "n"}\end{array}\right) = \frac{e^{-np}(np)^{c}}{c!} \tag{B1}$$

Most statistics books provide Poisson distribution tables that give the probability of "c" or fewer defects in a batch of size "n" from a lot having a fraction of defect "p".

The Selection of the "I" and "D" Values Listed in Table 2

As mentioned earlier, each of the sampling plans recommended in this guide consists of three variables: the batch size "n", the values of "I" and "D". Note that the values of "I" and "D" are specific values of "c" mentioned in Equation B1. The "I" value corresponds to the judgment criterion of rewarding good seaming practice, i.e., increasing the sampling interval if the number of failed samples does not exceed this particular value. The "D" value, on the other hand, corresponds to the judgment criterion of penalizing poor seaming practice, i.e., decreasing the sampling interval if the number of failed samples equals or exceeds this particular value.

The concept of the OC curves is used to determine the actual values of I's and D's for different sampling plans. The criteria used are as follows:

- For a batch of size "n", the "I" value should yield a 80~90% probability of rewarding good seaming practice, i.e., 80% < Pa < 90%.
- For a batch of size "n", the "D" value should yield a risk of 0.5% or less of penalizing

good seaming practice, i.e., Pa >99.5%. In other words, the probability for good seaming practice to be penalized is extremely small, i.e., less than 0.5%.

The above criteria are subjective. Nevertheless, it is felt to be adequate since the rights of both the installer and the owner/regulator are protected. Recognize that a sampling plan with tighter control (i.e., smaller values of "I" and "D") might seem to be more ideal at first glance, but it may result in a significant increase in the required number of destructive tests, i.e., it may be counter productive.

As an illustration, Figure B2 shows the graphic procedure of obtaining the "I" and "D" values for a batch of 50 samples (n=50) and an anticipated failure percentage of 4%. [In other words, it illustrates the procedure of obtaining one particular pair of numbers listed in Table 2, namely, "I" and "D" equal to 3 and 6, respectively.] Note that each OC curve shown in Figure B2 corresponds to a specific "c" value and is obtained via a Poisson distribution table.

Figure B2 can also used to determine the values of "I" and "D" for sampling plans with the same batch size (i.e., n = 50) but different anticipated failure percentage. The rest of the values listed in Table 2 can be verified in a similar manner using OC curves corresponding to different batch sizes.

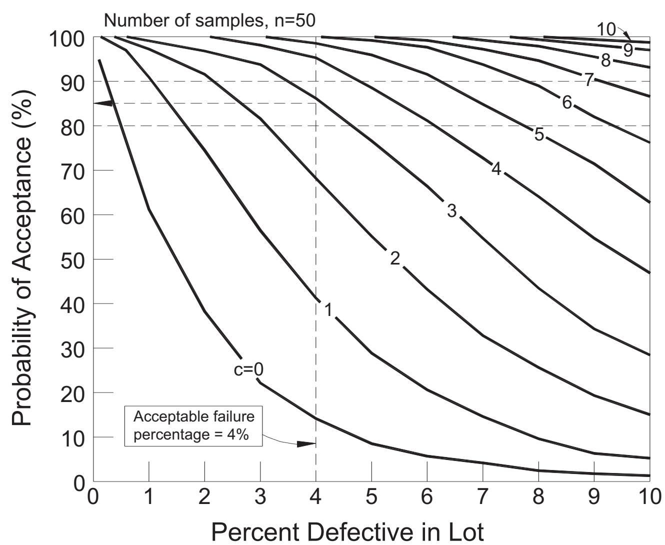


Figure B2 - The Determination of the Values of "I" and "D" for a Batch with 50 Samples and an Anticipated Failure Percentage of 4.0%.

Revision Schedule:

Adopted: March 27,1998

GRI Standard GM17

STANDARD SPECIFICATION FOR TEST PROPERTIES, TESTING FREQUENCY AND RECOMMENDED WARRANTY FOR LINEAR LOW DENSITY POLYETHYLENE (LLDPE) SMOOTH AND TEXTURED GEOMEMBRANES

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers linear low density polyethylene (LLDPE) geomembranes with a formulated sheet density of 0.939 g/ml, or lower, in the thickness range of 0.50 mm (20 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, maximum, or range of physical, mechanical and endurance properties that must be met, or exceeded by the geomembrane being manufactured.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good uniform quality LLDPE geomembranes for use in general applications.

Note 2: Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application. In this situation, interactions with the manufacturers are required.

1.5 This specification also presents a recommended warranty which is focused on the geomembrane material itself.

1.6 The recommended warranty attached to this specification does not cover installation considerations which are independent of the manufacturing of the geomembrane.

Note 3: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

2. Referenced Documents

2.1 ASTM Standards:

D 638	Test Method for Tensile Properties of Plastics
D 792	Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004	Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238	Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505	Test Method for Density of Plastics by the Density-Gradient Technique
D 1603	Test Method for Carbon Black in Olefin Plastics
D 3895	Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis
D 4218	Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199	Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5323	Practice for Determination of 2% Secant Modulus for Polyethylene Geomembranes
D 5994	Test Method for Measuring the Core Thickness of Textured Geomembranes
D 5596	Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5617	Test Method for Multi-Axial Tension Test for Geosynthetics
D 5721	Practice for Air-Oven Aging of Polyolefin Geomembranes GM17 - 3 of 14 rev. 2 - 12/13/00
D 5885	Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry

2.2 GRI Standards:

GM 11	Accelerated Weathering of Geomembranes using a Fluorescent UVA-Condensation Exposure Device
GM 12	Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pages.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications ref. EPA/600/R-93/182.

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project ref. EPA/600/R-93/182.

Linear Low Density Polyethylene (LLDPE), n - A ethylene/ -olefin copolymer having a linear molecular structure. The comonomers used to produce the resin can include hexane, octane, or methyl pentene. LLDPE resins have a natural density in the range of 0.915 to 0.926 g/ml (ref. Pate, T. J. Chapter 29 in Handbook of Plastic Materials and Technology, I.I. Rubin Ed., Wiley,1990).

Formulation, n - The mixture of a unique combination of ingredients identified by type, properties and quantity. For linear low density polyethylene geomembranes, a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

4. Material Classification and Formulation

4.1 This specification covers linear low density polyethylene geomembranes with a formulated sheet density of 0.939 g/ml, or lower. Density can be measured by ASTM D1505 or ASTM D792. If the latter, Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.926 g/ml or lower, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min. This refers to the natural, i.e., nonformulated, resin.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be of the same formulation (or other approved formulation) as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth LLDPE geomembranes and Table 2 is for single and double sided textured LLDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is "soft". It is to be understood that the tables refer to the latest revision of the referenced test methods and practices.

Note 4: There are several tests sometimes included in other LLDPE geomembrane specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693 and D 5397)
- Solvent Vapor Transmission
- Water Absorption
- Ozone Resistance
- Hydrostatic Resistance
- Tensile Impact
- Small Scale Burst

- Wide Width Tensile
- Water Vapor Transmission
- Various Toxicity Tests
- Field Seam Strength

Note 5: There are several tests which are included in this standard (that are not customarily required in other LLDPE geomembrane specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet

Note 6: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Tensile Properties, incl. 2% Secant Modulus
- Puncture Resistance
- Axi-Symmetric Break Resistance Strain
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

Note 7: There are several GRI tests currently included in this standard. Since these topics are not covered in ASTM standards, this is necessary. They are the following:

- UV Fluorescent Light Exposure
- Asperity Height Measurement

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The various properties of the LLDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent, it must be followed in like manner.

Note 8: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively. Communication and interaction with the manufacturer is strongly suggested.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties and hydraulic integrity of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from such defects that would affect the specified properties and hydraulic integrity of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "minimum average."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

9.2 Marking of the geomembrane rolls shall be done in accordance with the manufacturers accepted procedure as set forth in their quality manual.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

English Units

Table 1(a) – Linear Low Density Polyethylene (LLDPE) Geomembrane (SMOOTH)

Properties	Test Method	Test Value								Testing Frequenc (minimum)
		20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness - mils (min. ave.)	D5199	nom.	nom.	nom.	nom.	nom.	nom.	nom.	nom.	per roll
• lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density g/ml (max.)	D 1505/D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	200,00 lb
Tensile Properties *(1)* (min. ave.) • break strength - lb/in. • break elongation - %	D 6693 Type IV	 76 800	 114 800	 152 800	 190 800	 228 800	 304 800	 380 800	 456 800	20,000 lb
2% Modulus – lb/in. (max.)	D 5323	1200	1800	2400	3000	3600	4800	6000	7200	per formulation
Tear Resistance - lb (min. ave.)	D 1004	11	16	22	27	33	44	55	66	45,000 lb
Puncture Resistance - lb (min. ave.)	D 4833	28	42	56	70	84	112	140	168	45,000 lb
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	30	30	30	30	30	30	30	30	per formulation
Carbon Black Content - %	D 1603 *(2)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	45,000 lb
Carbon Black Dispersion	D 5596	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(4)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 200,000 lb
Oven Aging at 85°C *(5)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	 per formulation
UV Resistance *(6)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(8)*	 D 3895 D 5885	 N. R. *(7)* 35	 N.R. *(7)* 35	 N.R. *(7)* 35	 N.R. *(7)* 35	 N.R. *(7)* 35	 N.R. *(7)* 35	 N.R. *(7)* 35	 N.R. *(7)* 35	 per formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Break elongation is calculated using a gage length of 2.0 in. at 2.0 in./min.

(2) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(3) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

(4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(6) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (Metric) Units

Table 1(b) – Linear Low Density Polyethylene (LLDPE) Geomembrane (SMOOTH)

Properties	Test Method	Test Value 0.50 mm	0.75 mm	1.0 mm	1.25 mm	1.50 mm	2.00 mm	2.5 mm	3.0 mm	Testing Frequency (minimum)
Thickness - mm (min. ave.)	D5199	nom.	nom.	nom.	nom.	nom.	nom.	nom.	nom.	per roll
• lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density g/ml (max.)	D 1505/D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	90,000 kg
Tensile Properties *(1)* (min. ave.) • break strength – N/mm • break elongation - %	D 6693 Type IV	13 800	20 800	27 800	33 800	40 800	53 800	66 800	80 800	9,000 kg
2% Modulus – N/mm (max.)	D 5323	210	370	420	520	630	840	1050	1260	per formulation
Tear Resistance - N (min. ave.)	D 1004	50	70	100	120	150	200	250	300	20,000 kg
Puncture Resistance - N (min. ave.)	D 4833	120	190	250	310	370	500	620	750	20,000 kg
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	30	30	30	30	30	30	30	30	per formulation
Carbon Black Content - %	D 1603 *(3)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 kg
Carbon Black Dispersion	D 5596	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(4)* (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 400	100 400	100 400	100 400	100 400	100 400	100 400	100 400	90,000 kg
Oven Aging at 85°C *(5)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	35 60	35 60	35 60	35 60	35 60	35 60	35 60	35 60	per formulation
UV Resistance *(6)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(8)*	D 3895 D 5885	N. R. *(7)* 35	N.R. *(7)* 35	N.R. *(7)* 35	N.R. *(7)* 35	N.R. *(7)* 35	N.R. *(7)* 35	N.R. *(7)* 35	N.R. *(7)* 35	per formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Break elongation is calculated using a gage length of 50 mm at 50 mm/min.

(2) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(3) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

(4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(6) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

English Units

Table 2(a) – Linear Low Density Polyethylene (LLDPE) Geomembrane (TEXTURED)

Properties	Test Method	Test Value								Testing Frequency (minimum)
		20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	GM 12	10	10	10	10	10	10	10	10	Every 2nd rc *(2)*
Density g/ml (max.)	D 1505/D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	200,000 lb
Tensile Properties *(3)* (min. ave.) • break strength – lb/in. • break elongation - %	D 6693 Type IV	30 250	45 250	60 250	75 250	90 250	120 250	150 250	180 250	20,000 lb
2% Modulus – lb/in. (max.)	D 5323	1200	1800	2400	3000	3600	4800	6000	7200	per formulation
Tear Resistance – lb (min. ave.)	D 1004	11	16	22	27	33	44	55	66	45,000 lb
Puncture Resistance – lb (min. ave.)	D 4833	22	33	44	55	66	88	110	132	45,000 lb
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	30	30	30	30	30	30	30	30	per formulation
Carbon Black Content - %	D 1603 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	45,000 lb
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	200,000 lb
Oven Aging at 85°C *(7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	per formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	 D 3895 D 5885	 N. R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	per formulation

(1) Of 10 readings; 8 out of 10 must be 7 mils, and lowest individual reading must be 5 mils
(2) Alternate the measurement side for double sided textured sheet
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Break elongation is calculated using a gage length of 2.0 in. at 2.0 in./min.

