D. "C" clamps for hangers on pipes will not be permitted unless installed with safety straps.

E. Maximum spacing of hangers on horizontal runs of pipe, having no concentrations of weight, shall be as follows:

SCHEDULE
Hanger Spacing for Various Pipes

Pipe Size (inches)	Spacing (feet)
1	7
1-1/4	10
1-1/2	10
2	10
2-1/2	10
3	12
3-1/2	12
4	10
6	8
8	8

F. Where Codes having jurisdiction require closer spacing, the hanger spacing shall be as required by Code in lieu of the distance specified herein.

G. Provide hangers at a maximum distance of two feet (2') from all changes in direction (horizontal and vertical) on both sides of concentrated loads independent of the piping.

H. Hangers, in general, for all horizontal piping shall be adjustable clevis type hangers.

I. All vertical drops and runout pipes shall be supported by extension style, split ring type hangers.

J. All horizontal piping shall be suspended from the building by mild steel rod connecting the pipe hanger to inserts, angle brackets and lag screws, as required by the building construction in accordance with the following table:

Pipe Size (inches)	Rod Diameter (inches)
1 - 3	3/8
3 - 6	1/2

K. Hanger rods for other installations shall be sized in accordance with recommended load capacities of Specification A.S.T.M. Designation A-107, latest amendment.

L. Remove rust from all ferrous hanger equipment (hangers, rods and bolts) and apply one (1) coat of rust inhibiting paint immediately after erection.

M. All piping installed under this Section of the Specifications shall be independently supported from the building structure and not from the piping, ductwork or conduit of other trades. All supplementary steel required to meet requirements specified herein shall be furnished and installed by this Contractor.

N. In areas where support of the pipe by hangers is not possible or feasible, piping shall be supported by an adjustable pipe roll stand with base plate equal to Figure 274, as manufactured by Grinnel Corporation. This installation method shall be done in accordance with the requirements of all pertinent Codes.

O. All supplementary steel throughout the project for this Section of the Specifications, both suspended and floor mounted, shall be furnished and installed by the Fire Protection Contractor and shall be subject to the approval of the Architect.

P. All piping shall have seismic restraints in accordance with NFPA #13 and the State Building Code. A letter of compliance signed by a registered structural engineer confirming that pipe hangers meet State Seismic Code requirements.

2.06 SLEEVES AND INSERTS

A. This Contractor shall be held responsible for the location of and maintaining in proper position, of sleeves, inserts and anchor bolts supplied and/or set in place by him. In the event that failure to do so requires cutting and patching of finished work, it shall be done at this Contractor's expense by the General Contractor.

B. All pipes passing through walls or partitions shall be provided with sleeves having an internal diameter one inch (1") larger than outside diameter of the pipe.

C. Unless otherwise indicated and/or specified herein, all sleeves through masonry floors or interior masonry walls shall be Schedule 40 black steel pipe, set flush with finished wall or set one inch (1") above finished floor surfaces, or as indicated on the architectural drawings.

D. Sleeves through interior non-masonry partitions shall be 22 gauge galvanized sheet steel, set flush with finished surfaces of the partitions.

E. Sleeves through interior walls adjacent to all building expansion joints shall be two (2) pipe size diameters larger than diameter of pipe.

F. Sleeves passing through lightproof or soundproof walls, floors and partitions and through firewalls shall be made tight, using approved caulking materials.

2.07 ESCUTCHEONS

A. Escutcheons shall be installed around all exposed bare pipe. Escutcheons shall be of sufficient outside diameters to cover the sleeve opening and shall fit snugly around the bare pipe.

B. Escutcheons shall be cast brass, grey primed finish and provided with a set-screw to properly hold escutcheons in place.

2.08 SPRINKLER HEADS

A. All sprinkler heads shall be of 1/2 inch nominal orifice size. Heads shall be listed by Underwriters' Laboratories, Inc. and approved by Factory Mutual.
All heads shall be manufactured by a single manufacturer.

B. All heads shall have a temperature rating of 165°F unless the distance from a heat source or location of head warrants, by Code, a head of another degree rating.

C. The following sprinkler heads shall be installed in the areas outlined, unless noted otherwise:
- Sprinkler heads in spaces without ceilings or in unfinished spaces shall be of the upright type, of brass, with deflectors and fusible links. In the event that conditions prohibit upright heads, pendant heads may be installed provided they are equipped with guard cages.
- Sprinkler heads in finished areas with hung ceilings shall be pendant type and shall be recessed white finished brass heads with deflectors, fusible links and white escutcheons plates unless the sprinkler head is located near a surface-mounted light fixture, beam or similar device. In these instances, sprinkler heads shall be surface mounted pendant units. All heads in any single room or area shall be of the same type.

2.09 SPARE SPRINKLER HEADS AND CABINETS

A. The Fire Protection Contractor shall furnish and install in the building, where directed by the Architect, a red metal cabinet containing spare sprinkler heads and wrenches.

B. The cabinets shall have shelves for storing the spare heads in an orderly manner. The shelf spaces shall be subdivided to segregate the sprinkler heads of each type and clearly identify them with approved markings. The cabinets shall have proper arrangement for hanging the wrenches. Cabinet shall be mounted 5'-0" A.F.F. at sprinkler riser.

C. Spare sprinkler heads shall be provided in numbers, as required by NFPA Pamphlet #13, corresponding to the types and temperature ratings of those installed in the premises (6 minimum of each type).

D. Wrenches shall be provided in a number so that there will always be a minimum of two (2) wrenches of each type required to remove any sprinkler head on the premises.

2.10 SEISMIC RESTRAINTS

A. All supports for equipment and piping shall be constructed and installed as per requirements of NFPA #13 and the Maine State Building Code in regards to seismic restraints.

2.11 DRAINS AND TEST CONNECTIONS

A. Drains and test connections shall be provided in the system as required by all governing Codes, regulations and ordinances.

B. Drains shall be provided at low point in piping, at base of risers, and wherever necessary to insure that all portions of the piping may be completely drained.

C. Test connections shall consist of drain piping with a one inch (1") shutoff valve (O.S. & Y.) type, piped outdoors to a safe place of discharge. Pipe through outside wall shall be galvanized steel pipe with sleeve caulked watertight and plugged with a brass plug.

2.12 FIRE PROTECTION ALARMS

A. O.S. & Y. valve monitor switches and sprinkler system's flow and pressure sensors shall be furnished and installed by the Fire Protection Contractor and wired by the Electrical Contractor. The Fire Protection Contractor shall coordinate with the Electrical Contractor on this portion of the system. Monitor switches shall be installed on all O.S.& Y. valves and shall be equal to Notifier OSY2 and be fitted with 2-SPDT switches. Flow switches shall be installed as indicated on the drawings and shall be equal to Notifier WFD 10/40 with adjustable delay.

2.13 ALARM CHECK VALVE

A. Alarm check valve shall be an approved type for wet pipe sprinkler systems complete with retarding chamber, water operating gong, drain valve, pressure gauges and other required trimmings. Valve shall be equal to Globe Model H-1 for variable pressure vertical installation, size as indicated on the drawings, with H-1 trim package, with Global Model "F" Water Motor and Gong. Water gong shall be located on outside of building with head and identification tag. Supply pipes to gong shall be IPS brass or copper.

2.14 BACKFLOW PREVENTER

A. This contractor shall furnish and install a six inch (6") backflow preventer, where shown on the drawings. The device shall be a Watts Model No. 774 or equal.

B. One (1) complete rebuilding kit shall be supplied with the backflow preventer.

C. This contractor shall be responsible to file design data sheets along with cuts of the backflow preventer, and obtain approval of same form the local Water Department.

2.15 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be Underwriters' Laboratories and NFPA approved unit with a Simese or a "Storz" type connection, as required by the local Fire Department. Unit shall be manufactured of heavy bronze caps, plugs and chains. Provide identification plate of cast brass with the words "AUTO.SPKR" in raised lettering.

PART 3 - EXECUTION

3.01 OPERATION AND START-UP

A. The Fire Protection Contractor shall furnish all labor, materials and equipment necessary to place the equipment into operation and then start and operate all systems to demonstrate the fitness of the installation.

B. Prior to start-up, the Fire Protection Contractor shall check all equipment for rotation, check belts for tightness, provide lubrication, clean all equipment, perform pressure tests and make all other adjustments necessary for start-up.

3.02 COORDINATION

A. The structure and its appurtenances, clearances and the related services, such as plumbing, heating, ventilation and electric service, have been planned to be adequate and suitable for the installation of equipment specified under this Section.

The Owner will not assume any increase in cost caused by different requirements peculiar to a particular make or type of equipment and any such incidental cost shall be borne by the Fire Protection Contractor. He shall be responsible for the proper installation and location of his required sleeves, chases, inserts, etc., and see that they are set in the forms before the concrete is poured. He shall be responsible for his work and equipment furnished and installed by him until the completion and final acceptance of this Contract, and he shall replace any work which may be damaged, lost or stolen, without additional cost to the Owner.

B. Cutting and Patching - It shall be the duty of the Fire Protection Contractor to consult with and give to the General Contractor the exact location and size of all openings and for information as to cutting and patching necessary for the same. In the event the Fire Protection Contractor fails to provide sleeves, inserts and templates or fails to notify other Contractors well in advance of his requirements, he shall be responsible for paying for all cutting and patching made necessary by his failure to do so.

C. In the event there is a conflict or inadequate space for the proper installation of Fire Protection equipment, the Fire Protection Contractor shall prepare a scaled (1/4" = 1'-0" size) composite sketch, showing the building structure and all equipment and items affecting the installation, to clearly identify the areas of conflict. The Fire Protection Contractor shall submit four (4) copies of the sketch, along with a written explanation of the problem, to the Architect for his review and determination on what action to take to resolve the conflict.

D. It shall be the duty of the Fire Protection Contractor to furnish full information to all trades relative to the work they are to do in connection with work under this Section. This includes data for wiring, including wiring diagrams, equipment foundations, pipe connections, etc., furnished under other Sections.

3.03 PAINTING

A. The Fire Protection Contractor shall apply one (1) coat of anti-rust paint and one (1) coat of flat black enamel to all support steel, hangers and other steel or iron elements of the Fire Protection system, furnished by him, which will be enclosed or above ceilings when the project is completed.

B. Paint shall be omitted from all items with a galvanized finish.

C. All surfaces to be painted shall be free of dirt, scale, rust, grease and oil. Rust spots are to be wire brushed. Ambient temperature shall be in accordance with paint

manufacturer's requirements when painting is being performed.

D. The Fire Protection Contractor shall touch up, with spray paint, all scratched or damaged surfaces of equipment with factory finish. Spray paint shall be the same color and type as factory finish.

E. The Painting Contractor shall paint all mechanical equipment, enclosures, covers, panels, insulation, conduit and other equipment exposed to view, except factory finished items. Care shall be taken not to paint over equipment nameplates. The Fire Protection Contractor shall leave surfaces to be painted ready to receive paint. The Painting Contractor shall apply paint in accordance with the Painting and Finishing portion of this Specification. Colors shall be selected by the Architect.

3.04 AS-BUILT DRAWINGS

A. This Contractor shall submit, at the completion of the building, two (2) sets of mylar reproducible drawings of the final, approved installation drawings, completely revised showing all field changes made, and marked "As-Built Drawing." The Architect will review these final plans and inform the Contractor of their acceptability.

END OF SECTION 15300

SECTION 15300

FIRE PROTECTION

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SECTION 15300

FIRE PROTECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Examine all drawings and all other Sections of the Specifications for requirements affecting this Section. Include in and make part of this Section all work related under other Sections and required on all Drawings and Documents.

B. Before submitting bid, visit the site and examine conditions under which the work has to be performed. Report to the Owner any conditions which might adversely affect the work to be performed.

C. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of this Specification. When a conflict occurs between Section 15300 and the aforementioned sections, the most stringent requirements shall apply.

D. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

E. All references to "this Contractor" in this SECTION shall mean the Fire Protection Contractor and all Subcontractors hired by and/or responsible to him.