(4) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (Metric) Units

Table 2(b) – Linear Low Density Polyethylene (LLDPE) Geomembrane (TEXTURED)

Properties	Test Method	Test Value								Testing Frequency (minimum)
		0.50 mm	0.75 mm	1.0 mm	1.25 mm	1.50 mm	2.00 mm	2.5 mm	3.0 mm	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mm (min. ave.) *(1)*	GM 12	10	10	10	10	10	10	10	10	Every 2nd roll *(2)*
Density g/ml (max.)	D 1505/D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	90,000 kg
Tensile Properties *(3)* (min. ave.) • break strength – N/mm • break elongation - %	D 6693 Type IV	5 250	9 250	11 250	13 250	16 250	21 250	26 250	31 250	9,000 kg
2% Modulus – N/mm (max.)	D 5323	210	370	420	520	630	840	1050	1260	per formulation
Tear Resistance – N (min. ave.)	D 1004	50	70	100	120	150	200	250	300	20,000 kg
Puncture Resistance – N (min. ave.)	D 4833	100	150	200	250	300	400	500	600	20,000 kg
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	30	30	30	30	30	30	30	30	per formulation
Carbon Black Content - %	D 1603 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 kg
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	90,000 kg
Oven Aging at 85°C *(7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	 35 60	per formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	 D 3895 D 5885	 N. R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	 N.R. *(9)* 35	per formulation

(1) Of 10 readings; 8 out of 10 must be ≥ 0.18 mm, and lowest individual reading must be ≥ 0.13 mm
(2) Alternate the measurement side for double sided textured sheet
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Break elongation is calculated using a gage length of 50 mm at 50 mm/min.

(4) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

11. Warranty

11.1 Upon request of the purchaser in the contract or order, a manufacturer's warranty of the quality of the material shall be furnished at the completion of the terms of the contract.

11.2 A recommended warranty for smooth and textured LLDPE geomembranes manufactured and tested in accordance with this specification is given in Appendix A.

11.3 The warranty in Appendix A is for the geomembrane itself. It does not cover subgrade preparation, installation, seaming, or backfilling. These are separate operations that are often beyond the control, or sphere of influence, of the geomembrane manufacturer.

Note 9: If a warranty is required for installation, it is to be developed between the installation contractor and the party requesting such a document.

Adoption and Revision Schedule for GRI Test Method GM17

"Test Properties, Testing Frequency and Recommended Warranted for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes"

Adopted: April 3, 2000

Revision 1: June 28, 2000: added a new Section 5.2 that the numeric tables values are neither MARV nor MaxARV. They are to be interpreted per the designated test method. Also, corrected typographical error of textured sheet thickness test method designation from D5199 to D5994.

Revision 2: December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to "strength" and "elongation".

Revision 3: June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 4.

GRI Test Method GM19*

STANDARD SPECIFICATION FOR SEAM STRENGTH AND RELATED PROPERTIES OF THERMALLY BONDED POLYOLEFIN GEOMEMBRANES

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification addresses the required seam strength and related properties of thermally bonded polyolefin geomembranes; in particular, high density polyethylene (HDPE), linear low density polyethylene (LLDPE) and flexible polypropylene both nonreinforced (fPP) and scrim reinforced (fPP-R).

1.2 Numeric values of seam strength and related properties are specified in both shear and peel modes.

Note 1: This specification does not address the test method details or specific testing procedures. It refers to the relevant ASTM test methods where applicable.

1.3 The thermal bonding methods focused upon are hot wedge (single and dual track) and extrusion fillet.

Note 2: Other acceptable, but less frequently used, methods of seaming are hot air and ultrasonic methods. They are inferred as being a subcategory of hot wedge seaming.

1.4 This specification also suggests the distance between destructive seam samples to be taken in the field, i.e., the sampling interval. However, project-specific conditions will always prevail in this regard.

1.5 This specification is only applicable to laboratory testing.

1.6 This specification does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards

D751 Standard Test Methods for Coated Fabrics

D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

2.2 EPA Standards

EPA 600/2.88/052 (NTIS PB-89-129670)

Lining of Waste Containment and Other Containment Facilities

2.3 NSF Standards

NSF International Standard, Flexible Membrane Liners, NSF 54-1993 (depreciated)

2.4 GRI Standards

GM13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

GM14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes

GM17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

GM18 Test Properties, Testing Frequency and Recommended Warranty for Flexible Polypropylene (fPP and fPP-R) Geomembranes

3. Definition

3.1 Geomembrane, n – An essentially impermeable geosynthetic composed of one or more synthetic sheets used for the purpose of liquid, gas or solid containment.

3.2 Hot Wedge Seaming – A thermal technique which melts the two opposing geomembrane surfaces to be seamed by running a hot metal wedge or knife between them. Pressure is applied to the top or bottom geomembrane, or both, to form a continuous bond. Seams of this type can be made with dual bond tracks separated by a nonbonded gap. These seams are referred to as dual hot wedge seams or double-track seams.

3.3 Hot Air Seaming – This seaming technique introduces high-temperature air or gas between two geomembrane surfaces to facilitate localized surface melting. Pressure is applied to the top or bottom geomembrane, forcing together the two surfaces to form a continuous bond.

3.4 Ultrasonic Seaming - A thermal technique which melts the two opposing geomembrane surfaces to be seamed by running a ultrasonically vibrated metal wedge or knife between them. Pressure is applied to the top or bottom geomembrane, or both, to form a continuous bond. Some seams of this type are made with dual bond tracks separated by a nonbonded gap. These seams are referred to as dual-track seams or double-track seams.

3.5 Extrusion Fillet Seaming – This seaming technique involves extruding molten resin at the edge of an overlapped geomembrane on another to form a continuous bond. A depreciated method called "extrusion flat" seaming extrudes the molten resin between the two overlapped sheets. In all types of extrusion seaming the surfaces upon which the molten resin is applied must be suitably prepared, usually by a slight grinding or buffing.

4. Significance and Use

4.1 The various methods of field fabrication of seams in polyolefin geomembranes are covered in existing ASTM standards mentioned in the referenced document section. What is not covered in those documents is the numeric values of strength and related properties that the completed seam must meet, or exceed. This specification provides this information insofar as minimum, or maximum, property values are concerned when the field fabricated seams are sampled and laboratory tested in shear and peel. The specification also provides guidance as to what spacing intervals the samples should be taken at typical field installation projects.

5. Sample and Specimen Preparation

5.1 The spacing for taking field seam samples for destructive testing is to be 1 per 500 feet (1 per 150 m) of seam length, or as by directed by the construction quality assurance inspector. As the project continues and data is accumulated, however, this sampling interval should be varied according to the procedure set forth in GRI GM14. Following this procedure three different situations can result.

5.1.1 Good seaming with fewer rejected test results than the preset historic average can result in a sequential increase in the spacing interval, i.e., one per greater than 500 ft. (one per greater than 150 m).

5.1.2 Poor seaming with more rejected test results than the preset historic average can result in a sequential decrease in the spacing interval, i.e., one per less than 500 ft. (one per less than 150 m).

5.1.3 Average seaming with approximately the same test results as the preset historic average will result in the spacing interval remaining the same, i.e., one per 500 ft. (one per 150 m).

Note 3: The method of attributes referred to in GRI GM14 is only one of several statistical strategies that might be used to vary sampling frequency. The use of control charts should also be considered in this regard.

5.2 The size of field seam samples is to be according to the referenced test method, e.g., ASTM D6392 or site-specific CQA plan.

5.3 The individual test specimens taken from the field seam samples are to be tested according to the referenced test method, i.e., ASTM D6392 for HDPE, LLDPE and fPP, and ASTM D751 (as modified by NSF 54) for fPP-R. The specimens are to be conditioned prior to testing according to these same test methods and evaluated accordingly.

6. Assessment of Seam Test Results

6.1 HDPE seams – For HDPE seams (both smooth and textured), the strength of four out of five 1.0 inch (25 mm) wide strip specimens in shear should meet or exceed the values given in Tables 1(a) and 1(b). The fifth must meet or exceed 80% of the given values. In addition, the shear percent elongation, calculated as follows, should exceed the values given in Tables 1(a) and 1(b):

$$E = \frac{L}{L_o}(100) \qquad (1)$$

where

E = elongation (%)
L = extension at end of test (in. or mm)
Lo = original average length (usually 1.0 in. or 25 mm)

Note 4: The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

For HDPE seams (both smooth and textured), the strength of four out of five 1.0 in. (25 mm) wide strip specimens tested in peel should meet or exceed the values given in Tables 1(a) and 1(b). The fifth must meet or exceed 80% of the given values.

In addition, the peel separation (or incursion) should not exceed the values given in Tables 1(a) and 1(b). The value shall be based on the proportion of area of separated bond to the area of the original bonding as follows:

$$S = \frac{A}{A_o}(100) \qquad (2)$$

where

S = separation (%)
A = average area of separation, or incursion (in^2 or mm^2)
A0 = original bonding area (in^2 or mm^2)

Note 5: The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%

Extrusion Fillet: AD1, AD2 and AD-WLD (unless strength is achieved)

6.2 LLDPE seams – For LLDPE seams (both smooth and textured), the strength of four out of five 1.0 in. (25 mm) wide strip specimens in shear should meet or exceed the values given in Table 2(a) and 1(b). The fifth must meet or exceed 80% of the given values. In addition, the shear percent elongation, calculated as follows, should exceed the values given in Tables 2(a) and 2(b).

$$E = \frac{L}{L_o}(100) \qquad (1)$$

where

E = elongation (%)
L = extension at end of test (in. or mm)
L_o = original average length (usually 1.0 in. or 25 mm)

Note 4: The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

For LLDPE seams (both smooth and textured), the strength of four out of five 1.0 in. (25 mm) wide strip specimens tested in peel should meet or exceed the values given in Tables 2(a) and 2(b). The fifth must meet or exceed 80% of the given values.

In addition, the peel separation (or incursion) should not exceed the values given in Tables 2(a) and 2(b). The value shall be based on the proportion of area of separated bond to the area of the original bonding as follows:

$$S = \frac{A}{A_o}(100) \qquad (2)$$

where

S = separation (%)
A = average depth of separation, or incursion (in.^{2} or mm^2)
A_o = original bonding distance (in.^{2} or mm^2)

Note 5: The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%

Extrusion Fillet: AD1, AD2, AD-WLD (unless strength is achieved)

6.3 fPP Seams – For fPP seams (both nonreinforced and scrim reinforced), the strength of four out of five specimens in shear should meet or exceed the values given in Tables 3(a) and 3(b). The fifth must meet or exceed 80% of the given values. Note that the unreinforced specimens are 1.0 in. (25 mm) wide strips and the scrim reinforced specimens are 4.0 in. (100 mm) wide grab tests. In addition, the shear percent elongation on the unreinforced specimens, calculated as follows, should exceed the values given in Tables 3(a) and 3(b).

$$E = \frac{L}{L_o}(100) \tag{1}$$

where

E = elongation (%)
L = extension at end of test (in. or mm)
L_o = original gauge length (usually 1.0 in. or 25 mm)

Note 4: The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

Shear elongation is not relevant to scrim reinforced geomembranes and as such is listed as "not applicable" in Table 3(a) and 3(b).

For fPP seams (both nonreinforced and scrim reinforced), the strength of four out of five specimens in peel should meet or exceed the values given in Tables 3(a) and 3(b). The fifth must meet or exceed 80% of the given values. Note that the unreinforced specimens are 1.0 in. (25 mm) wide strips and the scrim reinforced specimens are grab tests. In addition, the peel percent separation (or incursion) should not exceed the values given in Tables 3(a) and 3(b). The values should be based on the proportion of area of separated bond to the area of the original bonding as follows.

$$S = \frac{A}{A_o}(100) \tag{2}$$

where

S = separation in (%)
A = average depth of separation, or incursion (in.^{2} or mm^2)
A_o = original bonding distance (in.^{2} or mm^2)

Note 5: The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%

Extrusion Fillet: AD1, AD2 and AD-WLD (unless strength is achieved)

7. Retest and Rejection

7.1 If the results of the testing of a sample do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the construction quality control or construction quality assurance plan for the particular site under construction.

8. Certification

8.1 Upon request of the construction quality assurance officer or certification engineer, an installer's certification that the geomembrane was installed and tested in accordance with this specification, together with a report of the test results, shall be furnished at the completion of the installation.

Table 1(a) – Seam Strength and Related Properties of Thermally Bonded Smooth and Textured High Density Polyethylene (HDPE) Geomembranes **(English Units)**

Geomembrane Nominal Thickness	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams[1]							
shear strength[2], lb/in.	57	80	100	120	160	200	240
shear elongation at break[3], %	50	50	50	50	50	50	50
peel strength[2], lb/in.	45	60	76	91	121	151	181
peel separation, %	25	25	25	25	25	25	25
Extrusion Fillet Seams							
shear strength[2], lb/in.	57	80	100	120	160	200	240
shear elongation at break[3], %	50	50	50	50	50	50	50
peel strength[2], lb/in.	39	52	65	78	104	130	156
peel separation, %	25	25	25	25	25	25	25

Notes for Tables 1(a) and 1(b):

1. Also for hot air and ultrasonic seaming methods
2. Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing

Table 1(b) – Seam Strength and Related Properties of Thermally Bonded Smooth and Textured High Density Polyethylene (HDPE) Geomembranes **(S.I. Units)**

Geomembrane Nominal Thickness	0.75 mm	1.0 mm	1.25 mm	1.5 mm	2.0 mm	2.5 mm	3.0 mm
Hot Wedge Seams[1]							
shear strength[2], N/25 mm.	250	350	438	525	701	876	1050
shear elongation at break[3], %	50	50	50	50	50	50	50
peel strength[2], N/25 mm	197	263	333	398	530	661	793
peel separation, %	25	25	25	25	25	25	25
Extrusion Fillet Seams							
shear strength[2], N/25 mm	250	350	438	525	701	876	1050
shear elongation at break[3], %	50	50	50	50	50	50	50
peel strength[2], N/25 mm	197	263	333	398	530	661	793
peel separation, %	25	25	25	25	25	25	25

Table 2(a) – Seam Strength and Related Properties of Thermally Bonded Smooth and Textured Linear Low Density Polyethylene (LLDPE) Geomembranes **(English Units)**

Geomembrane Nominal Thickness	20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams[1]								
shear strength[2], lb/in.	30	45	60	75	90	120	150	180
shear elongation[3], %	50	50	50	50	50	50	50	50
peel strength[2], lb/in.	25	38	50	63	75	100	125	150
peel separation, %	25	25	25	25	25	25	25	25
Extrusion Fillet Seams								
shear strength[2], lb/in.	30	45	60	75	90	120	150	180
shear elongation[3], %	50	50	50	50	50	50	50	50
peel strength[2], lb/in.	22	34	44	57	66	88	114	136
peel separation, %	25	25	25	25	25	25	25	25

Notes for Tables 2(a) and 2(b):

1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing

Table 2(a) – Seam Strength and Related Properties of Thermally Bonded Smooth and Textured Linear Low Density Polyethylene (LLDPE) Geomembranes **(S.I. Units)**

Geomembrane Nominal Thickness	0.50 mm	0.75 mm	1.0 mm	1.25 mm	1.5 mm	2.0 mm	2.5 mm	3.0 mm
Hot Wedge Seams[1]								
shear strength[2], N/25 mm	131	197	263	328	394	525	657	788
shear elongation[3], %	50	50	50	50	50	50	50	50
peel strength[2], N/25 mm	109	166	219	276	328	438	547	657
peel separation, %	25	25	25	25	25	25	25	25
Extrusion Fillet Seams								
shear strength[2], N/25 mm	131	197	263	328	394	525	657	788
shear elongation[3], %	50	50	50	50	50	50	50	50
peel strength[2], N/25 mm	109	166	219	276	328	438	547	657
peel separation, %	25	25	25	25	25	25	25	25

Table 3(a) – Seam Strength and Related Properties of Thermally Bonded Nonreinforced and Reinforced Flexible Polypropylene (fPP) Geomembranes **(English Units)**

Geomembrane Nominal Thickness	30 mil-NR	40 mil-NR	36 mil-R[4]	45 mil-R[4]
Hot Wedge Seams[1]				
shear strength[2], lb/in. (NR); lb (R)	25	30	200	200
shear elongation[3], %	50	50	n/a	n/a
peel strength[2], lb/in. (NR); lb (R)	20	25	20	20
peel separation, %	25	25	n/a	n/a
Extrusion Fillet Seams				
shear strength[2], lb/in. (NR); lb (R)	25	30	200	200
shear elongation[3], %	50	50	n/a	n/a
peel strength[2], lb/in. (NR); lb (R)	20	25	20	20
peel separation, %	25	25	n/a	n/a

Notes for Tables 3(a) and 3(b):

1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5^{th} specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing
4. Values are based on grab tensile strength and elongations per D751 for laboratory tested specimens

Table 3(a) – Seam Strength and Related Properties of Thermally Bonded Nonreinforced and Reinforced Flexible Polypropylene (fPP) Geomembranes **(S.I. Units)**

Geomembrane Nominal Thickness	0.75 mm-NR	1.0 mm-NR	0.91 mm-R[4]	1.14 mm-R[4]
Hot Wedge Seams[1]				
shear strength[2], N/25 mm (NR); N (R)	110	130	890	890
shear elongation[3], %	50	50	n/a	n/a
peel strength[2], N/25 mm (NR); N (R)	85	110	90	90
peel separation, %	25	25	n/a	n/a
Extrusion Fillet Seams				
shear strength[2], N/25 mm (NR); N (R)	110	130	890	890
shear elongation[3], %	50	50	n/a	n/a
peel strength[2], N/25 mm (NR); N (R)	85	110	90	90
peel separation, %	25	25	n/a	n/a

1.0 Basic Drawing Tools

1.01 **Line** A straight line from one point to another

1.02 **Pline** A line that can be modified to have width and/or be joined to other lines or polylines.

1.03 **Arc** A curved line, usually with a starting point, middle point and an end point

1.04 **Circle** A perfect circle. Can be defined by radius, diameter, two points or three points.

1.05 **Ellipse** An egg shape, sort of.

1.06 **Polygon** A shape, such as a triangle, that can be made with as many sides as desired.

1.07 **Donut** A thick circle defined with an inner diameter and an outer diameter.

2.0 Basic Modification Tools

2.01 **Move** Command line: move Select objects you want to move, press enter, select a base point, select the point you want to move to.

2.02 **Trim** Command line: trim Select line or object you want to trim to, hit enter, then trim the lines or objects that are to be trimmed.

2.03 **Extend** Command line: extend Select line or object you want to extend to, hit enter, then pick the lines you want extended

2.04 **Hatch** Command line: hatch Pick the hatch you want, look at rotation and scale, associated or not, and then pick how you want to select the area to be hatched. You will need to play with these commands to learn.

2.05 **Explode** Command line: explode This command is used to separate a block or break up a pline. Select the items you want to explode then hit enter.

2.06 **Stretch** Command line: stretch

This command must be started with a crossing window, window the objects you want to stretch, hit enter, provide a base point then stretch to a new point.

It is sometimes helpful to use "snap" setting when using this command.

2.07 **Scale** Command line: scale

Select objects, pick a base point, type in how you want to scale the object. You can also do a reference scaling, Say you have a line in an object that is 6" long and you want it to be 24" long, you input the first dimension and then input the new dimension.

2.08 **Break** Command break:

Select the line you want to break, and then pick the two points you want to open.

2.09 **Break at**

Similar to Break, but you only break at one point.

2.10 **Fillet** Command line: Fillet

Create a fillet by picking two lines. Requires input of the two distances.

2.11 **Radius** Command line: Radius

Creates a radius by picking two lines. Requires inputting a radius. You can radius all corners of a polylines by picking 'polylines' from the side menu.

2.12 **Rotate** Command line: rotate

Pick object to rotate, hit enter, pick a base point, then the angle of rotation.angles are clockwise unless you use a negative, ie.. -90o

2.13 **Mirror** Command Line: mirror

Mirror places an mirror image around a reference line. Pick objects to be mirrored, hit enter, thin pick two points along reference line.

2.14 **Array** Command line: array

Pick objects to array, hit enter, enter number of times you wish to array, then pick the distances between arrays.

2.15 **Polar array** Command line: array p

Same as array but this arrays around a center point. Pick objects, then pick center point, then number of arrays, then the amount of angle, 0 to 360.

3.0 Drawing Commands

3.01 **Offset** Command Line: Offset

Offsets line to a defined distance entered by user.

3.02 **Draw Line w/ Typed Command** Command Line: line

Lines drawn from specific point with typed distance and rotation, ie… @24<45 this draws a line 24" long from a given point at a 45° angle

3.03 **Drawing Lines with Coordinates**
Command Line: line

Lines drawn from two points using given coordinates such are found on customer's drawings. You may enter coordinates in feet or inches. East coordinate goes first. Inches = 10”,10” (enter) 20”,20” always put a comma between east and north

Feet = 10',10' (enter) 20',20'

GSE STANDARD PRODUCTS

Product Data Sheet

GSE Nonwoven Geotextile

GSE Nonwoven Geotextiles is a family of polypropylene, staple fiber, nonwoven, needlepunched geotextiles. Manufactured using an advanced manufacturing and quality system, these products are the most uniform and consistent nonwoven, needlepunched geotextile currently available in the industry. GSE combines a fiber selection and approval system with in-line quality control and a state-of-the-art laboratory to ensure that every roll shipped meets customer specifications. The company has performed extensive performance testing to evaluate suitability of its nonwovens for various applications. GSE Nonwoven Geotextiles are available in a range of weights to meet your specific project needs. *These product specifications meet or exceed GRI GT12, GRI GT13 and AASHTO M288.*

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	NW4	NW6	NW8	NW10	NW12	NW16
Product Code			GEO 0408002	GEO 0608002	GEO 0808002	GEO 1008002	GEO 1208002	GEO 1608002
AASHTO M288 Class			3	2	1	>1	>>1	>>>1
Mass per Unit Area, oz/yd^2 (g/m^2)	ASTM D 5261	90,000 ft^2	4 (135)	6 (200)	8 (270)	10 (335)	12 (405)	16 (540)
Thickness	ASTM D 5199	1/90,000 ft^2	45 mil	70 mil	80 mil	100 mil	110 mil	155 mil
Grab Tensile Strength, lb (N)	ASTM D 4632	90,000 ft^2	120 (530)	170 (755)	220 (975)	260 (1,155)	320 (1,420)	390 (1,735)
Grab Elongation, %	ASTM D 4632	90,000 ft^2	50	50	50	50	50	50
Puncture Strength, lb (N)	ASTM D 4833	90,000 ft^2	60 (265)	90 (395)	120 (525)	165 (725)	190 (835)	240 (1,055)
Trapezoidal Tear Strength, lb (N)	ASTM D 4533	90,000 ft^2	50 (220)	70 (310)	95 (420)	100 (445)	125 (555)	150 (665)
Apparent Opening Size, Sieve No. (mm)	ASTM D 4751	540,000 ft^2	70 (0.212)	70 (0.212)	80 (0.180)	100 (0.150)	100 (0.150)	100 (0.150)
Permittivity, sec^{-1}	ASTM D 4491	540,000 ft^2	1.50	1.50	1.50	1.20	0.80	0.70
Permeability, cm/sec	ASTM D 4491	540,000 ft^2	0.22	0.30	0.30	0.30	0.29	0.27
Water Flow Rate, gpm/ft^2 ($l/min/m^2$)	ASTM D 4491	540,000 ft^2	120 (4,885)	110 (4,480)	110 (4,480)	85 (3,460)	60 (2,440)	50 (2,035)
UV Resistance (% retained after 500 hours)	ASTM D 4355	per formulation	70	70	70	70	70	70
Roll Length[(1)], ft (m)			600 (182)	600 (182)	600 (182)	300 (91)	300 (91)	300 (91)
Roll Width[(1)], ft (m)			15 (4.6)	15 (4.6)	15 (4.6)	15 (4.6)	15 (4.6)	15 (4.6)
Roll Area, ft^2 (m^2)			9,000 (836)	9,000 (836)	9,000 (836)	4,500 (418)	4,500 (418)	4,500 (418)

NOTES:

- The property values listed are in weaker principal direction. All values listed are Minimum Average Roll Values (MARV) except apparent opening size in mm and UV resistance. Apparent opening size (mm) is a Maximum Average Roll Value. UV is a typical value.
- [(1)]Roll lengths and widths have a tolerance of ±1%.

DS037 NW R03/15/06

North America	GSE Lining Technology, Inc.	Houston, Texas	800 435 2008	281 443 8564	Fax: 281 230 8650
South America	GSE Lining Technology Chile S.A.	Santiago, Chile		56 2 595 4200	Fax: 56 2 595 4290
Asia Pacific	GSE Lining Technology Company Limited	Bangkok, Thailand		66 2 937 0091	Fax: 66 2 937 0097
Europe & Africa	GSE Lining Technology GmbH	Hamburg, Germany		49 40 767420	Fax: 49 40 7674234
Middle East	GSE Lining Technology-Egypt	The 6th of October City, Egypt		202 2 828 8888	Fax: 202 2 828 8889

www.gseworld.com

GSE STANDARD PRODUCTS

Product Data Sheet

GSE Nonwoven "Heavyweight" Geotextile

GSE Nonwoven Geotextiles is a family of polypropylene, staple fiber, nonwoven needle punched geotextiles. Manufactured using an advanced manufacturing and quality system, these products are the most uniform and consistent nonwoven needle punched geotextile currently available in the industry. GSE combines a fiber selection and approval system with in-line quality control and a state-of-the-art laboratory to ensure that every roll shipped meets customer specifications. The company has performed extensive performance testing to evaluate suitability of its nonwovens for various applications. GSE Nonwoven Geotextiles are available in a range of weights to meet your specific project needs. *These product specifications meet or exceed GRI GT12.*

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	NW20	NW24	NW28	NW32
Product Code			GEO2008002	GEO2408002	GEO2808002	GEO3208002
Mass per Unit Area, oz/yd^2 (g/m^2)	ASTM D 5261	90,000 ft^2	20 (675)	24 (810)	28 (950)	32 (1,080)
Grab Tensile Strength, lb (N)	ASTM D 4632	90,000 ft^2	450 (1,980)	500 (2,200)	550 (2,420)	600 (2,640)
Grab Elongation, %	ASTM D 4632	90,000 ft^2	50	50	50	50
Puncture Strength, lb (N)	ASTM D 4833	90,000 ft^2	200 (880)	250 (1,100)	300 (1,320)	350 (1,540)
Trapezoidal Tear Strength, lb (N)	ASTM D 4533	90,000 ft^2	125 (550)	200 (880)	250 (1,100)	270 (1,190)
UV Resistance (% retained after 500 hours)	ASTM D 4355	per formulation	70	70	70	70
Roll Length[(1)], ft (m)			200 (61)	200 (61)	200 (61)	200 (61)
Roll Width[(1)], ft (m)			15 (4.6)	15 (4.6)	15 (4.6)	15 (4.6)
Roll Area, ft^2 (m^2)			3,000 (281)	3,000 (281)	3,000 (281)	3,000 (281)

NOTES:

- The property values listed are in weaker principal direction. All values listed are Minimum Average Roll Values (MARV) except UV resistance which is a typical value.
- [(1)]Roll lengths and widths have a tolerance of ±1%.