1.2 FIRE PROTECTION SYSTEM DESIGN/BUILD GUIDELINES

A. This Contractor shall provide engineered drawings, stamped by a Maine licensed professional Fire Protection engineer, clearly depicting the systems the Contractor proposes to install. The systems shall be complete in all respects and shall be designed to include the following major systems and components.
   1. A complete wet-pipe sprinkler system, including connection to water service, backflow preventer, alarm riser, all distribution piping with supports and bracing, sprinkler heads and testing devices.

B. Calculated sprinkler system shall include a demand of 250 gpm for hose streams. The hydraulics of the system should be calculated on the basis of the available water supply. The system water demand shall be 10 psi less than the available water supply at the demand flow, the margin of safety required, allowing for future deterioration of the water supply.

1.3 SCOPE OF WORK

A. Work in this Section of the Specifications includes all labor, materials, equipment and services necessary to calculate, design, engineer, furnish completely and install all FIRE PROTECTION SYSTEMS, as specified herein and, in general, as follows:
   1. Provide complete, stamped, engineered design drawings showing all system components and complete hydraulic calculations for the entire wet-pipe sprinkler system.
   2. Monitor, pressure and flow switches.

3. Valve tags, valve charts, nameplates, pipe identification and record drawings.
4. Access panels for all valves, drains and equipment.
5. Testing and guarantees.
6. All hangers, seismic restraints, inserts, sleeves, anchors, guides, strainers, gauges, thermometers, plus all related accessories required for a complete installation for the system, as specified herein and/or indicated on the drawings.
7. All operating and maintenance manuals, certification letters and Certificates of Approval.
8. All supplementary steel for piping and equipment supports.
9. Working drawings of the actual fire protection system installation and hydraulic calculations.
10. Pre-bid site visit to determine conditions and extent of work.
11. All required Design and Construction Affidavits required by the Portland Building Department.

1.4 WORK NOT INCLUDED

A. The following related work shall be performed by the designated trades and under the listed SECTION:
   1. Cutting and patching shall be the responsibility of the General Contractor and shall be performed by trades specializing in the specific surfaces affected, i.e., carpentry, masonry, metals, etc.
   2. Excavation and backfill shall be performed by the General Contractor.
   3. Wiring of equipment requiring power and furnished by the Fire Protection Contractor and starting devices for all motors incidental to the Fire Protection Systems shall be furnished and installed by the Electrical Contractor:
   4. Painting of piping, fittings, coverings, hangers, supports and all equipment not specifically specified to be painted by the Painting Contractor.
   5. Electricity and water for all tests and temporary operation of Fire Protection Systems: GENERAL CONDITIONS AND SUPPLEMENTARY GENERAL CONDITIONS.
   6. Equipment access panels for Fire Protection equipment shall be furnished by the Fire Protection Contractor and installed by the General Contractor.

1.5 INTENT

A. All work shall be in accordance with the arrangement, details and locations, as indicated on the Architectural Drawings, Reference Drawings, these Specifications and any supplemental addenda, bulletins or drawings issued by the Architect. Final arrangement of piping and equipment shall suit field conditions. Install all necessary fittings and equipment offsets required to meet job conditions. Work interfering with the work of another trade, shall be removed and reinstalled when so directed by the Architect. Discrepancies and questionable points shall be immediately reported to the Architect for clarification.

1.6 WORKING PLANS, FLOW TEST AND HYDRAULIC CALCULATIONS

A. General performance criteria for the fire protection systems has been developed in these Specifications. This Contractor is required to have a valid Maine Sprinkler Contractor's license and is responsible to engage a qualified Maine registered fire

protection engineer to prepare and be responsible for the design of the fire protection systems. The design of the fire protection systems and supporting calculations shall be submitted to the Architect for review, but solely for the purpose of reviewing relative to the criteria established herein. The review of the Contractor's engineer's design shall not, in any manner or respect, relieve the Contractor of full responsibility for the final design of the fire protection systems. It requires performance of design work, preparation and submission of drawings, procurements of approvals and provision of complete functional system of automatic sprinklers.

B. Within fifteen (15) days after the date of the Notice to Proceed and before commencement of any work, submit and obtain all approvals of all plans and calculations to the Owner's Insurance Underwriter, prior to submittal to the Agency having jurisdiction, including the Fire Department, for final approval. Furnish copies of approved working plans to the Architect for his approval promptly after obtaining other approvals.

C. Plans must show the following information in suitable fashion:
1. Name of Owner.
2. Names and addresses of Architect and Engineers.
3. Location of project.
4. North point.
5. Drawing scale.
6. Plans of all floors, partitions, exits, beams, lights, unit heater, diffusers, registers, duct over our feet (4') in width and ceiling heights.
7. Location, name, type, temperature rating and make of sprinkler heads including dimensioning of heads.
8. Structural beams and penetrations.
9. Source of water supply, size of pipe, and pressure available.
10. Number of sprinklers on each riser, area of each room and total number of rooms in the building, including location and size of risers, mains, branches, and most remote area.
11. Cutting and lengths of pipe.
12. Make, type, model, size and location of sprinkler water flow alarms and tamper switches.
13. Type of hangers, inserts and sleeves.
14. Inspector's test connections, drain pipes and test pipes.
15. Crosses, riser nipples and size.
16. Control gate, checks and flushing connections.
17. Riser diagram of entire schematic system indicating all alarms, valves, tamper switches, floor control valves, mains, risers, source of supply, quantity of sprinklers in each fire area, on each floor, water pressure at each floor and height of each floor with regard to water supply source.
18. Symbol list and abbreviations for entire Fire Protection System.

D. This Contractor shall be responsible to develop complete hydraulic calculations for the Fire Protection Systems as shown on his Drawings. This Contractor shall obtain flow tests for the building and base his calculations on these flow test results. Flow test results and hydraulic calculations are to be submitted to the Architect, the Owner's Insuring Agent and the Fire Department for review. A ten (10) psi "cushion" is the minimum required for the design of the piping system between the maximum GPM demand and the available water pressure.

E. This Contractor is responsible to carefully coordinate the extent of combustible materials in all floors, in soffits and in other areas of the building. All areas deemed by Code and the Fire Department of having concealed combustible construction shall be protected with sprinklers.

F. Sprinkler Contractor shall give special attention to the spacing, location, position and clearances of sprinkler heads required for proper coverage of all areas specified herein with respect to all electrical equipment, surface mounted and recessed lighting fixtures. The Sprinkler Contractor shall review electrical drawing for a complete understanding as to the dimension, depth and location of all electrical fixtures and equipment (switchgear, transformers, panels, surface mounted fluorescent and incandescent lighting fixtures, recessed halide and fluorescent lighting fixtures, etc.).

G. Sprinkler heads located in areas with finished ceiling tiles shall be considered satisfactory if they are within six inches (6") either way from exact center of the ceiling tile in the short direction (24") and with one (1) foot either way of exact center of the ceiling tile in the long direction (48") and shall be located as such on the Reflected Ceiling Plans and Sprinkler Shop Drawings.

H. Guards shall be installed on all sprinkler heads in areas where they are located 10'-0" or less above the floor and are in storage or work areas.

1.7 CODES, REGULATIONS AND STANDARDS

A. All work shall be installed in conformance to the governing Codes, Regulations and Ordinances. It shall be the responsibility of this Contractor to familiarize himself with all governing Codes, Regulations and ordinances.

B. All workmanship, methods and materials shall meet the highest standards of the trade and, in general, shall conform to the standards of the following associations:

American National Standards Institute (ANSI)
American Society of Mechanical Engineers (ASME)
National Board of Fire Underwriters (NBFU)
National Fire Protection Association (NFPA)
National Electrical Manufacturers Association (NEMA)
Occupational Safety and Health Act (OSHA)
Underwriters' Laboratories (U.L.)
American Society of Testing Materials (ASTM)
Maine State Building Code
Town of Portland Regulations and Ordinances

1.8 EXCHANGE OF INFORMATION AND COORDINATION

A. All systems and equipment covered by this Section of the Specifications shall not be installed in congested and problem areas without first coordinating the installation of same with the other trades and the General Contractor. This Contractor shall, at his own expense, relocate all equipment installed in congested or problem areas should they interfere with the proper installation of the equipment to be installed by other trades and by the General Contractor.

B. Particular attention shall be directed to the coordination of Systems with all equipment of other trades installed in the ceiling areas. Coordinate, with the other trades, the elevations of all equipment in hung ceiling areas to insure adequate space for the installation of fixtures before said equipment is installed.

C. Furnish to the General Contractor and all other Contractors all information relative to the portion of the installation specified in this Section that will affect them, sufficiently in advance, so that they may plan their work and installations accordingly.

D. In the case of failure on the part of this Contractor to give proper information, as indicated above, sufficiently in advance, this Contractor will pay for all backcharges incurred by the General Contractor and other Contractors for the modification and/or relocation of any portion of the work already performed by them in conjunction with this Contract due to this Contractor's delay or for having given incorrect information.

E. Obtain from the other trades, all information relative to the work covered by this Section of the Specifications, which this Contractor is to execute in conjunction with the installation of their respective equipment.

F. In the event that conflicts, if any, cannot be settled rapidly and amicably between the affected trades with work proceeding in a workmanlike manner, then the Architect shall decide which work is to be relocated and his judgement shall be final and binding.

1.9 WORKMANSHIP

A. The entire work provided in this Specification shall be constructed and finished, in every respect, in a workmanlike and substantial manner. It is not intended that the Specifications define each item, but this Contractor shall furnish and install all such parts as may be necessary to complete the work in accordance with the best trade practice and to the satisfaction of the Architect and the Owner. The Owner shall have the right to reject any part of the work in case the workmanship is not of satisfactory quality and this Contractor shall replace same with acceptable work at his own expense.

1.10 SITE INVESTIGATION

A. It shall be the responsibility of the Bidders to acquaint themselves with the available information, before submitting their bid. Bidders must visit the site and acquaint themselves with the existing conditions and shall study all Architectural, Structural, Mechanical and Electrical Drawings, as well as the Specifications. The Bidders shall fully inform themselves of all local and state Code requirements. Extra compensation will not be given for obvious conflictions apparent at the time of the start of the project.

1.11 TAXES AND INSURANCE

A. This Contractor shall include in his bid, applicable federal, state and local taxes and the premiums of the insurance required by the General Conditions of the Contract.

1.12 FEES, PERMITS AND INSPECTIONS

A. This Contractor shall obtain and pay for all the permits required for this Section of the work. He shall also obtain and pay for all the inspections and tests required. Defects discovered in work, materials and/or equipment shall be replaced at no cost to the Owner, and the inspection and test shall be repeated. When work is completed, this Contractor shall furnish a Certificate of Inspection and Approval, to the Owner, before final payment of the Contract will be allowed.

1.13 CONTRACT COST BREAKDOWN

A. At the start of construction, submit a breakdown of material and labor costs to aid the Architect in determining the value of the work installed, as the job progresses. The cost breakdown shall itemize categories of materials or portions of systems, as may be the case, to place a value on the work as it is installed.

B. No requisitions will be paid until after the breakdown is delivered to the Architect.

1.14 GUARANTEE

A. Unless otherwise noted, all materials, items of equipment and workmanship furnished under this Section shall carry an unconditional warranty against all defects in material and workmanship for a period of not less than one (1) year from the date of final acceptance. Any fault due to defective or improper material or workmanship which may develop within that period, shall be made good, forthwith, by and at the expense of this Contractor, including all other damage done to areas, materials and other systems resulting from this failure.

B. This Contractor shall guarantee that all elements of the Systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

C. Upon receipt of notice from the Owner of failure of any part of the Systems during the guarantee period, the affected part or parts shall be promptly replaced by this Contractor, at no charge to the Owner.

D. This Contractor shall furnish, before the final payment is made, a written guarantee covering the above requirements.

1.15 MATERIALS

A. Materials shall be the best of their respective kinds and in full accord with the most modern mechanical construction. All materials shall be new.

B. All materials necessary to make the installation complete in every detail shall be furnished and installed under this Contract, whether or not specifically noted herein.