DS038 NWhw R03/15/06

North America	GSE Lining Technology, Inc.	Houston, Texas	800 435 2008	281 443 8564	Fax: 281 230 8650
South America	GSE Lining Technology Chile S.A.	Santiago, Chile		56 2 595 4200	Fax: 56 2 595 4290
Asia Pacific	GSE Lining Technology Company Limited	Bangkok, Thailand		66 2 937 0091	Fax: 66 2 937 0097
Europe & Africa	GSE Lining Technology GmbH	Hamburg, Germany		49 40 767420	Fax: 49 40 7674234
Middle East	GSE Lining Technology-Egypt	The 6th of October City, Egypt		202 2 828 8888	Fax: 202 2 828 8889

www.gseworld.com

GSE®

Product Data Sheet

GSE STANDARD PRODUCTS

GSE HD

GSE HD is a smooth, high quality, high density polyethylene (HDPE) geomembrane produced from specially formulated, virgin polyethylene resin. This polyethylene resin is designed specifically for flexible geomembrane applications. It contains approximately 97.5% polyethylene, 2.5% carbon black and trace amounts of antioxidants and heat stabilizers; no other additives, fillers or extenders are used. GSE HD has outstanding chemical resistance, mechanical properties, environmental stress crack resistance, dimensional stability and thermal aging characteristics. GSE HD has excellent resistance to UV radiation and is suitable for exposed conditions. *These product specifications meet or exceed GRI GM13.*

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE				
Product Code			HDE 030A000	HDE 040A000	HDE 060A000	HDE 080A000	HDE 100A000
Thickness, (minimum average) mil (mm)	ASTM D 5199	every roll	30 (0.75)	40 (1.00)	60 (1.50)	80 (2.00)	100 (2.50)
Lowest individual reading (-10%)			27 (0.69)	36 (0.91)	54 (1.40)	72 (1.80)	90 (2.30)
Density, g/cm^3	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction)	ASTM D 6693, Type IV	20,000 lb					
Strength at Break, lb/in-width (N/mm)	Dumbell, 2 ipm		114 (20)	152 (27)	228 (40)	304 (53)	380 (67)
Strength at Yield, lb/in-width (N/mm)			63 (11)	84 (15)	126 (22)	168 (29)	210 (37)
Elongation at Break, %	G.L. 2.0 in (51 mm)		700	700	700	700	700
Elongation at Yield, %	G.L. 1.3 in (33 mm)		12	12	12	12	12
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	21 (93)	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	54 (240)	72 (320)	108 (480)	144 (640)	180 (800)
Carbon Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1	+Note 1
Notched Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lb	300	300	300	300	300
REFERENCE PROPERTY	**TEST METHOD**	**FREQUENCY**	**NOMINAL VALUE**				
Oxidative Induction Time, min	ASTM D 3895, 200° C; O_2, 1 atm	200,000 lb	>100	>100	>100	>100	>100
Roll Length[1] (approximate), ft (m)			1,120 (341)	870 (265)	560 (171)	430 (131)	340 (104)
Roll Width[1], ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft^2 (m^2)			25,200 (2,341)	19,575 (1,819)	12,600 (1,171)	9,675 (899)	7,650 (711)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- GSE HD is available in rolls weighing about 3,900 lb (1,769 kg)
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and LTB of <-77° C when tested with ASTM D 746.
- [1]Roll lengths and widths have a tolerance of ± 1%.

DS005 HD R03/09/06

North America	GSE Lining Technology, Inc.	Houston, Texas	800 435 2008	281 443 8564	Fax: 281 230 8650
South America	GSE Lining Technology Chile S.A.	Santiago, Chile		56 2 595 4200	Fax: 56 2 595 4290
Asia Pacific	GSE Lining Technology Company Limited	Bangkok, Thailand		66 2 937 0091	Fax: 66 2 937 0097
Europe & Africa	GSE Lining Technology GmbH	Hamburg, Germany		49 40 767420	Fax: 49 40 7674234
Middle East	GSE Lining Technology-Egypt	The 6th of October City, Egypt		202 2 828 8888	Fax: 202 2 828 8889

www.gseworld.com

P R O D U C T   I N F O R M A T I O N

Bituthene® System 4000

Self-adhesive HDPE waterproofing membrane with super tacky compound for use with patented, water-based System 4000 Surface Conditioner

Advantages

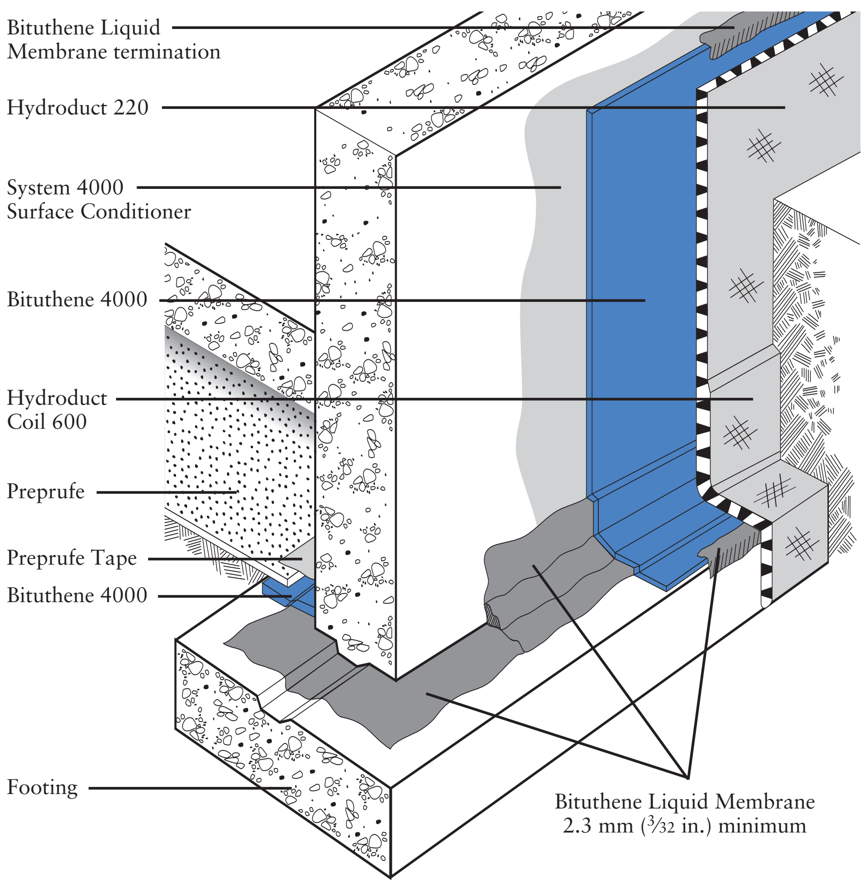
- **Excellent adhesion –** special adhesive compound engineered to work with high tack System 4000 Surface Conditioner
- **Cold applied –** simple application to substrates, especially at low temperatures
- **Reduced inventory and handling costs –** System 4000 Surface Conditioner is included with each roll of membrane
- **Wide application temperature range –** excellent bond to self and substrate from -4°C (25°F) and above
- **Overlap security –** minimizes margin for error under site conditions
- **Cross laminated, high density polyethylene carrier film –** provides high tear strength, puncture and impact resistance
- **Flexible –** accommodates minor structural movements and will bridge shrinkage cracks
- **RIPCORD® –** this Split Release on Demand feature allows the splitting of the membrane into two (2) pieces for ease of installation in detailed areas

Description

Bituthene® System 4000 is a 1.5 mm (1⁄16 in.) flexible, pre-formed waterproof membrane which combines a high performance, cross laminated, HDPE carrier film with a unique, super tacky, self-adhesive rubberized asphalt compound.

System 4000 Surface Conditioner is a unique, water-based, latex surface treatment which imparts an aggressive, high tack finish to the treated substrate. It is specifically formulated to bind site dust and concrete efflorescence, thereby providing a suitable surface for the Bituthene System 4000 Waterproofing Membrane.

Conveniently packaged in each roll of membrane, System 4000 Surface Conditioner promotes good initial adhesion and, more importantly, excellent permanent adhesion of the Bituthene System 4000 Waterproofing Membrane.



GRACE Construction Products

The VOC (Volatile Organic Compound) content of this product is 125 g/L.

Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at www.graceconstruction.com for most current list of allowable limits.

Use

Bituthene is ideal for waterproofing concrete, masonry and wood surfaces where in-service temperatures will not exceed 57°C (135°F). It can be applied to foundation walls, tunnels, earth sheltered structures and split slab construction, both above and below grade. (For above grade applications, see "Above Grade Waterproofing Bituthene System 4000.")

Bituthene is 1.5 mm (1⁄16 in.) thick, 0.9 m (3 ft) wide and 20 m (66.7 ft) long and is supplied in rolls. It is unrolled sticky side down onto concrete slabs or applied onto vertical concrete faces primed with System 4000 Surface Conditioner. Continuity is achieved by overlapping a minimum 50 mm (2 in.) and firmly rolling the joint.

Bituthene is extremely flexible. It is capable of bridging shrinkage cracks in the concrete and will accommodate minor differential movement throughout the service life of the structure.

Application Procedures

Safety, Storage and Handling Information

Bituthene products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at www.graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

Surfaces should be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Concrete must be properly dried (minimum 7 days for normal structural concrete and 14 days for lightweight structural concrete).

If time is critical, Bituthene Primer B2 may be used to allow priming and installation of membrane on damp surfaces or green concrete. Priming may begin in this case as soon as the concrete will maintain structural integrity. Use form release agents which will not transfer to the concrete. Remove forms as soon as possible from below horizontal slabs to prevent entrapment of excess moisture. Excess moisture may lead to blistering of the membrane. Cure concrete with clear, resin-based curing compounds which do not contain oil, wax or pigment. Except with Primer B2, allow concrete to thoroughly dry following rain. Do not apply any products to frozen concrete.

Repair defects such as spalled or poorly consolidated areas. Remove sharp protrusions and form match lines. On masonry surfaces, apply a parge coat to rough concrete block and brick walls or trowel cut mortar joints flush to the face of the concrete blocks.

Temperature

- Apply Bituthene System 4000 Membrane and Conditioner only in dry weather and when air and surface temperatures are -4°C (25°F) or above.
- Apply Bituthene Primer B2 in dry weather above -4°C (25°F). (See separate product information sheet.)

Conditioning

Bituthene System 4000 Surface Conditioner is ready to use and can be applied by spray or roller. For best results, use a pump-type air sprayer with fan tip nozzle, like the Bituthene System 4000 Surface Conditioner Sprayer, to apply the surface conditioner.

Apply Bituthene System 4000 Surface Conditioner to clean, dry, frost-free surfaces at a coverage rate of 7.4 m^2/L (300 ft^2/gal). Coverage should be uniform. Surface conditioner should not be applied so heavily that it puddles or runs. **Do not apply conditioner to Bituthene membrane.**

Allow Bituthene System 4000 Surface Conditioner to dry one hour or until substrate returns to its original color. At low temperatures or in high humidity conditions, dry time may be longer.

Bituthene System 4000 Surface Conditioner is clear when dry and may be slightly tacky. In general, conditioning should be limited to what can be covered within 24 hours. In situations where long dry times may prevail, substrates may be conditioned in advance. Substrates should be reconditioned if significant dirt or dust accumulates.

Before surface conditioner dries, tools should be cleaned with water. After surface conditioner dries, tools should be cleaned with mineral spirits. Mineral spirits is a combustible liquid which should be used only in accordance with manufacturer's recommendations. **Do not use solvents to clean hands or skin.**

Corner Details

The treatment of corners varies depending on the location of the corner. For detailed information on Bituthene Liquid Membrane, see separate product information sheet.

- At wall to footing inside corners –
  Option 1: Apply membrane to within 25 mm (1 in.) of base of wall. Treat the inside corner by installing a 20 mm (3⁄4 in.) fillet of Bituthene Liquid Membrane. Extend Bituthene Liquid Membrane at least 65 mm (2½ in.) onto footing, and 65 mm (2½ in.) onto wall membrane.

  Option 2: Treat the inside corner by installing a 20 mm (3⁄4 in.) fillet of Bituthene Liquid Membrane. Apply 300 mm (12 in.) wide strip of sheet membrane centered over fillet. Apply wall membrane over inside corner and extend 150 mm (6 in.) onto footing. Apply 25 mm (1 in.) wide troweling of Bituthene Liquid Membrane over all terminations and seams within 300 mm (12 in.) of corner.
- At footings where the elevation of the floor slab is 150 mm (6 in.) or more above the footing, treat the inside corner either by the above two methods or terminate the membrane at the base of the wall. Seal the termination with Bituthene Liquid Membrane.