C. It is the intent of the Specifications that one manufacturer be selected, not a combination, for any particular classification of materials.

D. Where materials, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish the standard of desired quality and style and shall be the basis of the bid.

1.16 MATERIALS AND EQUIPMENT HANDLING

A. This Contractor shall do all handling of his materials and equipment and the resulting cleanup, at his expense, in a safe and satisfactory manner. Special attention shall be paid to the protection of life and property and the equipment or apparatus handled, and any corresponding damages shall be replaced, repaired or paid for by this Contractor, as approved by the Architect. This Contractor shall provide all rigging, hoisting and staging required to complete the work of this Section, unless specifically noted otherwise.

1.17 MAINTENANCE AND PROTECTION OF MATERIALS

A. This Contractor shall be responsible for the maintenance and protection, from loss or damage of all causes, of all equipment, materials and tools supplied by him and stored or installed on the job site, until final acceptance of the project by the Owner.

B. This Contractor shall store his materials and equipment in the location designated by the Owner and maintain the storage area in a safe condition.

C. This Contractor shall clean, patch and repair any material and finishes of the building or its contents damaged during the execution of this Contract.

1.18 SHOP DRAWINGS AND MATERIAL SCHEDULE

A. Submit complete Installation Drawings and component submittals in accordance with provisions of the General Conditions, Supplementary General Conditions, Special Conditions and General Requirements.

B. Within 15 days after the date of Notice to Proceed and before purchasing any materials or equipment, submit to the Architect for approval, submit complete, stamped, engineered drawings clearly depicting all piping, components and systems proposed to fulfill the work of this Section. After the plans have been received and approved by the Architect, submit complete component submittals of all equipment and materials. Do not order any material or equipment until approval has been obtained from the Architect.

C. The approval of equipment and materials does not relieve this Contractor from the responsibility of Shop Drawings errors in details, sizes, quantities and dimensions which deviate from the Specifications and/or job conditions as they exist.

D. If apparatus or materials are substituted by this Contractor for those specified, and such substitution necessitates changes in any mechanical or electrical equipment, or alteration to connections, piping, supports, or construction, same shall be provided. This Contractor is to assume the cost and entire responsibility thereof. The Architect's permission to make such a substitution shall not relieve this Contractor from full responsibility for the work.

E. Changes to work already performed, made necessary by delays in obtaining approvals, are the responsibility of this Contractor.

1.19 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Provide operating instructions to the Owner's designated representative, with respect to operating and maintenance procedures, for all equipment and systems installed. The cost of up to eight (8) hours of instruction shall be included in the Contract Price.

B. At the completion of the project, turn over to the Architect, three (3) complete manuals containing the following:
   1. Complete shop drawings of all equipment.
   2. Operation description of all Systems.
   3. Names, addresses and telephone numbers of all suppliers of the products, materials, equipment and Systems.
   4. Guarantees on all products, materials and equipment.
   5. Preventive maintenance instructions for all Systems.
   6. Spare parts list of all System components.

C. Each manual shall be typewritten and bound under one (1) hard cover and will be reviewed by the Architect. The manuals shall be clearly and permanently identified on the cover with the name of the project.

D. Upon completion of the instructions, this Contractor shall obtain a letter of acceptance of the instructions as being complete from the Owner. Submit a copy of said letter to the Architect.

1.20 CLEANING OF SYSTEMS

A. Before the Systems are accepted, all equipment shall be thoroughly cleaned, so that no dirt, dust or other foreign matter will be deposited and be detrimental to the operation of the Systems.

B. After the installation is complete, equipment with factory finished surfaces shall be cleaned and damaged or scratched spots shall be touched up with the same type and color paint applied at the factory.

C. All equipment that is to receive finish paint by the Painting Contractor, shall be cleaned by this Contractor and left ready to have surfaces prepared to receive paint.

1.21 RUBBISH REMOVAL

A. At the completion of the work, or when ordered by the General Contractor or the Architect, this Contractor shall remove from the property, all the rubbish or waste material belonging to him. Keep the job site free from accumulation of waste material and rubbish; premises must be maintained in a clean condition.

1.22 TEMPORARY STRUCTURES

A. This Contractor shall provide, on the premises and where directed by the Architect,

shall maintain in good condition, and shall remove when directed, suitable and substantial watertight sheds in which he shall store all his materials and equipment.

1.23 TEMPORARY SERVICES

A. All water, electricity, fire protection and sanitary facilities required for safe and efficient construction during normal working hours shall be furnished in accordance with the General Requirements.

1.24 TESTS

A. Furnish all labor, materials, instruments, supplies and services and bear all cost for the accomplishment of the tests herein specified. Correct all defects appearing under test, repeat the tests until no defects are disclosed and leave the equipment clean and ready for use.

B. Perform any tests, other than herein specified, which may be required by legal Authorities or by Agencies to whose requirements this work is to conform.

C. Dispose of test water and wastes after tests are complete, in a manner satisfactory to the Architect and in accordance with governing regulations.

1.25 EQUIPMENT ACCESS REQUIREMENTS

A. All work shall be installed so that all parts requiring inspection, operation, maintenance and repair are readily accessible.

B. Furnish access panels in walls and ceilings as required to permit access for adjustment, removal and the replacement and servicing of all equipment, and all other items requiring maintenance and adjustments. Access panels shall be installed by the General Contractor.

C. Coordinate the exact location of access panels in all finished spaces with the Architect.

1.26 MOTOR CHARACTERISTICS

A. Unless otherwise indicated, motors for equipment specified under this Section shall be furnished and installed by the Fire Protection Contractor and shall be as follows, unless noted otherwise:

1. Motors 1/3 HP and smaller shall be wound for 120 volts, single phase, 60 cycle AC service.

B. Unless otherwise specified, all motor starters shall be furnished and installed by the Electrical Contractor.

1.27 WIRING DIAGRAMS

A. This Contractor shall furnish wiring diagrams for all equipment furnished under this

Section for which wiring is to be installed by the Electrical Contractor.

1.28 PROCEDURE FOR TESTING

A. Partial tests shall be made, as required, by the progress of the work.

B. All labor, materials, instruments, devices and power required for testing shall be furnished by this Contractor. All tests shall be performed in the presence and to the satisfaction of the Architect and such other parties as may have legal jurisdiction.

C. Repair, or if directed by the Architect, replace all defective work with new work without extra charge to the Contract. Repeat tests as directed until all work is proven to meet the requirements specified herein.

D. Restore to its finished condition any work or materials disturbed by tests.

E. This Contractor shall be responsible for removing all temporary piping connections required for tests and dispose of test water and wastes after tests in a manner satisfactory to the Architect.

F. This Contractor shall make hydrostatic, pneumatic and operational tests on all fire protection equipment in accordance with standards of the National Board of Fire Underwriters and as required by the NFPA.

G. Fire Protection Systems:
   1. Upon completion of the sprinkler system piping, this Contractor shall inspect and test each system in the presence of the Owner's representative and the Fire Chief.
   2. The complete testing procedure for the systems shall be in accordance with the requirements stated in the National Fire Protection Association's respective pamphlet for each system, but not less than the procedures specified herein.
   3. In general, the Fire Protection Systems shall be tested with water to a hydrostatic pressure of 200 pounds per square inch. This pressure shall be maintained for a minimum of four (4) hours or until the system has been inspected for leaks or defects. If any leaks or defects are detected, they shall be remedied in an approved manner and the System shall be retested in the manner specified herein.
   4. This Contractor shall secure all Certificates of Approval from all agencies. Each Certificate shall be delivered to the Architect before final acceptance.

PART 2 - PRODUCTS

2.01 INSTALLATION REQUIREMENTS

A. This Contractor shall comply with all the rules, Codes, ordinances, regulations and requirements of all legally constituted authorities having jurisdiction over the whole or any part of the work herein specified. Regulations supplement this Specification and shall take precedence in any case of conflict.

B. All equipment and materials furnished in connection with the installation shall be new and furnished in accordance with the requirements of the Standards of the NFPA and they shall be of the best grade and quality of their respective kinds, free

from natural, manufacturing or construction flaws, defects or irregularities and finish, fittings and workmanship shall be equal to the highest commercial grade.

C. Castings of all metals of all kinds shall be clean, smooth, close grained, of uniform thickness and free from all defects such as sand holes, blisters or cracks.

D. Before the installation will be accepted, the Fire Protection Contractor shall have every portion of his work in first-class working condition.

E. Where installing any of the apparatus herein called for, sufficient clearance shall be allowed to permit the removal and replacing of parts that may require future removal for repairs and replacement.

F. Exposed piping shall be installed as tight as practical to structural members.

G. Piping shall be installed neatly and square to all surfaces. Horizontal sidewall sprinklers shall be installed as tight to beams and ceilings as the sprinkler listing will allow with reference to the existence of beams.

2.02 ACCESS PANELS

A. Furnish access panels for installation by the General Contractor in walls and as required to permit access for adjustment, removal and replacement and servicing of all equipment such as inspector's tests and all other items requiring maintenance and adjustment.

B. All access panels shall be located in closets, storage rooms and/or other non-public areas, in a workmanlike manner, positioned so that the junction can be easily reached, and the size shall be sufficient for this purpose (minimum 16" x 16"). When access panels are required in corridors or other public areas, they shall be located as directed by the Architect.

C. Access panels shall be of steel construction, prime painted and furnished with cylinder lock and two (2) keys, as manufactured by Inland Steel Products Company, "Milnor," Miami-Carey, Walsh-Hannon-Gladwin, Inc., "Way-Loctor" or approved equal. Access panels located in Fire-Rated ceilings and Fire-Rated walls shall be constructed with 1-1/2 hour Fire-Rating and shall bear the U.L. Label insuring the Fire-Rating construction.

2.03 PIPE AND FITTINGS

A. All piping inside the building for the sprinkler system 2-1/2 inches and smaller in size shall be Schedule 40 black steel pipe with threaded ends conforming to ASTM Standard A135, latest amendment, approved for use in Fire Protection Systems. All piping inside the building, three inches (3") and larger in size, unless otherwise noted, shall be Schedule 10 black steel pipe with rolled groove ends, approved for use in Fire Protection Systems.

B. Fittings for the sprinkler systems shall be cast iron. Cast iron fittings shall be extra heavy pattern for pipe sized larger than two inches (2"). Malleable iron fittings of standard weight pattern will be acceptable in sizes up to six inches (6"). U.L. approved and F.M. listed groove fittings will be allowed. All fittings shall be

approved by Underwriters Laboratories for use in sprinkler systems and shall be designed and guaranteed for a working pressure of not less than 175 psi cold water pressure.

C. All close and shoulder nipples shall be of corresponding materials as the pipe and shall be extra heavy pattern.

D. All pipe shall be run true to line and grade and, in general, parallel to walls and ceilings. All open ends of the pipe lines, equipment, etc., shall be properly capped and plugged during the installation in order to keep dirt or foreign materials out of the system. All work shall be performed in a practical manner and according to the highest standards of workmanship.

E. All threaded pipes shall have full tapered threads with ends reamed out after threading and cutting.

F. The interior of all pipes and fittings shall be cleaned before assembling. All pipe threads (not fittings) shall have a thorough application of approved pipe joint cement before assembling. Any leaky joints shall be remade, as caulking will not be permitted. All pipe shall be pitched as required. Means shall be provided to completely drain the entire system. Capped flushing connections shall be provided at the ends of all cross mains.

2.04 VALVES

A. All valves shall be of the O.S. & Y. type, of approved extra heavy flanged pattern and be designed and guaranteed for a minimum working pressure of 175 psi. All shut-off valves shall be located in conveniently accessible positions. Valves controlling the water supply to each system shall have an approved sign attached to the yoke indicating the purpose of the valve.

B. Check valve shall be of approved type for fire protection systems and be designed and guaranteed for a minimum working pressure of 175 psi.

C. Drain valves shall be Underwriters' approved all bronze angle, globe pattern with renewable disc, hose with cap and chain, ample size hand wheel and rated for a working pressure of 175 psi.

2.05 HANGERS AND SUPPORTS

A. All piping shall be supported throughout the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.

B. Pipe hangers shall be of black malleable iron, heavy petters in two (2) parts bolted together, of a type approved for Fire Protection Systems installation.

C. Hangers shall fit the pipe snugly but leave the pipe sufficient freedom of movement for expansion or contraction. Hangers which permit wide lateral motion of the pipe will not be acceptable.

D. "C" clamps for hangers on pipes will not be permitted unless installed with safety straps.

E. Maximum spacing of hangers on horizontal runs of pipe, having no concentrations of weight, shall be as follows:

SCHEDULE
Hanger Spacing for Various Pipes

Pipe Size (inches)	Spacing (feet)
1	7
1-1/4	10
1-1/2	10
2	10
2-1/2	10
3	12
3-1/2	12
4	10
6	8
8	8

F. Where Codes having jurisdiction require closer spacing, the hanger spacing shall be as required by Code in lieu of the distance specified herein.

G. Provide hangers at a maximum distance of two feet (2') from all changes in direction (horizontal and vertical) on both sides of concentrated loads independent of the piping.

H. Hangers, in general, for all horizontal piping shall be adjustable clevis type hangers.

I. All vertical drops and runout pipes shall be supported by extension style, split ring type hangers.

J. All horizontal piping shall be suspended from the building by mild steel rod connecting the pipe hanger to inserts, angle brackets and lag screws, as required by the building construction in accordance with the following table:

Pipe Size (inches)	Rod Diameter (inches)
1 - 3	3/8
3 - 6	1/2

K. Hanger rods for other installations shall be sized in accordance with recommended load capacities of Specification A.S.T.M. Designation A-107, latest amendment.

L. Remove rust from all ferrous hanger equipment (hangers, rods and bolts) and apply one (1) coat of rust inhibiting paint immediately after erection.

M. All piping installed under this Section of the Specifications shall be independently supported from the building structure and not from the piping, ductwork or conduit of other trades. All supplementary steel required to meet requirements specified herein shall be furnished and installed by this Contractor.

N. In areas where support of the pipe by hangers is not possible or feasible, piping shall be supported by an adjustable pipe roll stand with base plate equal to Figure 274, as manufactured by Grinnel Corporation. This installation method shall be done in accordance with the requirements of all pertinent Codes.

O. All supplementary steel throughout the project for this Section of the Specifications, both suspended and floor mounted, shall be furnished and installed by the Fire Protection Contractor and shall be subject to the approval of the Architect.

P. All piping shall have seismic restraints in accordance with NFPA #13 and the State Building Code. A letter of compliance signed by a registered structural engineer confirming that pipe hangers meet State Seismic Code requirements.

2.06 SLEEVES AND INSERTS

A. This Contractor shall be held responsible for the location of and maintaining in proper position, of sleeves, inserts and anchor bolts supplied and/or set in place by him. In the event that failure to do so requires cutting and patching of finished work, it shall be done at this Contractor's expense by the General Contractor.

B. All pipes passing through walls or partitions shall be provided with sleeves having an internal diameter one inch (1") larger than outside diameter of the pipe.

C. Unless otherwise indicated and/or specified herein, all sleeves through masonry floors or interior masonry walls shall be Schedule 40 black steel pipe, set flush with finished wall or set one inch (1") above finished floor surfaces, or as indicated on the architectural drawings.

D. Sleeves through interior non-masonry partitions shall be 22 gauge galvanized sheet steel, set flush with finished surfaces of the partitions.

E. Sleeves through interior walls adjacent to all building expansion joints shall be two (2) pipe size diameters larger than diameter of pipe.

F. Sleeves passing through lightproof or soundproof walls, floors and partitions and through firewalls shall be made tight, using approved caulking materials.

2.07 ESCUTCHEONS

A. Escutcheons shall be installed around all exposed bare pipe. Escutcheons shall be of sufficient outside diameters to cover the sleeve opening and shall fit snugly around the bare pipe.

B. Escutcheons shall be cast brass, grey primed finish and provided with a set-screw to properly hold escutcheons in place.

2.08 SPRINKLER HEADS

A. All sprinkler heads shall be of 1/2 inch nominal orifice size. Heads shall be listed by Underwriters' Laboratories, Inc. and approved by Factory Mutual.
All heads shall be manufactured by a single manufacturer.

B. All heads shall have a temperature rating of 165°F unless the distance from a heat source or location of head warrants, by Code, a head of another degree rating.

C. The following sprinkler heads shall be installed in the areas outlined, unless noted otherwise:
- Sprinkler heads in spaces without ceilings or in unfinished spaces shall be of the upright type, of brass, with deflectors and fusible links. In the event that conditions prohibit upright heads, pendant heads may be installed provided they are equipped with guard cages.
- Sprinkler heads in finished areas with hung ceilings shall be pendant type and shall be recessed white finished brass heads with deflectors, fusible links and white escutcheons plates unless the sprinkler head is located near a surface-mounted light fixture, beam or similar device. In these instances, sprinkler heads shall be surface mounted pendant units. All heads in any single room or area shall be of the same type.

2.09 SPARE SPRINKLER HEADS AND CABINETS

A. The Fire Protection Contractor shall furnish and install in the building, where directed by the Architect, a red metal cabinet containing spare sprinkler heads and wrenches.

B. The cabinets shall have shelves for storing the spare heads in an orderly manner. The shelf spaces shall be subdivided to segregate the sprinkler heads of each type and clearly identify them with approved markings. The cabinets shall have proper arrangement for hanging the wrenches. Cabinet shall be mounted 5'-0" A.F.F. at sprinkler riser.

C. Spare sprinkler heads shall be provided in numbers, as required by NFPA Pamphlet #13, corresponding to the types and temperature ratings of those installed in the premises (6 minimum of each type).

D. Wrenches shall be provided in a number so that there will always be a minimum of two (2) wrenches of each type required to remove any sprinkler head on the premises.

2.10 SEISMIC RESTRAINTS

A. All supports for equipment and piping shall be constructed and installed as per requirements of NFPA #13 and the Maine State Building Code in regards to seismic restraints.

2.11 DRAINS AND TEST CONNECTIONS

A. Drains and test connections shall be provided in the system as required by all governing Codes, regulations and ordinances.

B. Drains shall be provided at low point in piping, at base of risers, and wherever necessary to insure that all portions of the piping may be completely drained.

C. Test connections shall consist of drain piping with a one inch (1") shutoff valve (O.S. & Y.) type, piped outdoors to a safe place of discharge. Pipe through outside wall shall be galvanized steel pipe with sleeve caulked watertight and plugged with a brass plug.

2.12 FIRE PROTECTION ALARMS

A. O.S. & Y. valve monitor switches and sprinkler system's flow and pressure sensors shall be furnished and installed by the Fire Protection Contractor and wired by the Electrical Contractor. The Fire Protection Contractor shall coordinate with the Electrical Contractor on this portion of the system. Monitor switches shall be installed on all O.S.& Y. valves and shall be equal to Notifier OSY2 and be fitted with 2-SPDT switches. Flow switches shall be installed as indicated on the drawings and shall be equal to Notifier WFD 10/40 with adjustable delay.

2.13 ALARM CHECK VALVE

A. Alarm check valve shall be an approved type for wet pipe sprinkler systems complete with retarding chamber, water operating gong, drain valve, pressure gauges and other required trimmings. Valve shall be equal to Globe Model H-1 for variable pressure vertical installation, size as indicated on the drawings, with H-1 trim package, with Global Model "F" Water Motor and Gong. Water gong shall be located on outside of building with head and identification tag. Supply pipes to gong shall be IPS brass or copper.

2.14 BACKFLOW PREVENTER

A. This contractor shall furnish and install a six inch (6") backflow preventer, where shown on the drawings. The device shall be a Watts Model No. 774 or equal.

B. One (1) complete rebuilding kit shall be supplied with the backflow preventer.

C. This contractor shall be responsible to file design data sheets along with cuts of the backflow preventer, and obtain approval of same form the local Water Department.

2.15 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be Underwriters' Laboratories and NFPA approved unit with a Simese or a "Storz" type connection, as required by the local Fire Department. Unit shall be manufactured of heavy bronze caps, plugs and chains. Provide identification plate of cast brass with the words "AUTO.SPKR" in raised lettering.

PART 3 - EXECUTION

3.01 OPERATION AND START-UP

A. The Fire Protection Contractor shall furnish all labor, materials and equipment necessary to place the equipment into operation and then start and operate all systems to demonstrate the fitness of the installation.

B. Prior to start-up, the Fire Protection Contractor shall check all equipment for rotation, check belts for tightness, provide lubrication, clean all equipment, perform pressure tests and make all other adjustments necessary for start-up.

3.02 COORDINATION

A. The structure and its appurtenances, clearances and the related services, such as plumbing, heating, ventilation and electric service, have been planned to be adequate and suitable for the installation of equipment specified under this Section.

The Owner will not assume any increase in cost caused by different requirements peculiar to a particular make or type of equipment and any such incidental cost shall be borne by the Fire Protection Contractor. He shall be responsible for the proper installation and location of his required sleeves, chases, inserts, etc., and see that they are set in the forms before the concrete is poured. He shall be responsible for his work and equipment furnished and installed by him until the completion and final acceptance of this Contract, and he shall replace any work which may be damaged, lost or stolen, without additional cost to the Owner.

B. Cutting and Patching - It shall be the duty of the Fire Protection Contractor to consult with and give to the General Contractor the exact location and size of all openings and for information as to cutting and patching necessary for the same. In the event the Fire Protection Contractor fails to provide sleeves, inserts and templates or fails to notify other Contractors well in advance of his requirements, he shall be responsible for paying for all cutting and patching made necessary by his failure to do so.

C. In the event there is a conflict or inadequate space for the proper installation of Fire Protection equipment, the Fire Protection Contractor shall prepare a scaled (1/4" = 1'-0" size) composite sketch, showing the building structure and all equipment and items affecting the installation, to clearly identify the areas of conflict. The Fire Protection Contractor shall submit four (4) copies of the sketch, along with a written explanation of the problem, to the Architect for his review and determination on what action to take to resolve the conflict.

D. It shall be the duty of the Fire Protection Contractor to furnish full information to all trades relative to the work they are to do in connection with work under this Section. This includes data for wiring, including wiring diagrams, equipment foundations, pipe connections, etc., furnished under other Sections.

3.03 PAINTING

A. The Fire Protection Contractor shall apply one (1) coat of anti-rust paint and one (1) coat of flat black enamel to all support steel, hangers and other steel or iron elements of the Fire Protection system, furnished by him, which will be enclosed or above ceilings when the project is completed.

B. Paint shall be omitted from all items with a galvanized finish.

C. All surfaces to be painted shall be free of dirt, scale, rust, grease and oil. Rust spots are to be wire brushed. Ambient temperature shall be in accordance with paint

manufacturer's requirements when painting is being performed.

D. The Fire Protection Contractor shall touch up, with spray paint, all scratched or damaged surfaces of equipment with factory finish. Spray paint shall be the same color and type as factory finish.

E. The Painting Contractor shall paint all mechanical equipment, enclosures, covers, panels, insulation, conduit and other equipment exposed to view, except factory finished items. Care shall be taken not to paint over equipment nameplates. The Fire Protection Contractor shall leave surfaces to be painted ready to receive paint. The Painting Contractor shall apply paint in accordance with the Painting and Finishing portion of this Specification. Colors shall be selected by the Architect.

3.04 AS-BUILT DRAWINGS

A. This Contractor shall submit, at the completion of the building, two (2) sets of mylar reproducible drawings of the final, approved installation drawings, completely revised showing all field changes made, and marked "As-Built Drawing." The Architect will review these final plans and inform the Contractor of their acceptability.

END OF SECTION 15300

SECTION 15300

FIRE PROTECTION

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SECTION 15300

FIRE PROTECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Examine all drawings and all other Sections of the Specifications for requirements affecting this Section. Include in and make part of this Section all work related under other Sections and required on all Drawings and Documents.