Joints

Properly seal all joints with waterstop, joint filler and sealant as required. Bituthene membranes are not intended to function as the primary joint seal. Allow sealants to fully cure. Pre-strip all slab and wall cracks over 1.5 mm (1⁄16 in.) wide and all construction and control joints with 230 mm (9 in.) wide sheet membrane strip.

Application on Horizontal Surfaces

(Note: Preprufe® pre-applied membranes are strongly recommended for below slab or for any application where the membrane is applied before concreting. See Preprufe product information sheets.)

Apply membrane from the low point to the high point so that laps shed water. Overlap all seams at least 50 mm (2 in.). Stagger all end laps. Roll the entire membrane firmly and completely as soon as possible. Use a linoleum roller or standard water-filled garden roller less than 760 mm (30 in.) wide, weighing a minimum of 34 kg (75 lbs) when filled. Cover the face of the roller with a resilient material such as a 13 mm (½ in.) plastic foam or two wraps of indoor-outdoor carpet to allow the membrane to fully contact the primed substrate. Seal all T-joints and membrane terminations with Bituthene Liquid Membrane at the end of the day.

Protrusions and Drains

Apply membrane to within 25 mm (1 in.) of the base of the protrusion. Apply Bituthene Liquid Membrane 2.5 mm (0.1 in.) thick around protrusion. Bituthene Liquid Membrane should extend over the membrane a minimum of 65 mm (2½ in.) and up the penetration to just below the finished height of the wearing course.

Vertical Surfaces

Apply membrane in lengths up to 2.5 m (8 ft). Overlap all seams at least 50 mm (2 in.). On higher walls apply membrane in two or more sections with the upper overlapping the lower by at least 50 mm (2 in.). Roll all membrane with a hand roller.

Terminate the membrane at grade level. Press the membrane firmly to the wall with the butt end of a hardwood tool such as a hammer handle or secure into a reglet. Failure to use heavy pressure at terminations can result in a poor seal. A termination bar may be used to ensure a tight seal. Terminate the membrane at the base of the wall if the bottom of the interior floor slab is at least 150 mm (6 in.) above the footing. Otherwise, use appropriate inside corner detail where the wall and footing meet.

Membrane Repairs

Patch tears and inadequately lapped seams with membrane. Clean membrane with a damp cloth and dry. Slit fishmouths and repair with a patch extending 150 mm (6 in.) in all directions from the slit and seal edges of the patch with Bituthene Liquid Membrane. Inspect the membrane thoroughly before covering and make any repairs.

Drainage

Hydroduct® drainage composites are recommended for both active drainage and protection of the membrane. See Hydroduct product information sheets.

Protection of Membrane

Protect Bituthene membranes to avoid damage from other trades, construction materials or backfill. Place protection immediately in temperatures above 25°C (77°F) to avoid potential for blisters.

- On vertical applications, use Hydroduct 220 Drainage Composite. Adhere Hydroduct 220 Drainage Composite to membrane with Hydroduct Tape. Alternative methods of protection are to use 25 mm (1 in.) expanded polystyrene or 6 mm (¼ in.) extruded polystyrene that has a minimum compressive strength of 55 kN/m^2 (8 lbs/in.^{2}). Such alternatives do not provide positive drainage to the system.

  If 6 mm (¼ in.) extruded polystyrene protection board is used, backfill should not contain sharp rock or aggregate over 50 mm (2 in.) in diameter. Adhere polystyrene protection board with Hydroduct Tape.
- In mud slab waterproofing, or other applications where positive drainage is not desired and where reinforced concrete slabs are placed over the membrane, the use of 6 mm (¼ in.) hardboard or 2 layers of 3 mm (⅛ in.) hardboard is recommended.

Insulation

Always apply Bituthene membrane directly to primed or conditioned structural substrates. Insulation, if used, must be applied over the membrane. Do not apply Bituthene membranes over lightweight insulating concrete.

Backfill

Place backfill as soon as possible. Use care during backfill operation to avoid damage to the waterproofing system. Follow generally accepted practices for backfilling and compaction. Backfill should be added and compacted in 150 mm (6 in.) to 300 mm (12 in.) lifts.

For areas which cannot be fully compacted, a termination bar is recommended across the top termination of the membrane.

System 4000 Surface Conditioner Sprayer

The Bituthene System 4000 Surface Conditioner Sprayer is a professional grade, polyethylene, pump-type, compressed air sprayer with a brass fan tip nozzle. It has a 7.6 L (2 gal) capacity. The nozzle orifice and spray pattern have been specifically engineered for the optimum application of Bituthene System 4000 Surface Conditioner.

Hold nozzle 450 mm (18 in.) from substrate and squeeze handle to spray. Spray in a sweeping motion until substrate is uniformly covered.

Sprayer should be repressurized by pumping as needed. For best results, sprayer should be maintained at high pressure during spraying.

To release pressure, invert the sprayer and spray until all compressed air is released.

Maintenance

The Bituthene System 4000 Surface Conditioner Sprayer should perform without trouble for an extended period if maintained properly.

Sprayer should not be used to store Bituthene System 4000 Surface Conditioner. The sprayer should be flushed with clean water immediately after spraying. For breaks in the spray operation of one hour or less, invert the sprayer and squeeze the spray handle until only air comes from the nozzle. This will avoid clogging.

Should the sprayer need repairs or parts, call the maintenance telephone number on the sprayer tank (800-323-0620).

Supply

Bituthene System 4000	0.9 m x 20 m roll (18.6 m^2) 3 ft x 66.7 ft (200 ft^2)
Roll weight	38 kg (83 lbs) gross
Palletization	25 rolls per pallet
Storage	Store upright in dry conditions below +35°C (95°F).
System 4000 Surface Conditioner	1 x 2.3 L (0.625 gal) bottle in each roll of System 4000 Membrane
Ancillary Products	
Surface Conditioner Sprayer	7.6 L (2 gal) capacity professional grade sprayer with specially engineered nozzle
Bituthene Liquid Membrane	5.7 L (1.5 gal) pail/125 pails per pallet or 15.1 L (4 gal) pail/ 48 pails per pallet
Hydroduct Tape	2.5 cm x 61.0 m (1 in. x 200 ft) roll/6 rolls per carton
Bituthene Mastic	12 – 0.9 L (30 oz) tubes/carton or 18.9 L (5 gal) pail/36 pails per pallet
Complementary Material	
Hydroduct	See separate data sheets
Equipment by others:	Soft broom, utility knife, brush or roller for priming

Placing Steel

When placing steel over properly protected membrane, use concrete bar supports (dobies) or chairs with plastic tips or rolled feet to prevent damage from sharp edges. Use special care when using wire mesh, especially if the mesh is curled.

Approvals

- City of Los Angeles Research Report RR 24386
- U.S. Department of Housing and Urban Development (HUD) HUD Materials Release 628E

Warranty

Five year material warranties covering Bituthene and Hydroduct products are available upon request. Contact your Grace sales representative for details.

Technical Services

Support is provided by full time, technically trained Grace representatives and technical service personnel, backed by a central research and development staff.

Physical Properties for Bituthene 4000 Membrane

Property	Typical Value	Test Method
Color	Dark gray-black	
Thickness	1.5 mm (1⁄16 in.) nominal	ASTM D3767 – method A
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -32°C (-25°F)	Unaffected	ASTM D1970
Tensile strength, membrane, die C	2240 kPa (325 lbs/in.^{2}) minimum	ASTM D412 modified[1]
Tensile strength, film	34.5 MPa (5,000 lbs/in.^{2}) minimum	ASTM D882 modified[1]
Elongation, ultimate failure of rubberized asphalt	300% minimum	ASTM D412 modified[1]
Crack cycling at -32°C (-25°F), 100 cycles	Unaffected	ASTM C836
Lap adhesion at minimum application temperature	880 N/m (5 lbs/in.)	ASTM D1876 modified[2]
Peel strength	1576 N/m (9 lbs/in.)	ASTM D903 modified[3]
Puncture resistance, membrane	222 N (50 lbs) minimum	ASTM E154
Resistance to hydrostatic head	70 m (210 ft) of water	ASTM D5385
Permeance	2.9 ng/m^{2}sPa (0.05 perms) maximum	ASTM E96, section 12 – water method
Water absorption	0.1% maximum	ASTM D570

Footnotes:

1. The test is run at a rate of 50 mm (2 in.) per minute.
2. The test is conducted 15 minutes after the lap is formed and run at a rate of 50 mm (2 in.) per minute at 5°C (40°F).
3. The 180° peel strength is run at a rate of 300 mm (12 in.) per minute.

Physical Properties for System 4000 Surface Conditioner

Property	Typical Value
Solvent type	Water
Flash point	>60°C (>140°F)
VOC* content	125 g/L
Application temperature	-4°C (25°F) and above
Freeze thaw stability	5 cycles (minimum)
Freezing point (as packaged)	-10°C (14°F)
Dry time (hours)	1 hour**

* Volatile Organic Compound
** Dry time will vary with weather conditions

For Technical Assistance call toll free at 866-333-3SBM (3726).

Visit our web sites at www.graceconstruction.com

W. R. Grace & Co.-Conn. 62 Whittemore Avenue Cambridge, MA 02140

BIT-220E Printed in USA 3/06 FA/LI/4M

GRACE
Construction Products

GRACE

BITUTHENE® LIQUID MEMBRANE

Two component, elastomeric, liquid applied detailing compound for use with Grace waterproofing membranes

Description

Bituthene® Liquid Membrane is a two component, elastomeric, cold applied, trowel grade material designed for a variety of uses with the Grace waterproofing systems. The VOC (Volatile Organic Compound) content is 10 g/L.

Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at www.graceconstruction.com for most current list of allowable limits.

Advantages

- **Liquid applied**—conforms to irregular profiles
- **Waterproof**—resistant to water vapor and water pressure
- **Tough, rubber-like**—flexible and damage resistant
- **Chemically cured**—unaffected by in-service temperature variations
- **Cold applied**—no flame hazard
- **System compatible**—formulated for use with Grace waterproofing membrane systems

Use

Bituthene Liquid Membrane is ideally suited for the following uses:

- Fillet material at inside corners
- Reinforcement material at inside corners
- Flashing material around drains, protrusions, curbs and parapets
- Sealing material at terminations
- Repair material for defects on concrete surfaces
- Flashing material at corners

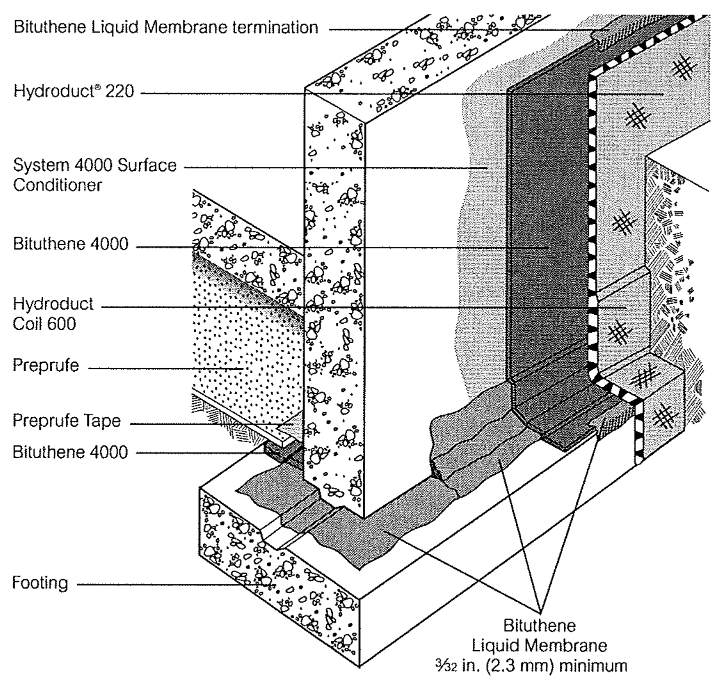
The two parts of Bituthene Liquid Membrane are mixed on site and troweled on to provide a simple and quick waterproofing detailing aid in conjunction with Bituthene, Preprufe® and Procor® systems.

Compatibility

Bituthene Liquid Membrane is completely compatible with Bituthene, Preprufe and Procor, and with existing asphalt or coal tar-based waterproofing materials. It is also compatible with cured silicone and polyurethane sealants. It is not compatible with creosote, pentachlorophenol, linseed oil or polysulfide-based sealants.

Product Advantages

- Liquid applied
- Waterproof
- Tough, rubber-like
- Chemically cured
- Cold applied
- System compatible



Drawings are for illustration purposes only.
Please refer to www.graceconstruction.com for specific application details.

Supply

Bituthene Liquid Membrane (Parts A & B)		
Unit size	1.5 gal (5.7 L)	4 gal (15.1 L)
Weight per unit	16 lbs (8 kg)	44 lbs (20 kg)
Units per pallet	100	24

Physical Properties

Property	Typical Value	Test Method
Color		
Part A	Black	
Part B	Clear	
Mixture of Parts A and B	Black	
Solids content	100%	ASTM D1644
Elongation	250% minimum	ASTM D412
Peel strength	5 lbs/in. (880 N/m) minimum	ASTM D903
Flexibility, 180° bend over 1 in. (25 mm) mandrel at -25°F (-32°C)	Unaffected	ASTM D1970

Application Procedures

Safety, Storage and Handling Information

Bituthene products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at www.graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

All surfaces must be dry and free from dirt, grease, oil, dust or other contaminants. Bituthene Liquid Membrane may be applied at temperatures of 25°F (-4°C) or above. Below 40°F (5°C), store in a warm place before application.