B. Before submitting bid, visit the site and examine conditions under which the work has to be performed. Report to the Owner any conditions which might adversely affect the work to be performed.

C. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of this Specification. When a conflict occurs between Section 15300 and the aforementioned sections, the most stringent requirements shall apply.

D. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

E. All references to "this Contractor" in this SECTION shall mean the Fire Protection Contractor and all Subcontractors hired by and/or responsible to him.

1.2 FIRE PROTECTION SYSTEM DESIGN/BUILD GUIDELINES

A. This Contractor shall provide engineered drawings, stamped by a Maine licensed professional Fire Protection engineer, clearly depicting the systems the Contractor proposes to install. The systems shall be complete in all respects and shall be designed to include the following major systems and components.
   1. A complete wet-pipe sprinkler system, including connection to water service, backflow preventer, alarm riser, all distribution piping with supports and bracing, sprinkler heads and testing devices.

B. Calculated sprinkler system shall include a demand of 250 gpm for hose streams. The hydraulics of the system should be calculated on the basis of the available water supply. The system water demand shall be 10 psi less than the available water supply at the demand flow, the margin of safety required, allowing for future deterioration of the water supply.

1.3 SCOPE OF WORK

A. Work in this Section of the Specifications includes all labor, materials, equipment and services necessary to calculate, design, engineer, furnish completely and install all FIRE PROTECTION SYSTEMS, as specified herein and, in general, as follows:
   1. Provide complete, stamped, engineered design drawings showing all system components and complete hydraulic calculations for the entire wet-pipe sprinkler system.
   2. Monitor, pressure and flow switches.

3. Valve tags, valve charts, nameplates, pipe identification and record drawings.
4. Access panels for all valves, drains and equipment.
5. Testing and guarantees.
6. All hangers, seismic restraints, inserts, sleeves, anchors, guides, strainers, gauges, thermometers, plus all related accessories required for a complete installation for the system, as specified herein and/or indicated on the drawings.
7. All operating and maintenance manuals, certification letters and Certificates of Approval.
8. All supplementary steel for piping and equipment supports.
9. Working drawings of the actual fire protection system installation and hydraulic calculations.
10. Pre-bid site visit to determine conditions and extent of work.
11. All required Design and Construction Affidavits required by the Portland Building Department.

1.4 WORK NOT INCLUDED

A. The following related work shall be performed by the designated trades and under the listed SECTION:
   1. Cutting and patching shall be the responsibility of the General Contractor and shall be performed by trades specializing in the specific surfaces affected, i.e., carpentry, masonry, metals, etc.
   2. Excavation and backfill shall be performed by the General Contractor.
   3. Wiring of equipment requiring power and furnished by the Fire Protection Contractor and starting devices for all motors incidental to the Fire Protection Systems shall be furnished and installed by the Electrical Contractor:
   4. Painting of piping, fittings, coverings, hangers, supports and all equipment not specifically specified to be painted by the Painting Contractor.
   5. Electricity and water for all tests and temporary operation of Fire Protection Systems: GENERAL CONDITIONS AND SUPPLEMENTARY GENERAL CONDITIONS.
   6. Equipment access panels for Fire Protection equipment shall be furnished by the Fire Protection Contractor and installed by the General Contractor.

1.5 INTENT

A. All work shall be in accordance with the arrangement, details and locations, as indicated on the Architectural Drawings, Reference Drawings, these Specifications and any supplemental addenda, bulletins or drawings issued by the Architect. Final arrangement of piping and equipment shall suit field conditions. Install all necessary fittings and equipment offsets required to meet job conditions. Work interfering with the work of another trade, shall be removed and reinstalled when so directed by the Architect. Discrepancies and questionable points shall be immediately reported to the Architect for clarification.

1.6 WORKING PLANS, FLOW TEST AND HYDRAULIC CALCULATIONS

A. General performance criteria for the fire protection systems has been developed in these Specifications. This Contractor is required to have a valid Maine Sprinkler Contractor's license and is responsible to engage a qualified Maine registered fire

protection engineer to prepare and be responsible for the design of the fire protection systems. The design of the fire protection systems and supporting calculations shall be submitted to the Architect for review, but solely for the purpose of reviewing relative to the criteria established herein. The review of the Contractor's engineer's design shall not, in any manner or respect, relieve the Contractor of full responsibility for the final design of the fire protection systems. It requires performance of design work, preparation and submission of drawings, procurements of approvals and provision of complete functional system of automatic sprinklers.

B. Within fifteen (15) days after the date of the Notice to Proceed and before commencement of any work, submit and obtain all approvals of all plans and calculations to the Owner's Insurance Underwriter, prior to submittal to the Agency having jurisdiction, including the Fire Department, for final approval. Furnish copies of approved working plans to the Architect for his approval promptly after obtaining other approvals.

C. Plans must show the following information in suitable fashion:
1. Name of Owner.
2. Names and addresses of Architect and Engineers.
3. Location of project.
4. North point.
5. Drawing scale.
6. Plans of all floors, partitions, exits, beams, lights, unit heater, diffusers, registers, duct over our feet (4') in width and ceiling heights.
7. Location, name, type, temperature rating and make of sprinkler heads including dimensioning of heads.
8. Structural beams and penetrations.
9. Source of water supply, size of pipe, and pressure available.
10. Number of sprinklers on each riser, area of each room and total number of rooms in the building, including location and size of risers, mains, branches, and most remote area.
11. Cutting and lengths of pipe.
12. Make, type, model, size and location of sprinkler water flow alarms and tamper switches.
13. Type of hangers, inserts and sleeves.
14. Inspector's test connections, drain pipes and test pipes.
15. Crosses, riser nipples and size.
16. Control gate, checks and flushing connections.
17. Riser diagram of entire schematic system indicating all alarms, valves, tamper switches, floor control valves, mains, risers, source of supply, quantity of sprinklers in each fire area, on each floor, water pressure at each floor and height of each floor with regard to water supply source.
18. Symbol list and abbreviations for entire Fire Protection System.

D. This Contractor shall be responsible to develop complete hydraulic calculations for the Fire Protection Systems as shown on his Drawings. This Contractor shall obtain flow tests for the building and base his calculations on these flow test results. Flow test results and hydraulic calculations are to be submitted to the Architect, the Owner's Insuring Agent and the Fire Department for review. A ten (10) psi "cushion" is the minimum required for the design of the piping system between the maximum GPM demand and the available water pressure.

E. This Contractor is responsible to carefully coordinate the extent of combustible materials in all floors, in soffits and in other areas of the building. All areas deemed by Code and the Fire Department of having concealed combustible construction shall be protected with sprinklers.

F. Sprinkler Contractor shall give special attention to the spacing, location, position and clearances of sprinkler heads required for proper coverage of all areas specified herein with respect to all electrical equipment, surface mounted and recessed lighting fixtures. The Sprinkler Contractor shall review electrical drawing for a complete understanding as to the dimension, depth and location of all electrical fixtures and equipment (switchgear, transformers, panels, surface mounted fluorescent and incandescent lighting fixtures, recessed halide and fluorescent lighting fixtures, etc.).

G. Sprinkler heads located in areas with finished ceiling tiles shall be considered satisfactory if they are within six inches (6") either way from exact center of the ceiling tile in the short direction (24") and with one (1) foot either way of exact center of the ceiling tile in the long direction (48") and shall be located as such on the Reflected Ceiling Plans and Sprinkler Shop Drawings.

H. Guards shall be installed on all sprinkler heads in areas where they are located 10'-0" or less above the floor and are in storage or work areas.

1.7 CODES, REGULATIONS AND STANDARDS

A. All work shall be installed in conformance to the governing Codes, Regulations and Ordinances. It shall be the responsibility of this Contractor to familiarize himself with all governing Codes, Regulations and ordinances.

B. All workmanship, methods and materials shall meet the highest standards of the trade and, in general, shall conform to the standards of the following associations:

American National Standards Institute (ANSI)
American Society of Mechanical Engineers (ASME)
National Board of Fire Underwriters (NBFU)
National Fire Protection Association (NFPA)
National Electrical Manufacturers Association (NEMA)
Occupational Safety and Health Act (OSHA)
Underwriters' Laboratories (U.L.)
American Society of Testing Materials (ASTM)
Maine State Building Code
Town of Portland Regulations and Ordinances

1.8 EXCHANGE OF INFORMATION AND COORDINATION

A. All systems and equipment covered by this Section of the Specifications shall not be installed in congested and problem areas without first coordinating the installation of same with the other trades and the General Contractor. This Contractor shall, at his own expense, relocate all equipment installed in congested or problem areas should they interfere with the proper installation of the equipment to be installed by other trades and by the General Contractor.

B. Particular attention shall be directed to the coordination of Systems with all equipment of other trades installed in the ceiling areas. Coordinate, with the other trades, the elevations of all equipment in hung ceiling areas to insure adequate space for the installation of fixtures before said equipment is installed.

C. Furnish to the General Contractor and all other Contractors all information relative to the portion of the installation specified in this Section that will affect them, sufficiently in advance, so that they may plan their work and installations accordingly.

D. In the case of failure on the part of this Contractor to give proper information, as indicated above, sufficiently in advance, this Contractor will pay for all backcharges incurred by the General Contractor and other Contractors for the modification and/or relocation of any portion of the work already performed by them in conjunction with this Contract due to this Contractor's delay or for having given incorrect information.

E. Obtain from the other trades, all information relative to the work covered by this Section of the Specifications, which this Contractor is to execute in conjunction with the installation of their respective equipment.

F. In the event that conflicts, if any, cannot be settled rapidly and amicably between the affected trades with work proceeding in a workmanlike manner, then the Architect shall decide which work is to be relocated and his judgement shall be final and binding.

1.9 WORKMANSHIP

A. The entire work provided in this Specification shall be constructed and finished, in every respect, in a workmanlike and substantial manner. It is not intended that the Specifications define each item, but this Contractor shall furnish and install all such parts as may be necessary to complete the work in accordance with the best trade practice and to the satisfaction of the Architect and the Owner. The Owner shall have the right to reject any part of the work in case the workmanship is not of satisfactory quality and this Contractor shall replace same with acceptable work at his own expense.

1.10 SITE INVESTIGATION

A. It shall be the responsibility of the Bidders to acquaint themselves with the available information, before submitting their bid. Bidders must visit the site and acquaint themselves with the existing conditions and shall study all Architectural, Structural, Mechanical and Electrical Drawings, as well as the Specifications. The Bidders shall fully inform themselves of all local and state Code requirements. Extra compensation will not be given for obvious conflictions apparent at the time of the start of the project.

1.11 TAXES AND INSURANCE

A. This Contractor shall include in his bid, applicable federal, state and local taxes and the premiums of the insurance required by the General Conditions of the Contract.

1.12 FEES, PERMITS AND INSPECTIONS

A. This Contractor shall obtain and pay for all the permits required for this Section of the work. He shall also obtain and pay for all the inspections and tests required. Defects discovered in work, materials and/or equipment shall be replaced at no cost to the Owner, and the inspection and test shall be repeated. When work is completed, this Contractor shall furnish a Certificate of Inspection and Approval, to the Owner, before final payment of the Contract will be allowed.

1.13 CONTRACT COST BREAKDOWN

A. At the start of construction, submit a breakdown of material and labor costs to aid the Architect in determining the value of the work installed, as the job progresses. The cost breakdown shall itemize categories of materials or portions of systems, as may be the case, to place a value on the work as it is installed.

B. No requisitions will be paid until after the breakdown is delivered to the Architect.

1.14 GUARANTEE

A. Unless otherwise noted, all materials, items of equipment and workmanship furnished under this Section shall carry an unconditional warranty against all defects in material and workmanship for a period of not less than one (1) year from the date of final acceptance. Any fault due to defective or improper material or workmanship which may develop within that period, shall be made good, forthwith, by and at the expense of this Contractor, including all other damage done to areas, materials and other systems resulting from this failure.

B. This Contractor shall guarantee that all elements of the Systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

C. Upon receipt of notice from the Owner of failure of any part of the Systems during the guarantee period, the affected part or parts shall be promptly replaced by this Contractor, at no charge to the Owner.

D. This Contractor shall furnish, before the final payment is made, a written guarantee covering the above requirements.

1.15 MATERIALS

A. Materials shall be the best of their respective kinds and in full accord with the most modern mechanical construction. All materials shall be new.

B. All materials necessary to make the installation complete in every detail shall be furnished and installed under this Contract, whether or not specifically noted herein.

C. It is the intent of the Specifications that one manufacturer be selected, not a combination, for any particular classification of materials.

D. Where materials, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish the standard of desired quality and style and shall be the basis of the bid.

1.16 MATERIALS AND EQUIPMENT HANDLING

A. This Contractor shall do all handling of his materials and equipment and the resulting cleanup, at his expense, in a safe and satisfactory manner. Special attention shall be paid to the protection of life and property and the equipment or apparatus handled, and any corresponding damages shall be replaced, repaired or paid for by this Contractor, as approved by the Architect. This Contractor shall provide all rigging, hoisting and staging required to complete the work of this Section, unless specifically noted otherwise.

1.17 MAINTENANCE AND PROTECTION OF MATERIALS

A. This Contractor shall be responsible for the maintenance and protection, from loss or damage of all causes, of all equipment, materials and tools supplied by him and stored or installed on the job site, until final acceptance of the project by the Owner.

B. This Contractor shall store his materials and equipment in the location designated by the Owner and maintain the storage area in a safe condition.

C. This Contractor shall clean, patch and repair any material and finishes of the building or its contents damaged during the execution of this Contract.

1.18 SHOP DRAWINGS AND MATERIAL SCHEDULE

A. Submit complete Installation Drawings and component submittals in accordance with provisions of the General Conditions, Supplementary General Conditions, Special Conditions and General Requirements.

B. Within 15 days after the date of Notice to Proceed and before purchasing any materials or equipment, submit to the Architect for approval, submit complete, stamped, engineered drawings clearly depicting all piping, components and systems proposed to fulfill the work of this Section. After the plans have been received and approved by the Architect, submit complete component submittals of all equipment and materials. Do not order any material or equipment until approval has been obtained from the Architect.

C. The approval of equipment and materials does not relieve this Contractor from the responsibility of Shop Drawings errors in details, sizes, quantities and dimensions which deviate from the Specifications and/or job conditions as they exist.

D. If apparatus or materials are substituted by this Contractor for those specified, and such substitution necessitates changes in any mechanical or electrical equipment, or alteration to connections, piping, supports, or construction, same shall be provided. This Contractor is to assume the cost and entire responsibility thereof. The Architect's permission to make such a substitution shall not relieve this Contractor from full responsibility for the work.

E. Changes to work already performed, made necessary by delays in obtaining approvals, are the responsibility of this Contractor.

1.19 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Provide operating instructions to the Owner's designated representative, with respect to operating and maintenance procedures, for all equipment and systems installed. The cost of up to eight (8) hours of instruction shall be included in the Contract Price.

B. At the completion of the project, turn over to the Architect, three (3) complete manuals containing the following:
   1. Complete shop drawings of all equipment.
   2. Operation description of all Systems.
   3. Names, addresses and telephone numbers of all suppliers of the products, materials, equipment and Systems.
   4. Guarantees on all products, materials and equipment.
   5. Preventive maintenance instructions for all Systems.
   6. Spare parts list of all System components.

C. Each manual shall be typewritten and bound under one (1) hard cover and will be reviewed by the Architect. The manuals shall be clearly and permanently identified on the cover with the name of the project.

D. Upon completion of the instructions, this Contractor shall obtain a letter of acceptance of the instructions as being complete from the Owner. Submit a copy of said letter to the Architect.

1.20 CLEANING OF SYSTEMS

A. Before the Systems are accepted, all equipment shall be thoroughly cleaned, so that no dirt, dust or other foreign matter will be deposited and be detrimental to the operation of the Systems.

B. After the installation is complete, equipment with factory finished surfaces shall be cleaned and damaged or scratched spots shall be touched up with the same type and color paint applied at the factory.

C. All equipment that is to receive finish paint by the Painting Contractor, shall be cleaned by this Contractor and left ready to have surfaces prepared to receive paint.

1.21 RUBBISH REMOVAL

A. At the completion of the work, or when ordered by the General Contractor or the Architect, this Contractor shall remove from the property, all the rubbish or waste material belonging to him. Keep the job site free from accumulation of waste material and rubbish; premises must be maintained in a clean condition.

1.22 TEMPORARY STRUCTURES

A. This Contractor shall provide, on the premises and where directed by the Architect,

shall maintain in good condition, and shall remove when directed, suitable and substantial watertight sheds in which he shall store all his materials and equipment.

1.23 TEMPORARY SERVICES

A. All water, electricity, fire protection and sanitary facilities required for safe and efficient construction during normal working hours shall be furnished in accordance with the General Requirements.

1.24 TESTS

A. Furnish all labor, materials, instruments, supplies and services and bear all cost for the accomplishment of the tests herein specified. Correct all defects appearing under test, repeat the tests until no defects are disclosed and leave the equipment clean and ready for use.

B. Perform any tests, other than herein specified, which may be required by legal Authorities or by Agencies to whose requirements this work is to conform.

C. Dispose of test water and wastes after tests are complete, in a manner satisfactory to the Architect and in accordance with governing regulations.

1.25 EQUIPMENT ACCESS REQUIREMENTS

A. All work shall be installed so that all parts requiring inspection, operation, maintenance and repair are readily accessible.

B. Furnish access panels in walls and ceilings as required to permit access for adjustment, removal and the replacement and servicing of all equipment, and all other items requiring maintenance and adjustments. Access panels shall be installed by the General Contractor.

C. Coordinate the exact location of access panels in all finished spaces with the Architect.

1.26 MOTOR CHARACTERISTICS

A. Unless otherwise indicated, motors for equipment specified under this Section shall be furnished and installed by the Fire Protection Contractor and shall be as follows, unless noted otherwise:

1. Motors 1/3 HP and smaller shall be wound for 120 volts, single phase, 60 cycle AC service.

B. Unless otherwise specified, all motor starters shall be furnished and installed by the Electrical Contractor.

1.27 WIRING DIAGRAMS

A. This Contractor shall furnish wiring diagrams for all equipment furnished under this

Section for which wiring is to be installed by the Electrical Contractor.

1.28 PROCEDURE FOR TESTING

A. Partial tests shall be made, as required, by the progress of the work.

B. All labor, materials, instruments, devices and power required for testing shall be furnished by this Contractor. All tests shall be performed in the presence and to the satisfaction of the Architect and such other parties as may have legal jurisdiction.

C. Repair, or if directed by the Architect, replace all defective work with new work without extra charge to the Contract. Repeat tests as directed until all work is proven to meet the requirements specified herein.

D. Restore to its finished condition any work or materials disturbed by tests.

E. This Contractor shall be responsible for removing all temporary piping connections required for tests and dispose of test water and wastes after tests in a manner satisfactory to the Architect.

F. This Contractor shall make hydrostatic, pneumatic and operational tests on all fire protection equipment in accordance with standards of the National Board of Fire Underwriters and as required by the NFPA.

G. Fire Protection Systems:
1. Upon completion of the sprinkler system piping, this Contractor shall inspect and test each system in the presence of the Owner's representative and the Fire Chief.
2. The complete testing procedure for the systems shall be in accordance with the requirements stated in the National Fire Protection Association's respective pamphlet for each system, but not less than the procedures specified herein.
3. In general, the Fire Protection Systems shall be tested with water to a hydrostatic pressure of 200 pounds per square inch. This pressure shall be maintained for a minimum of four (4) hours or until the system has been inspected for leaks or defects. If any leaks or defects are detected, they shall be remedied in an approved manner and the System shall be retested in the manner specified herein.
4. This Contractor shall secure all Certificates of Approval from all agencies. Each Certificate shall be delivered to the Architect before final acceptance.

PART 2 - PRODUCTS

2.01 INSTALLATION REQUIREMENTS

A. This Contractor shall comply with all the rules, Codes, ordinances, regulations and requirements of all legally constituted authorities having jurisdiction over the whole or any part of the work herein specified. Regulations supplement this Specification and shall take precedence in any case of conflict.

B. All equipment and materials furnished in connection with the installation shall be new and furnished in accordance with the requirements of the Standards of the NFPA and they shall be of the best grade and quality of their respective kinds, free

from natural, manufacturing or construction flaws, defects or irregularities and finish, fittings and workmanship shall be equal to the highest commercial grade.

C. Castings of all metals of all kinds shall be clean, smooth, close grained, of uniform thickness and free from all defects such as sand holes, blisters or cracks.

D. Before the installation will be accepted, the Fire Protection Contractor shall have every portion of his work in first-class working condition.

E. Where installing any of the apparatus herein called for, sufficient clearance shall be allowed to permit the removal and replacing of parts that may require future removal for repairs and replacement.

F. Exposed piping shall be installed as tight as practical to structural members.

G. Piping shall be installed neatly and square to all surfaces. Horizontal sidewall sprinklers shall be installed as tight to beams and ceilings as the sprinkler listing will allow with reference to the existence of beams.

2.02 ACCESS PANELS

A. Furnish access panels for installation by the General Contractor in walls and as required to permit access for adjustment, removal and replacement and servicing of all equipment such as inspector's tests and all other items requiring maintenance and adjustment.

B. All access panels shall be located in closets, storage rooms and/or other non-public areas, in a workmanlike manner, positioned so that the junction can be easily reached, and the size shall be sufficient for this purpose (minimum 16" x 16"). When access panels are required in corridors or other public areas, they shall be located as directed by the Architect.

C. Access panels shall be of steel construction, prime painted and furnished with cylinder lock and two (2) keys, as manufactured by Inland Steel Products Company, "Milnor," Miami-Carey, Walsh-Hannon-Gladwin, Inc., "Way-Loctor" or approved equal. Access panels located in Fire-Rated ceilings and Fire-Rated walls shall be constructed with 1-1/2 hour Fire-Rating and shall bear the U.L. Label insuring the Fire-Rating construction.

2.03 PIPE AND FITTINGS

A. All piping inside the building for the sprinkler system 2-1/2 inches and smaller in size shall be Schedule 40 black steel pipe with threaded ends conforming to ASTM Standard A135, latest amendment, approved for use in Fire Protection Systems. All piping inside the building, three inches (3") and larger in size, unless otherwise noted, shall be Schedule 10 black steel pipe with rolled groove ends, approved for use in Fire Protection Systems.

B. Fittings for the sprinkler systems shall be cast iron. Cast iron fittings shall be extra heavy pattern for pipe sized larger than two inches (2"). Malleable iron fittings of standard weight pattern will be acceptable in sizes up to six inches (6"). U.L. approved and F.M. listed groove fittings will be allowed. All fittings shall be

approved by Underwriters Laboratories for use in sprinkler systems and shall be designed and guaranteed for a working pressure of not less than 175 psi cold water pressure.

C. All close and shoulder nipples shall be of corresponding materials as the pipe and shall be extra heavy pattern.

D. All pipe shall be run true to line and grade and, in general, parallel to walls and ceilings. All open ends of the pipe lines, equipment, etc., shall be properly capped and plugged during the installation in order to keep dirt or foreign materials out of the system. All work shall be performed in a practical manner and according to the highest standards of workmanship.

E. All threaded pipes shall have full tapered threads with ends reamed out after threading and cutting.

F. The interior of all pipes and fittings shall be cleaned before assembling. All pipe threads (not fittings) shall have a thorough application of approved pipe joint cement before assembling. Any leaky joints shall be remade, as caulking will not be permitted. All pipe shall be pitched as required. Means shall be provided to completely drain the entire system. Capped flushing connections shall be provided at the ends of all cross mains.

2.04 VALVES

A. All valves shall be of the O.S. & Y. type, of approved extra heavy flanged pattern and be designed and guaranteed for a minimum working pressure of 175 psi. All shut-off valves shall be located in conveniently accessible positions. Valves controlling the water supply to each system shall have an approved sign attached to the yoke indicating the purpose of the valve.