Mixing

Add the entire contents of the Part B container to Part A and mix for 3 to 5 minutes until uniform. Part A is black and Part B is clear. Take care to scrape material from the side and bottom of the containers to assure thorough mixing. A low speed (150 rpm) mechanical mixer with flat paddle blades is required. Do not apply any material if streaks can be seen due to insufficient mixing.

Once mixed, Bituthene Liquid Membrane must be applied by trowel within 1.5 hours. More time is available at lower temperatures. At high temperatures, thickening and curing will be faster. Material that has thickened must be discarded. The material will cure to a very flexible rubber-like material.

Bituthene Liquid Membrane must be applied at a minimum thickness of 3⁄32 in. (2.3 mm) unless otherwise noted on details. In fillet applications, the face of the fillet should be a minimum of ¾ in. (20 mm). In corner flashing application details, it should extend 6 in. (150 mm) in each direction from the corner. Bituthene Liquid Membrane will adhere to primed or unprimed concrete.

Bituthene Liquid Membrane should be allowed to cure at least 24 hours before flood testing.

Coverage

As a fillet material, 1 gal (3.8 L) will cover approximately 100 linear feet (30 m). As a flashing material, 1 gal (3.8 L) will cover approximately 17 ft^2 (1.6 m^2). As a fillet and reinforcement, 1 gal (3.8 L) will cover approximately 14 linear feet (4.3 m).

Cleaning

Clean tools and equipment with mineral spirits before Bituthene Liquid Membrane has cured. Mineral spirits is a combustible liquid and should be used only in accordance with the manufacturer's safety recommendations. Do not use solvents to clean hands or skin.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

GRACE

BIT-230D Printed in USA 3/07
FA/LI/1M

GRACE

BITUTHENE® LIQUID MEMBRANE

Two component, elastomeric, liquid applied detailing compound for use with Grace waterproofing membranes

Description

Bituthene® Liquid Membrane is a two component, elastomeric, cold applied, trowel grade material designed for a variety of uses with the Grace waterproofing systems. The VOC (Volatile Organic Compound) content is 10 g/L.

Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at www.graceconstruction.com for most current list of allowable limits.

Advantages

- **Liquid applied—**conforms to irregular profiles
- **Waterproof—**resistant to water vapor and water pressure
- **Tough, rubber-like—**flexible and damage resistant
- **Chemically cured—**unaffected by in-service temperature variations
- **Cold applied—**no flame hazard
- **System compatible—**formulated for use with Grace waterproofing membrane systems

Use

Bituthene Liquid Membrane is ideally suited for the following uses:

- Fillet material at inside corners
- Reinforcement material at inside corners
- Flashing material around drains, protrusions, curbs and parapets
- Sealing material at terminations
- Repair material for defects on concrete surfaces
- Flashing material at corners

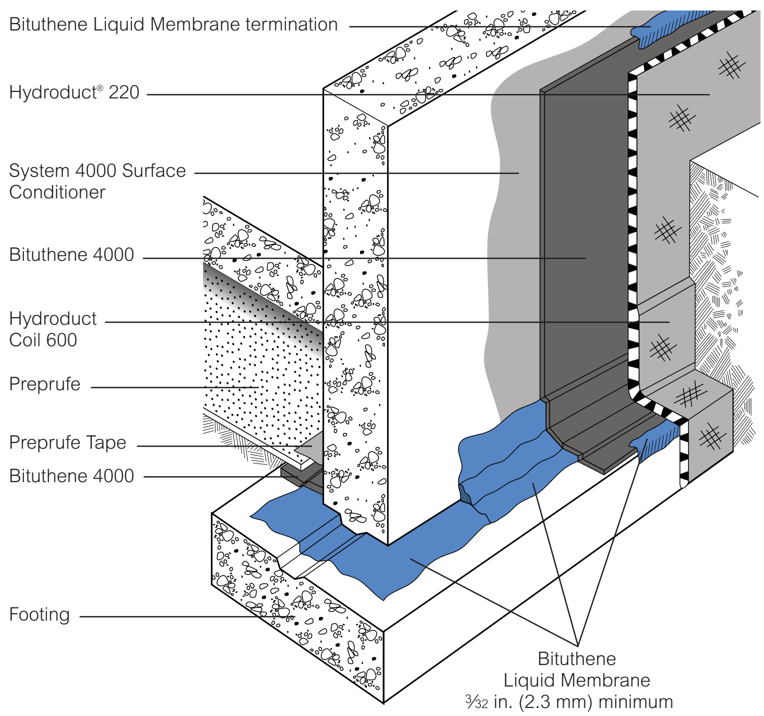
The two parts of Bituthene Liquid Membrane are mixed on site and troweled on to provide a simple and quick waterproofing detailing aid in conjunction with Bituthene, Preprufe® and Procor® systems.

Compatibility

Bituthene Liquid Membrane is completely compatible with Bituthene, Preprufe and Procor, and with existing asphalt or coal tar-based waterproofing materials. It is also compatible with cured silicone and polyurethane sealants. It is not compatible with creosote, pentachlorophenol, linseed oil or polysulfide-based sealants.

Product Advantages

- Liquid applied
- Waterproof
- Tough, rubber-like
- Chemically cured
- Cold applied
- System compatible



Drawings are for illustration purposes only.
Please refer to www.graceconstruction.com for specific application details.

Supply

Bituthene Liquid Membrane (Parts A & B)		
Unit size	1.5 gal (5.7 L)	4 gal (15.1 L)
Weight per unit	16 lbs (8 kg)	44 lbs (20 kg)
Units per pallet	100	24

Physical Properties

Property	Typical Value	Test Method
Color		
Part A	Black	
Part B	Clear	
Mixture of Parts A and B	Black	
Solids content	100%	ASTM D1644
Elongation	250% minimum	ASTM D412
Peel strength	5 lbs/in. (880 N/m) minimum	ASTM D903
Flexibility, 180° bend over 1 in. (25 mm) mandrel at -25°F (-32°C)	Unaffected	ASTM D1970

Application Procedures

Safety, Storage and Handling Information

Bituthene products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at www.graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

All surfaces must be dry and free from dirt, grease, oil, dust or other contaminants. Bituthene Liquid Membrane may be applied at temperatures of 25°F (-4°C) or above. Below 40°F (5°C), store in a warm place before application.

Mixing

Add the entire contents of the Part B container to Part A and mix for 3 to 5 minutes until uniform. Part A is black and Part B is clear. Take care to scrape material from the side and bottom of the containers to assure thorough mixing. A low speed (150 rpm) mechanical mixer with flat paddle blades is required. Do not apply any material if streaks can be seen due to insufficient mixing.

Once mixed, Bituthene Liquid Membrane must be applied by trowel within 1.5 hours. More time is available at lower temperatures. At high temperatures, thickening and curing will be faster. Material that has thickened must be discarded. The material will cure to a very flexible rubber-like material.

Bituthene Liquid Membrane must be applied at a minimum thickness of 3⁄32 in. (2.3 mm) unless otherwise noted on details. In fillet applications, the face of the fillet should be a minimum of ¾ in. (20 mm). In corner flashing application details, it should extend 6 in. (150 mm) in each direction from the corner. Bituthene Liquid Membrane will adhere to primed or unprimed concrete.

Bituthene Liquid Membrane should be allowed to cure at least 24 hours before flood testing.

Coverage

As a fillet material, 1 gal (3.8 L) will cover approximately 100 linear feet (30 m). As a flashing material, 1 gal (3.8 L) will cover approximately 17 ft^2 (1.6 m^2). As a fillet and reinforcement, 1 gal (3.8 L) will cover approximately 14 linear feet (4.3 m).

Cleaning

Clean tools and equipment with mineral spirits before Bituthene Liquid Membrane has cured. Mineral spirits is a combustible liquid and should be used only in accordance with the manufacturer's safety recommendations. Do not use solvents to clean hands or skin.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

BIT-230D Printed in USA 3/07 FA/LI/1M

GRACE

ATTACHMENT 2

RADON AWAY G-501 SPECIFICATIONS

300R Membrane termination. Remove the release liner and roll firmly.

Preprufe 160R to Plaza Deck Waterproofing - Install Preprufe 160R over the prepared vertical surface following the standard vertical application instructions above. Terminate the Preprufe 160R Membrane 6" (150 mm) above the proposed height of the finished wall. Once the wall is poured and properly cured, remove temporary forming and trim the excess Preprufe 160R remaining above the wall. Install the plaza deck waterproofing according to the manufacturer's standard installation procedures. Ensure that the plaza deck waterproofing overlaps the 160R membrane a minimum of 9" (225 mm) and terminate it onto the Preprufe 160R using a bead of Bituthene Liquid Membrane.

Preprufe 160R to Post-Applied Wall Waterproofing - Install Preprufe 160R over the prepared vertical surface following the standard vertical application instructions above. Extend the Preprufe 160R Membrane 12" (300 mm) beyond the end of the blind-side wall. As the foundation wall formwork is installed, fold the 12" (300 mm) piece of Preprufe 160R Membrane to form a sharp corner. Secure it to the inside face of the exterior form panel. Once the wall is poured and cured for seven days, remove the formwork and install the post-applied waterproofing according to the manufacturer's standard installation procedures.

Preprufe 300R Membrane Wall Termination

- Option 1 (Liquid Membrane Detail) - Install Preprufe 300R Membrane over a mud slab as detailed in horizontal applications above. For compacted earth, contact a local Grace representative. Install Preprufe 300R Membrane tight to all vertical and horizontal intersections. At the termination of the membrane, place a 1" (25.4 mm) fillet of Bituthene liquid membrane and trowel a 90 mil (2.2 mm) coating a minimum of 3" (75 mm) onto vertical and horizontal surfaces. Remove the release liner and install a minimum 12" (300 mm) strip of Bituthene Membrane centered over the horizontal termination. Install Preprufe Tape to cover the strip of Bituthene Membrane by overlapping a minimum of 1" (25.4 mm) until a minimum of 2" (51 mm) overlap onto the Preprufe Membrane is achieved. Terminate the top edge of the strip of Bituthene Membrane and Preprufe Tape along the wall with a bead of Bituthene Liquid Membrane.
- Option 2 (Sheet Membrane Detail) - Install Preprufe 300R Membrane over the prepared substrate as detailed in horizontal applications above. Install Preprufe 300R Membrane tight to all vertical and horizontal intersections. Install a minimum 6" (150 mm) strip of Bituthene Membrane on the vertical surface along the joint. Mix and apply Bituthene Liquid Membrane to form a minimum 1" (25.4 mm) continuous fillet between the Preprufe Membrane and the wall. Install Preprufe CJ Tape 6" (150 mm) from the edge of the wall onto the Preprufe Membrane and terminate 2" (51 mm) onto the strip of Bituthene Membrane. Install Preprufe CJ Tape onto the strip of Bituthene Membrane and overlap onto the previous Preprufe CJ Tape a minimum of 2" (51 mm). Terminate the top edge of the strip of Bituthene Membrane and Preprufe Tape along the wall with a bead of Bituthene Liquid Membrane.

Membrane Repair

Inspect the membrane for damage before placement of reinforcing steel, formwork and concrete. Repair small punctures 1/2" (12 mm), or less, and slices by applying Preprufe Tape centered over the damaged area and roll firmly. Remove the release liner from the tape. Repair holes and large punctures by applying a patch of Preprufe membrane, which extends 6" (150 mm) beyond the damaged area. Seal all edges of the patch with Preprufe Tape, remove the release liner from the tape and roll firmly.

CONCRETE PLACEMENT

Lightly soiled membrane should be cleaned with air blower and heavily soiled membrane should be cleaned with a power-washer. Cast concrete within 56 days (42 days in hot climates) of application of the membrane. Concrete must be placed carefully to avoid damage to the membrane. Never use a sharp object to consolidate concrete.

REMOVAL OF FORMWORK

Preprufe Membranes can be applied to removable formwork, such as slab perimeters, elevator and lift pits, etc. Once the concrete is poured, the formwork must remain in place until the concrete has gained sufficient compressive strength to develop the surface bond. Preprufe Membranes are not recommended for conventional twin-sided wall forming systems.

A minimum concrete compressive strength of 1500 psi (10 N/mm^2) is recommended prior to stripping formwork supporting Preprufe Membranes. Premature stripping may result in displacement of the membrane and/or spalling of the concrete.

As a guide, to reach the minimum compressive strength stated above, a structural concrete mix with an ultimate strength of 6000 psi (40 N/mm^2) will typically require a cure time of approximately 6 days at an average ambient temperature of 25 degrees F (-4 degrees C) or 2 days at 70 degrees F (21 degrees C).

6. Availability & Cost

AVAILABILITY

A network of distributors carries Preprufe and Bituthene products for prompt delivery to project sites.