B. Check valve shall be of approved type for fire protection systems and be designed and guaranteed for a minimum working pressure of 175 psi.

C. Drain valves shall be Underwriters' approved all bronze angle, globe pattern with renewable disc, hose with cap and chain, ample size hand wheel and rated for a working pressure of 175 psi.

2.05 HANGERS AND SUPPORTS

A. All piping shall be supported throughout the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.

B. Pipe hangers shall be of black malleable iron, heavy petters in two (2) parts bolted together, of a type approved for Fire Protection Systems installation.

C. Hangers shall fit the pipe snugly but leave the pipe sufficient freedom of movement for expansion or contraction. Hangers which permit wide lateral motion of the pipe will not be acceptable.

D. "C" clamps for hangers on pipes will not be permitted unless installed with safety straps.

E. Maximum spacing of hangers on horizontal runs of pipe, having no concentrations of weight, shall be as follows:

SCHEDULE
Hanger Spacing for Various Pipes

Pipe Size (inches)	Spacing (feet)
1	7
1-1/4	10
1-1/2	10
2	10
2-1/2	10
3	12
3-1/2	12
4	10
6	8
8	8

F. Where Codes having jurisdiction require closer spacing, the hanger spacing shall be as required by Code in lieu of the distance specified herein.

G. Provide hangers at a maximum distance of two feet (2') from all changes in direction (horizontal and vertical) on both sides of concentrated loads independent of the piping.

H. Hangers, in general, for all horizontal piping shall be adjustable clevis type hangers.

I. All vertical drops and runout pipes shall be supported by extension style, split ring type hangers.

J. All horizontal piping shall be suspended from the building by mild steel rod connecting the pipe hanger to inserts, angle brackets and lag screws, as required by the building construction in accordance with the following table:

Pipe Size (inches)	Rod Diameter (inches)
1 - 3	3/8
3 - 6	1/2

K. Hanger rods for other installations shall be sized in accordance with recommended load capacities of Specification A.S.T.M. Designation A-107, latest amendment.

L. Remove rust from all ferrous hanger equipment (hangers, rods and bolts) and apply one (1) coat of rust inhibiting paint immediately after erection.

M. All piping installed under this Section of the Specifications shall be independently supported from the building structure and not from the piping, ductwork or conduit of other trades. All supplementary steel required to meet requirements specified herein shall be furnished and installed by this Contractor.

N. In areas where support of the pipe by hangers is not possible or feasible, piping shall be supported by an adjustable pipe roll stand with base plate equal to Figure 274, as manufactured by Grinnel Corporation. This installation method shall be done in accordance with the requirements of all pertinent Codes.

O. All supplementary steel throughout the project for this Section of the Specifications, both suspended and floor mounted, shall be furnished and installed by the Fire Protection Contractor and shall be subject to the approval of the Architect.

P. All piping shall have seismic restraints in accordance with NFPA #13 and the State Building Code. A letter of compliance signed by a registered structural engineer confirming that pipe hangers meet State Seismic Code requirements.

2.06 SLEEVES AND INSERTS

A. This Contractor shall be held responsible for the location of and maintaining in proper position, of sleeves, inserts and anchor bolts supplied and/or set in place by him. In the event that failure to do so requires cutting and patching of finished work, it shall be done at this Contractor's expense by the General Contractor.

B. All pipes passing through walls or partitions shall be provided with sleeves having an internal diameter one inch (1") larger than outside diameter of the pipe.

C. Unless otherwise indicated and/or specified herein, all sleeves through masonry floors or interior masonry walls shall be Schedule 40 black steel pipe, set flush with finished wall or set one inch (1") above finished floor surfaces, or as indicated on the architectural drawings.

D. Sleeves through interior non-masonry partitions shall be 22 gauge galvanized sheet steel, set flush with finished surfaces of the partitions.

E. Sleeves through interior walls adjacent to all building expansion joints shall be two (2) pipe size diameters larger than diameter of pipe.

F. Sleeves passing through lightproof or soundproof walls, floors and partitions and through firewalls shall be made tight, using approved caulking materials.

2.07 ESCUTCHEONS

A. Escutcheons shall be installed around all exposed bare pipe. Escutcheons shall be of sufficient outside diameters to cover the sleeve opening and shall fit snugly around the bare pipe.

B. Escutcheons shall be cast brass, grey primed finish and provided with a set-screw to properly hold escutcheons in place.

2.08 SPRINKLER HEADS

A. All sprinkler heads shall be of 1/2 inch nominal orifice size. Heads shall be listed by Underwriters' Laboratories, Inc. and approved by Factory Mutual.
All heads shall be manufactured by a single manufacturer.

B. All heads shall have a temperature rating of 165°F unless the distance from a heat source or location of head warrants, by Code, a head of another degree rating.

C. The following sprinkler heads shall be installed in the areas outlined, unless noted otherwise:
- Sprinkler heads in spaces without ceilings or in unfinished spaces shall be of the upright type, of brass, with deflectors and fusible links. In the event that conditions prohibit upright heads, pendant heads may be installed provided they are equipped with guard cages.
- Sprinkler heads in finished areas with hung ceilings shall be pendant type and shall be recessed white finished brass heads with deflectors, fusible links and white escutcheons plates unless the sprinkler head is located near a surface-mounted light fixture, beam or similar device. In these instances, sprinkler heads shall be surface mounted pendant units. All heads in any single room or area shall be of the same type.

2.09 SPARE SPRINKLER HEADS AND CABINETS

A. The Fire Protection Contractor shall furnish and install in the building, where directed by the Architect, a red metal cabinet containing spare sprinkler heads and wrenches.

B. The cabinets shall have shelves for storing the spare heads in an orderly manner. The shelf spaces shall be subdivided to segregate the sprinkler heads of each type and clearly identify them with approved markings. The cabinets shall have proper arrangement for hanging the wrenches. Cabinet shall be mounted 5'-0" A.F.F. at sprinkler riser.

C. Spare sprinkler heads shall be provided in numbers, as required by NFPA Pamphlet #13, corresponding to the types and temperature ratings of those installed in the premises (6 minimum of each type).

D. Wrenches shall be provided in a number so that there will always be a minimum of two (2) wrenches of each type required to remove any sprinkler head on the premises.

2.10 SEISMIC RESTRAINTS

A. All supports for equipment and piping shall be constructed and installed as per requirements of NFPA #13 and the Maine State Building Code in regards to seismic restraints.

2.11 DRAINS AND TEST CONNECTIONS

A. Drains and test connections shall be provided in the system as required by all governing Codes, regulations and ordinances.

B. Drains shall be provided at low point in piping, at base of risers, and wherever necessary to insure that all portions of the piping may be completely drained.

C. Test connections shall consist of drain piping with a one inch (1") shutoff valve (O.S. & Y.) type, piped outdoors to a safe place of discharge. Pipe through outside wall shall be galvanized steel pipe with sleeve caulked watertight and plugged with a brass plug.

2.12 FIRE PROTECTION ALARMS

A. O.S. & Y. valve monitor switches and sprinkler system's flow and pressure sensors shall be furnished and installed by the Fire Protection Contractor and wired by the Electrical Contractor. The Fire Protection Contractor shall coordinate with the Electrical Contractor on this portion of the system. Monitor switches shall be installed on all O.S.& Y. valves and shall be equal to Notifier OSY2 and be fitted with 2-SPDT switches. Flow switches shall be installed as indicated on the drawings and shall be equal to Notifier WFD 10/40 with adjustable delay.

2.13 ALARM CHECK VALVE

A. Alarm check valve shall be an approved type for wet pipe sprinkler systems complete with retarding chamber, water operating gong, drain valve, pressure gauges and other required trimmings. Valve shall be equal to Globe Model H-1 for variable pressure vertical installation, size as indicated on the drawings, with H-1 trim package, with Global Model "F" Water Motor and Gong. Water gong shall be located on outside of building with head and identification tag. Supply pipes to gong shall be IPS brass or copper.

2.14 BACKFLOW PREVENTER

A. This contractor shall furnish and install a six inch (6") backflow preventer, where shown on the drawings. The device shall be a Watts Model No. 774 or equal.

B. One (1) complete rebuilding kit shall be supplied with the backflow preventer.

C. This contractor shall be responsible to file design data sheets along with cuts of the backflow preventer, and obtain approval of same form the local Water Department.

2.15 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be Underwriters' Laboratories and NFPA approved unit with a Simese or a "Storz" type connection, as required by the local Fire Department. Unit shall be manufactured of heavy bronze caps, plugs and chains. Provide identification plate of cast brass with the words "AUTO.SPKR" in raised lettering.

PART 3 - EXECUTION

3.01 OPERATION AND START-UP

A. The Fire Protection Contractor shall furnish all labor, materials and equipment necessary to place the equipment into operation and then start and operate all systems to demonstrate the fitness of the installation.

B. Prior to start-up, the Fire Protection Contractor shall check all equipment for rotation, check belts for tightness, provide lubrication, clean all equipment, perform pressure tests and make all other adjustments necessary for start-up.

3.02 COORDINATION

A. The structure and its appurtenances, clearances and the related services, such as plumbing, heating, ventilation and electric service, have been planned to be adequate and suitable for the installation of equipment specified under this Section.

The Owner will not assume any increase in cost caused by different requirements peculiar to a particular make or type of equipment and any such incidental cost shall be borne by the Fire Protection Contractor. He shall be responsible for the proper installation and location of his required sleeves, chases, inserts, etc., and see that they are set in the forms before the concrete is poured. He shall be responsible for his work and equipment furnished and installed by him until the completion and final acceptance of this Contract, and he shall replace any work which may be damaged, lost or stolen, without additional cost to the Owner.

B. Cutting and Patching - It shall be the duty of the Fire Protection Contractor to consult with and give to the General Contractor the exact location and size of all openings and for information as to cutting and patching necessary for the same. In the event the Fire Protection Contractor fails to provide sleeves, inserts and templates or fails to notify other Contractors well in advance of his requirements, he shall be responsible for paying for all cutting and patching made necessary by his failure to do so.

C. In the event there is a conflict or inadequate space for the proper installation of Fire Protection equipment, the Fire Protection Contractor shall prepare a scaled (1/4" = 1'-0" size) composite sketch, showing the building structure and all equipment and items affecting the installation, to clearly identify the areas of conflict. The Fire Protection Contractor shall submit four (4) copies of the sketch, along with a written explanation of the problem, to the Architect for his review and determination on what action to take to resolve the conflict.

D. It shall be the duty of the Fire Protection Contractor to furnish full information to all trades relative to the work they are to do in connection with work under this Section. This includes data for wiring, including wiring diagrams, equipment foundations, pipe connections, etc., furnished under other Sections.

3.03 PAINTING

A. The Fire Protection Contractor shall apply one (1) coat of anti-rust paint and one (1) coat of flat black enamel to all support steel, hangers and other steel or iron elements of the Fire Protection system, furnished by him, which will be enclosed or above ceilings when the project is completed.

B. Paint shall be omitted from all items with a galvanized finish.

C. All surfaces to be painted shall be free of dirt, scale, rust, grease and oil. Rust spots are to be wire brushed. Ambient temperature shall be in accordance with paint

manufacturer's requirements when painting is being performed.

D. The Fire Protection Contractor shall touch up, with spray paint, all scratched or damaged surfaces of equipment with factory finish. Spray paint shall be the same color and type as factory finish.

E. The Painting Contractor shall paint all mechanical equipment, enclosures, covers, panels, insulation, conduit and other equipment exposed to view, except factory finished items. Care shall be taken not to paint over equipment nameplates. The Fire Protection Contractor shall leave surfaces to be painted ready to receive paint. The Painting Contractor shall apply paint in accordance with the Painting and Finishing portion of this Specification. Colors shall be selected by the Architect.

3.04 AS-BUILT DRAWINGS

A. This Contractor shall submit, at the completion of the building, two (2) sets of mylar reproducible drawings of the final, approved installation drawings, completely revised showing all field changes made, and marked "As-Built Drawing." The Architect will review these final plans and inform the Contractor of their acceptability.