COST

For specific information, contact a local distributor or a Grace Construction Products representative.

7. Warranty

A 5 year material warranty for Preprufe and Bituthene membrane products is available from the manufacturer upon request.

8. Maintenance

Preprufe 300R and Preprufe 160R membranes will not require maintenance when installed in accordance with Grace's recommendations.

9. Technical Services

Support is provided by full-time, technically trained Grace field sales representatives and technical service personnel, backed by a central research and development staff.

10. Filing Systems

- Reed First Source
- Additional product information is available from the manufacturer.

PF-118C Printed in U.S.A. 11/06 AFS/LI/3M

RadonAway™

INSTALLATION INSTRUCTION IN014 Rev G

DynaVac - XP/XR Series		DynaVac - GP Series	
XP101	p/n 23008-1	GP201	p/n 23007-1
XP151	p/n 23010-1	GP301	p/n 23006-1
XP201	p/n 23011-1	GP401	p/n 23009-1
XR261	p/n 23019-1	GP501	p/n 23005-1

1.0 SYSTEM DESIGN CONSIDERATIONS

1.1 INTRODUCTION

The DynaVac GP/XP/XR Series Radon Fans are intended for use by trained, professional Radon mitigators. The purpose of this instruction is to provide additional guidance for the most effective use of a DynaVac Fan. This instruction should be considered as a supplement to EPA standard practices, state and local building codes and state regulations. In the event of a conflict, those codes, practices and regulations take precedence over this instruction.

1.2 ENVIRONMENTALS

The GP/XP/XR Series Fans are designed to perform year-round in all but the harshest climates without additional concern for temperature or weather. For installations in an area of severe cold weather, please contact RadonAway for assistance. When not in operation, the fan should be stored in an area where the temperature is never less than 32 degrees F. or more than 100 degrees F.

1.3 ACOUSTICS

The GP/XP/XR Series Fan, when installed properly, operates with little or no noticeable noise to the building occupants. The velocity of the outgoing air should be considered in the overall system design. In some cases the "rushing" sound of the outlet air may be disturbing. In these instances, the use of a RadonAway Exhaust Muffler is recommended.

1.4 GROUND WATER

In the event that a temporary high water table results in water at or above slab level, water may be drawn into the riser pipes thus blocking air flow to the GP/XP/XR Series Fan. The lack of cooling air may result in the fan cycling on and off as the internal temperature rises above the thermal cutoff and falls upon shutoff. Should this condition arise, it is recommended that the fan be turned off until the water recedes allowing for return to normal operation.

1.5 SLAB COVERAGE

The GP/XP/XR Series Fan can provide coverage up to 2000+ sq. ft. per slab penetration. This will primarily depend on the sub-slab material in any particular installation. In general, the tighter the material, the smaller the area covered per penetration. Appropriate selection of the GP/XP/XR Series Fan best suited for the sub-slab material can improve the slab coverage. The GP & XP series have a wide range of models to choose from to cover a wide range of subslab material. The higher static suction fans are generally used for tighter subslab materials. The XR Series is specifically designed for high flow applications such as stone/gravel and drain tile. Additional suction points can be added as required. It is recommended that a small pit (5 to 10 gallons in size) be created below the slab at each suction hole.

1.6 CONDENSATION & DRAINAGE

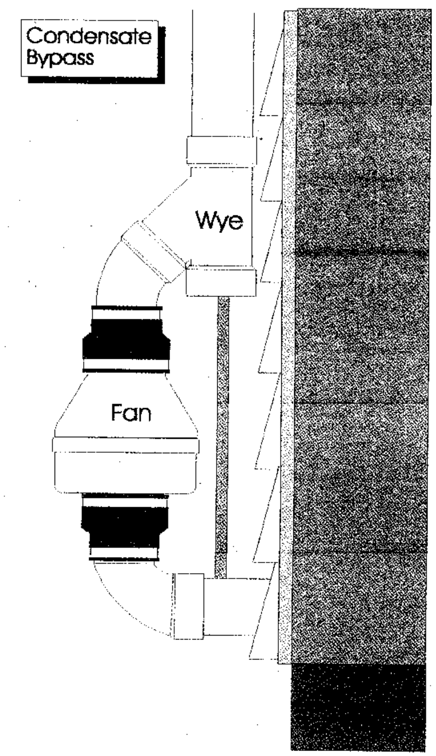
Condensation is formed in the piping of a mitigation system when the air in the piping is chilled below its dew point. This can occur at points where the system piping goes through unheated space such as an attic, garage or outside. The system design must provide a means for water to drain back to a slab hole to remove the condensation. The GP/XP/XR Series Fan **MUST** be mounted vertically plumb and level, with the outlet pointing up for proper drainage through the fan. Avoid mounting the fan in any orientation that will allow water to accumulate inside the fan housing. The GP/XP/XR Series Fans are **NOT** suitable for underground burial.

For GP/XP/XR Series Fan piping, the following table provides the minimum recommended pipe diameter and pitch under several system conditions.

Pipe Dia.	Minimum Rise per Foot of Run* @25 CFM	@50 CFM	@100 CFM
4"	1/8"	1/4"	3/8"
3"	1/4"	3/8"	1 1/2"

*Typical GP/XP/XR Series Fan operational flow rate is 25 - 90 CFM. (For more precision, determine flow rate by using the chart in the addendum.)

Under some circumstances in an outdoor installation a condensate bypass should be installed in the outlet ducting as shown. This may be particularly true in cold climate installations which require long lengths of outlet ducting or where the outlet ducting is likely to produce large amounts of condensation because of high soil moisture or outlet duct material. Schedule 20 piping and other thin-walled plastic ducting and Aluminum downspout will normally produce much more condensation than Schedule 40 piping.



The bypass is constructed with a 45 degree Wye fitting at the bottom of the outlet stack. The bottom of the Wye is capped and fitted with a tube that connects to the inlet piping or other drain. The condensation produced in the outlet stack is collected in the Wye fitting and drained through the bypass tube. The bypass tubing may be insulated to prevent freezing.

1.7 "SYSTEM ON" INDICATOR

A properly designed system should incorporate a "System On" Indicator for affirmation of system operation. A manometer, such as a U-Tube, or a vacuum alarm is recommended for this purpose.

1.8 ELECTRICAL WIRING

The GP/XP/XR Series Fans operate on standard 120V 60 Hz. AC. All wiring must be performed in accordance with the National Fire Protection Association's (NFPA)"National Electrical Code, Standard #70"-current edition for all commercial and industrial work, and state and local building codes. All wiring must be performed by a qualified and licensed electrician. Outdoor installations require the use of a U.L. listed watertight conduit. Ensure that all exterior electrical boxes are outdoor rated and properly sealed to prevent water penetration into the box. A means, such as a weep hole, is recommended to drain the box.

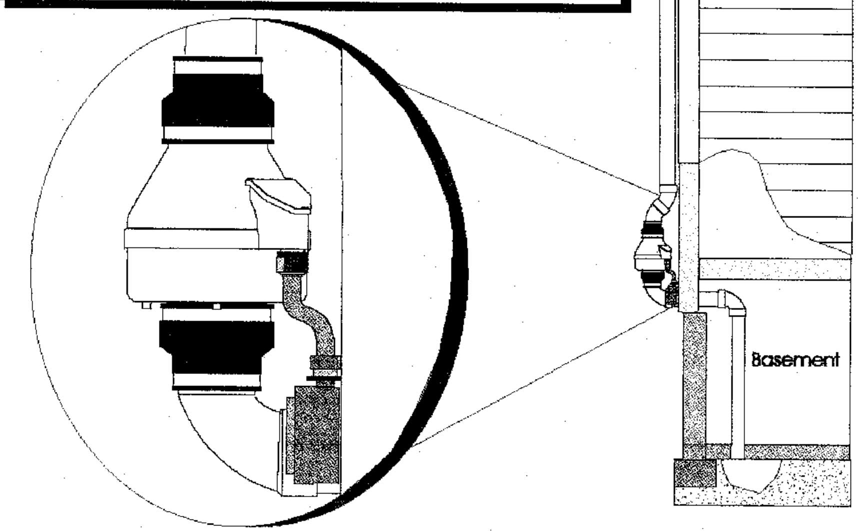
1.9 SPEED CONTROLS

The GP/XP/XR Series Fans are rated for use with electronic speed controls ,however, they are generally not recommended.

2.0 INSTALLATION

The GP/XP/XR Series Fan can be mounted indoors or outdoors. (It is suggested that EPA recommendations be followed in choosing the fan location.) The GP/XP/XR Series Fan may be mounted directly on the system piping or fastened to a supporting structure by means of optional mounting bracket.

Typical GP/XP/XR Outdoor Installation

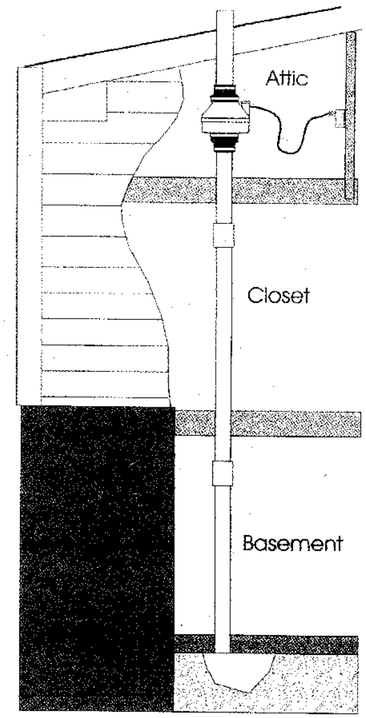


2.1 MOUNTING

Mount the GP/XP/XR Series Fan vertically with outlet up. Insure the unit is plumb and level. When mounting directly on the system piping assure that the fan does not contact any building surface to avoid vibration noise.

2.2 MOUNTING BRACKET (optional)

The GP/XP/XR Series fan may be optionally secured with the integral mounting bracket on the GP Series fan or with RadonAway P/N 25007-2 mounting bracket for an XP/XR Series fan. Foam or rubber grommets may also be used between the bracket and mounting surface for vibration isolation.



2.3 SYSTEM PIPING

Complete piping run, using flexible couplings as means of disconnect for servicing the unit and vibration isolation.

2.4 ELECTRICAL CONNECTION

Connect wiring with wire nuts provided, observing proper connections(See Section 1.8):

Fan Wire	Connection
Green	Ground
Black	AC Hot
White	AC Common

2.5 VENT MUFFLER (optional)

Install the muffler assembly in the selected location in the outlet ducting. Solvent weld all connections. The muffler is normally installed at the end of the vent pipe.

2.6 OPERATION CHECKS

_____ **Verify** all connections are tight and **leak-free**.

_____ **Insure** the GP/XP/XR Series Fan and all ducting is secure and vibration-free.

_____ **Verify** system vacuum pressure with manometer. **Insure** vacuum pressure is **less than** maximum recommended operating pressure
(Based on sea-level operation, at higher altitudes reduce by about 4% per 1000 Feet.)
(Further reduce Maximum Operating Pressure by 10% for High Temperature environments)
See Product Specifications. If this is exceeded, increase the number of suction points.

_____ **Verify Radon levels by testing to EPA protocol.**

XP/XR SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the XP & XR Series Fan:

	Typical CFM Vs Static Suction "WC								
	0"	.25"	.5"	.75"	1.0"	1.25"	1.5"	1.75"	2.0"
XP101	125	118	90	56	5	-	-	-	-
XP151	180	162	140	117	78	46	10	-	-
XP201	150	130	110	93	74	57	38	20	-
XR261	250	215	185	150	115	80	50	20	-

Maximum Recommended Operating Pressure*		
XP101	0.9" W.C.	(Sea Level Operation)**
XP151	1.3" W.C.	(Sea Level Operation)**
XP201	1.7" W.C.	(Sea Level Operation)**
XR261	1.6" W.C.	(Sea Level Operation)**

*Reduce by 10% for High Temperature Operation
**Reduce by 4% per 1000 feet of altitude

Power Consumption @ 120 V AC	
XP101	40 - 49 watts
XP151	45 - 60 watts
XP201	45 - 66 watts
XR261	65 - 105 watts

XP Series Inlet/Outlet: 4.5" OD (4.0" PVC Sched 40 size compatible)
XR Series Inlet/Outlet: 5.875" OD
Mounting: Mount on the duct pipe or with optional mounting bracket.
Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe
Storage temperature range: 32 - 100 degrees F.
Normal operating temperature range: -20 - 120 degrees F.
Maximum inlet air temperature: 80 degrees F.
Size: 9.5H" x 8.5" Dia.
Weight: 6 lbs. (XR261 - 7 lbs)
Continuous Duty
Thermally protected
Class B Insulation
3000 RPM
Residential Use Only
Rated for Indoor or Outdoor use

LISTED Electric Fan 77728 Tested to UL Std. 507

GP SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the GPx01 Series Fan:

	Typical CFM Vs Static Suction "WC						
	1.0"	1.5"	2.0"	2.5"	3.0"	3.5"	4.0"
GP501	95	87	80	70	57	30	5
GP401	93	82	60	38	12	-	-
GP301	92	77	45	10	-	-	-
GP201	82	58	5	-	-	-	-

Maximum Recommended Operating Pressure*		
GP501	3.8" W.C.	(Sea Level Operation)**
GP401	3.0" W.C.	(Sea Level Operation)**
GP301	2.4" W.C.	(Sea Level Operation)**
GP201	1.8" W.C.	(Sea Level Operation)**

*Reduce by 10% for High Temperature Operation
**Reduce by 4% per 1000 feet of altitude

Power Consumption @ 120 V AC	
GP501	70 - 140 watts
GP401	60 - 110 watts
GP301	55 - 90 watts
GP201	40 - 60 watts

Inlet/Outlet: 3.5" OD (3.0" PVC Sched 40 size compatible)
Mounting: Fan may be mounted on the duct pipe or with integral flanges.
Weight: 12 lbs.
Size: 13H" x 12.5" x 12.5"
Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe
Storage temperature range: 32 - 100 degrees F.
Normal operating temperature range: -20 - 120 degrees F.
Maximum inlet air temperature: 80 degrees F.
Continuous Duty
Class B Insulation
3000 RPM
Thermally protected
Rated for Indoor or Outdoor Use

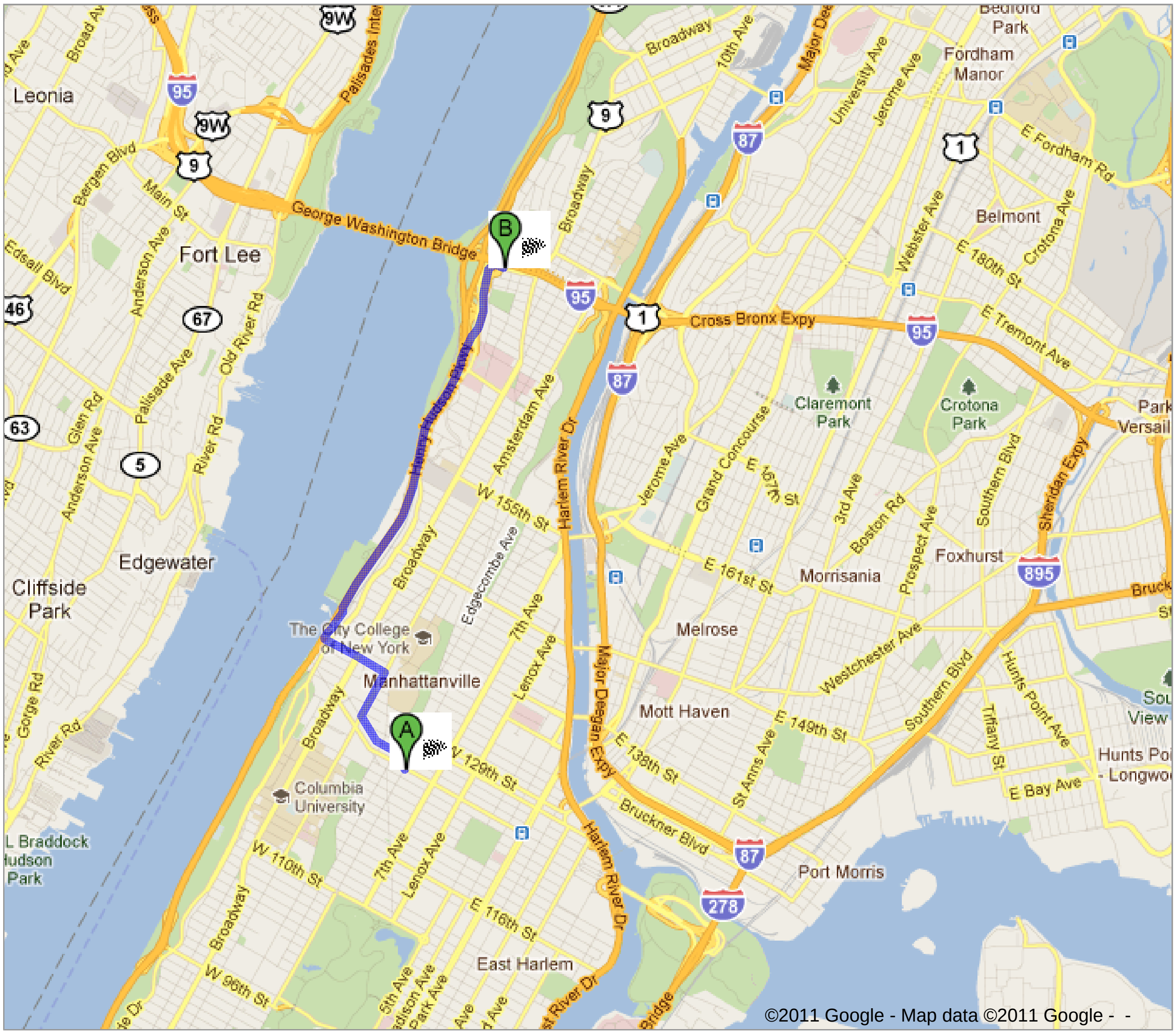
LISTED Electric Fan 77728 Tested to UL Std. 507

Addendum 8

Truck Route

Google maps

To see all the details that are visible on the screen, use the "Print" link next to the map.



Driving directions to George Washington Bridge, New York, NY

2329 Frederick Douglass Blvd
New York, NY 10027

1. Head **northeast** on **8th Ave/Frederick Douglass Blvd** toward **W 125th St/Dr Martin Luther King Jr Blvd**
   328 ft
2. Take the 2nd left onto **W 126th St**
   0.4 mi
3. Turn right onto **Amsterdam Ave**
   0.3 mi
4. Turn left onto **W 133rd St**
   0.4 mi
5. Turn right onto the **Newyork 9A N/H. Hudson Pkwy** ramp
   0.2 mi
6. Merge onto **New York 9A N**
   1.5 mi
7. Take exit **14** for **I-95/George Washington Bridge** toward **Cross Bronx Expy/W 178 St**
   0.4 mi
8. Follow signs for **I-95 N/Cr Bronx Expy**
   0.2 mi
9. Keep right at the fork, follow signs for **West 178 Street**
   240 ft

George Washington Bridge
New York, NY

Google maps

Directions to George Washington Bridge, New York, NY
3.4 mi – about **9 mins**

2329 Frederick Douglass Blvd, New York, NY 10027

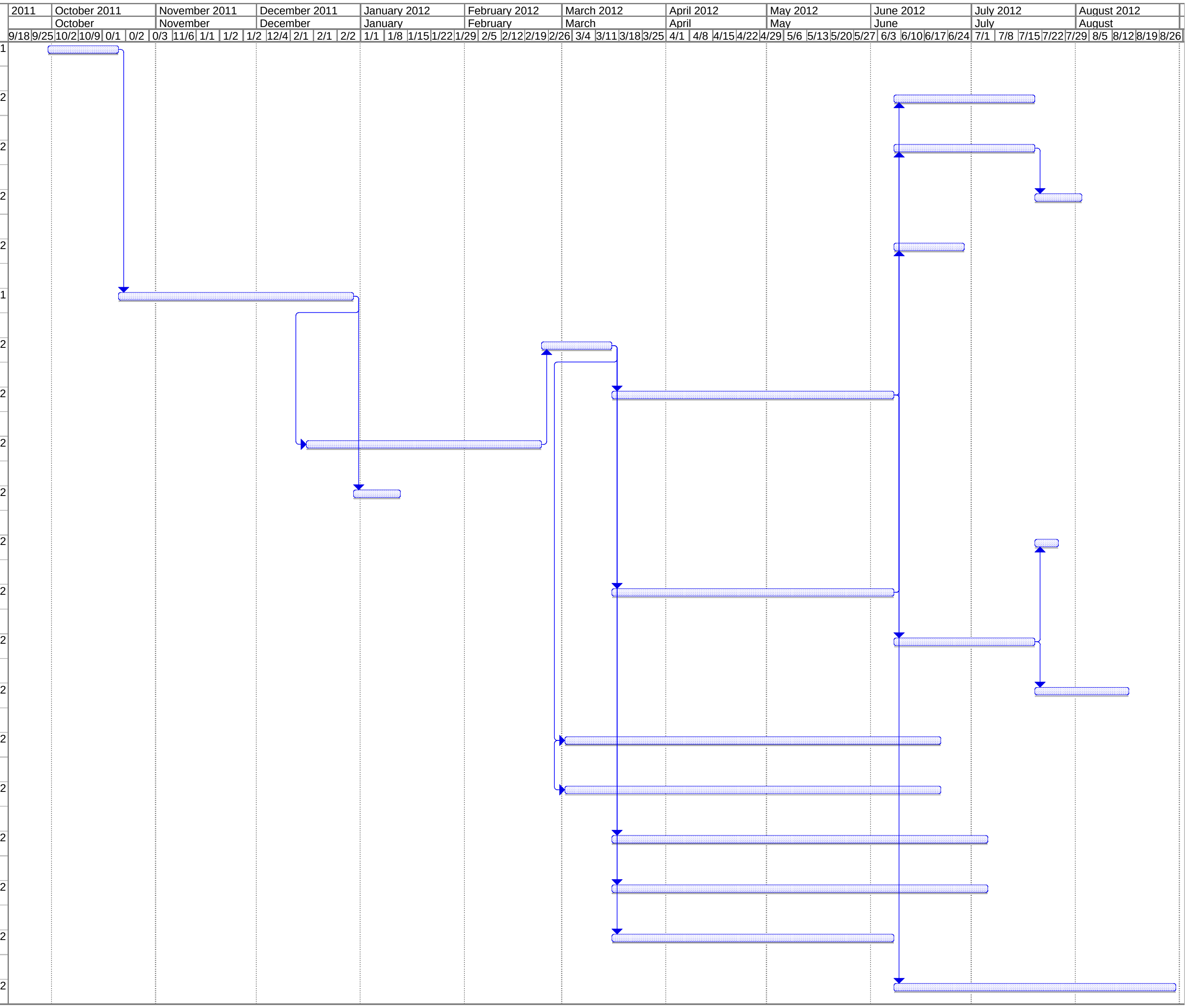
1. Head **northeast** on **8th Ave/Frederick Douglass Blvd** toward **W 125th St/Dr Martin Luther King Jr Blvd**	go 328 ft total 328 ft
2. Take the 2nd left onto **W 126th St** About 1 min	go 0.4 mi total 0.4 mi
3. Turn right onto **Amsterdam Ave** About 1 min	go 0.3 mi total 0.7 mi
4. Turn left onto **W 133rd St** About 2 mins	go 0.4 mi total 1.1 mi
5. Turn right onto the **Newyork 9A N/H. Hudson Pkwy** ramp	go 0.2 mi total 1.3 mi
9A 6. Merge onto **New York 9A N** About 2 mins	go 1.5 mi total 2.8 mi
7. Take exit **14** for **I-95/George Washington Bridge** toward **Cross Bronx Expy/W 178 St**	go 0.4 mi total 3.1 mi
8. Follow signs for **I-95 N/Cr Bronx Expy**	go 0.2 mi total 3.3 mi
9. Keep right at the fork, follow signs for **West 178 Street**	go 240 ft total 3.4 mi

George Washington Bridge, New York, NY

Addendum 9

Updated Project Schedule

ID	Task Name	Duration	Start	Finish
1	EARTHWORK/ EXCAVATION	3 wks	Fri 9/30/11	Thu 10/20/11
2				
3	SIDEWALKS	6 wks	Fri 6/8/12	Thu 7/19/12
4				
5	CURBS	6 wks	Fri 6/8/12	Thu 7/19/12
6				
7	ASPHALT	2 wks	Fri 7/20/12	Thu 8/2/12
8				
9	FENCE PVC,2 GATES	3 wks	Fri 6/8/12	Thu 6/28/12
10				
11	CAST IN CONCRETE	10 wks	Fri 10/21/11	Thu 12/29/11
12				
13	SLAB	3 wks	Fri 2/24/12	Thu 3/15/12
14				
15	MASONRY	12 wks	Fri 3/16/12	Thu 6/7/12
16				
17	STRUCTURAL STEEL	10 wks	Fri 12/16/11	Thu 2/23/12
18				
19	ROOFING	2 wks	Fri 12/30/11	Thu 1/12/12
20				
21	DOORS	1 wk	Fri 7/20/12	Thu 7/26/12
22				
23	STORE FRONT	12 wks	Fri 3/16/12	Thu 6/7/12
24				
25	DRYWALL/TAPING/INSULATIC	6 wks	Fri 6/8/12	Thu 7/19/12
26				
27	CERAMIC/QUARRY TILE	4 wks	Fri 7/20/12	Thu 8/16/12
28				
29	PLUMBING & SERVICES	16 wks	Fri 3/2/12	Thu 6/21/12
30				
31	FIRE PROTECTION	16 wks	Fri 3/2/12	Thu 6/21/12
32				
33	HVAC	16 wks	Fri 3/16/12	Thu 7/5/12
34				
35	ELECTRIC	16 wks	Fri 3/16/12	Thu 7/5/12
36				
37	FIRE ALARM	12 wks	Fri 3/16/12	Thu 6/7/12
38				
39	Conveying Systems	12 wks	Fri 6/8/12	Thu 8/30/12



Project: Project1
Date: Thu 9/1/11

125th St

Task		Progress		Summary		External Tasks		Split
Split		Milestone		Project Summary		External MileTask		