END OF SECTION 15300

SECTION 15300

FIRE PROTECTION

TABLE OF CONTENTS

Statement of Special Inspections

Project: *McDonald's Restaurant*

Location: *332 St. John Street, Portland, ME*

Owner: *McDonald's Corporation 2111 McDonald's Drive, Oakbrook, IL 60523*

Design Professional in Responsible Charge: *Dale A. Dubois, PE*

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

☒ Structural ☐ Mechanical/Electrical/Plumbing

☐ Architectural ☐ Other: _____

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

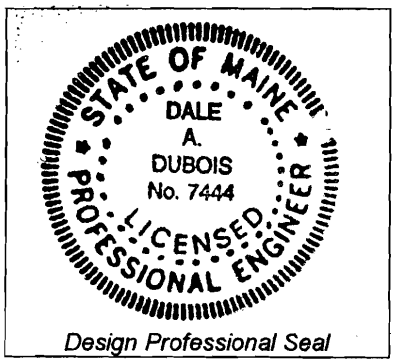
Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: or ☒ per attached schedule.

Prepared by: Local Inspection Engineer

Dale A. Dubois, PE
(type or print name)

Signature *8/15/2007* Date



Design Professional Seal

Owner's Authorization:

Signature Date

Building Official's Acceptance:

Signature Date

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- ☒ Soils and Foundations
- ☒ Cast-in-Place Concrete
- ☐ Precast Concrete
- ☐ Masonry
- ☒ Structural Steel
- ☐ Cold-Formed Steel Framing
- ☐ Spray Fire Resistant Material
- ☒ Wood Construction
- ☐ Exterior Insulation and Finish System
- ☐ Mechanical & Electrical Systems
- ☐ Architectural Systems
- ☐ Special Cases

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. **Special Inspection Coordinator**	*Dubois Engineering Associates, Inc.* *Dale A. Dubois, PE*	*117 Harrison Street* *Manchester, NH 03104* *(603) 666-0900* *DuboisEng@Comcast.net*
2. Local Structural Inspector	*Dubois Engineering Associates, Inc.* *Dale A. Dubois, PE*	*117 Harrison Street* *Manchester, NH 03104* *(603) 666-0900* *DuboisEng@Comcast.net*
3. Inspector		
4. Testing Agency	*UTS* *Bill Crabtree*	*5 Richardson Lane* *Stoneham, MA 02180* *(781) 438-7755*
5. Testing Agency		
6. Other		

Note: The inspectors and testing agencies shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

Quality Assurance Plan

Quality Assurance for Seismic Resistance

Seismic Design Category	*B*
Quality Assurance Plan Required (Y/N)	*N*

Description of seismic force resisting system and designated seismic systems:
Bearing wall system: Light frame walls with shear panels-wood structural panels as well as Ordinary steel concentrically braced frame.

Quality Assurance for Wind Requirements

Basic Wind Speed (3 second gust)	*110 MPH*
Wind Exposure Category	*B*
Quality Assurance Plan Required (Y/N)	*N*

Description of wind force resisting system and designated wind resisting components:
Bearing wall system: Light frame walls with shear panels-wood structural panels as well as Ordinary steel concentrically braced frame.

Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated above must submit a Statement of Responsibility.

Qualifications of Inspectors and Testing Technicians

The qualifications of all personnel performing Special Inspection and testing activities are subject to the approval of the Building Official. The credentials of all Inspectors and testing technicians shall be provided if requested.

Key for Minimum Qualifications of Inspection Agents:

When the Registered Design Professional in Responsible Charge deems it appropriate that the individual performing a stipulated test or inspection have a specific certification or license as indicated below, such designation shall appear below the *Agency Number* on the Schedule.

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EDI-EIFS	EIFS Third Party Inspector

Other

_____ _____

Soils and Foundations

Item	Agency # (Qualif.)	Scope
1. Shallow Foundations	4	*Inspect soils below footings for adequate bearing capacity and consistency with geotechnical report.* *Inspect removal of unsuitable material and preparation of subgrade prior to placement of controlled fill*
2. Controlled Structural Fill	4	*Perform sieve tests (ASTM D422 & D1140) and modified Proctor tests (ASTM D1557) of each source of fill material.* *Inspect placement, lift thickness and compaction of controlled fill.* *Test density of each lift of fill by nuclear methods (ASTM D2922)* *Verify extent and slope of fill placement.*
3. Deep Foundations	4	*Inspect installation of Geo-Pier Rammed Aggregate pile system for conformance with approved Certified shop drawings.*
4. Load Testing	4	*Oversee Load testing of Geo Pier system to verify capacity.*
4. Other:		

Cast-in-Place Concrete

Item	Agency # (Qualif.)	Scope
1. Mix Design	*4*	*Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design.*
2. Material Certification		
3. Reinforcement Installation	*2&4*	*Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters*
4. Post-Tensioning Operations		.
5. Welding of Reinforcing		
6. Anchor Rods	*2&4*	*Inspect size, positioning and embedment of anchor rods. Inspect concrete placement and consolidation around anchors.*
7. Concrete Placement	*4*	*Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.*
8. Sampling and Testing of Concrete	*4*	*Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064).*
9. Curing and Protection	*4*	*Inspect curing, cold weather protection and hot weather protection procedures.*
10. Other:		

Structural Steel

Item	Agency # (Qualif.)	Scope
1. Fabricator Certification/ Quality Control Procedures ☐ Fabricator Exempt	*2*	*Review shop fabrication and quality control procedures.*
2. Material Certification	*2*	*Review certified mill test reports and identification markings on wide-flange shapes, high-strength bolts, nuts and welding electrodes*
3. Open Web Steel Joists	*2*	*Inspect installation, field welding and bridging of joists.*
4. Bolting	*2*	*Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence. Continuous inspection of bolts in slip-critical connections.*
5. Welding	*2&4*	*Visually inspect all welds.. Verify size and length of fillet welds.* *Ultrasonic testing of all full-penetration welds.*
6. Shear Connectors		.
7. Structural Details	*2*	*Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details.*
8. Metal Deck		.
9. Other:		

Wood Construction

Item	Agency # (Qualif.)	Scope
1. Fabricator Certification/ Quality Control Procedures ☐ Fabricator Exempt	*2*	*Review shop fabrication quality control procedures for wood truss plant.*
2. Shop Drawing review & Material Grading	*2*	*Review all shop drawing for conformance with Structural Documents. Visually inspect grades of material for conformance with approved shop drawings.*
3. Connections	*2*	*Visually inspect all connections for conformance with structural details and approved shop drawings*
4. Framing and Details	*2*	*Visually inspect all connections for conformance with structural details and approved shop drawings.*
5. Diaphragms and Shearwalls	*2*	*Inspect size, configuration, blocking and fastening of shearwalls and diaphragms. Verify panel grade and thickness.*
6. Prefabricated Wood Trusses	*2*	*Inspect the fabrication of wood trusses.*
7. Permanent Truss Bracing	*2*	*Visually inspect conformance with approved shop drawings*
8. Other:		

Statement of Special Inspections

Project: *McDonald's Restaurant*

Location: *332 St. John Street, Portland, ME*

Owner: *McDonald's Corporation 2111 McDonald's Drive, Oakbrook, IL 60523*

Design Professional in Responsible Charge: *Dale A. Dubois, PE*

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

☒ Structural ☐ Mechanical/Electrical/Plumbing

☐ Architectural ☐ Other: _____

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

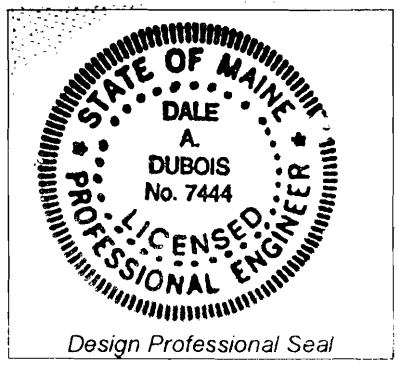
Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: or ☒ per attached schedule.

Prepared by: Local Inspection Engineer

Dale A. Dubois, PE
(type or print name)

8/15/2007
Signature Date



Design Professional Seal

Owner's Authorization:

Signature Date

Building Official's Acceptance:

Signature Date

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- ☒ Soils and Foundations
- ☒ Cast-in-Place Concrete
- ☐ Precast Concrete
- ☐ Masonry
- ☒ Structural Steel
- ☐ Cold-Formed Steel Framing
- ☐ Spray Fire Resistant Material
- ☒ Wood Construction
- ☐ Exterior Insulation and Finish System
- ☐ Mechanical & Electrical Systems
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Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. **Special Inspection Coordinator**	*Dubois Engineering Associates, Inc.* *Dale A. Dubois, PE*	*117 Harrison Street* *Manchester, NH 03104* *(603) 666-0900* *DuboisEng@Comcast.net*
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Quality Assurance Plan

Quality Assurance for Seismic Resistance

Seismic Design Category	*B*
Quality Assurance Plan Required (Y/N)	*N*

Description of seismic force resisting system and designated seismic systems:
Bearing wall system: Light frame walls with shear panels-wood structural panels as well as Ordinary steel concentrically braced frame.

Quality Assurance for Wind Requirements

Basic Wind Speed (3 second gust)	*110 MPH*
Wind Exposure Category	*B*
Quality Assurance Plan Required (Y/N)	*N*

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Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated above must submit a Statement of Responsibility.

Qualifications of Inspectors and Testing Technicians

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Signature

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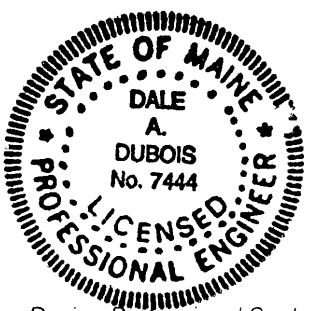
Date



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DUBOIS
ENGINEERING
ASSOCIATES, INC.

CONSULTING ENGINEERS

STRUCTURAL ○ FORENSIC

STRUCTURAL CALCULATIONS

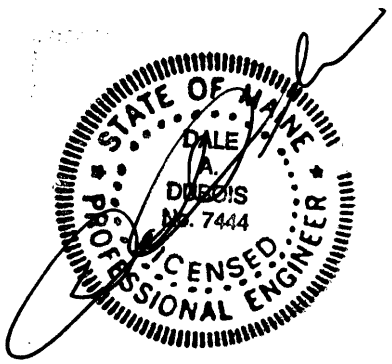
FOR

McDonald's Restaurant

332 St. John Street
Portland, ME

Prepared for:

LANDRY ARCHITECTS
389 Main Street
Salem, NH 03079



August 15, 2007
Project #07056

117 HARRISON STREET, MANCHESTER, NH 03104-3642 ○ (603) 666-0900 ○ FAX (603) 669-0900

DUBOIS
ENGINEERING
ASSOCIATES, INC.

CONSULTING ENGINEERS

STRUCTURAL ○ FORENSIC

August 15, 2007

Project #07056

Mr. Thomas B. Duff, RA
Landry Architects
389 Main Street
Salem, NH 03079

RE: Structural Calculations
McDonald's Restaurant
332 St John Street
Portland, ME

Dear Thom:

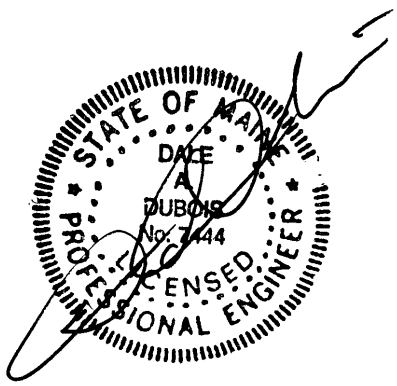
I respectfully submit the following set of structural calculations for the design of the new McDonald's restaurant to be constructed on 332 St John Street in Portland, ME. These calculations were used to as a basis of the design of the structure for this restaurant.

The calculations were developed in accordance with the 2003 International Building Code as required and good engineering practices.

If you should have any questions regarding this matter or require additional information, please call at your convenience.

Sincerely,

Dale A. Dubois, P.E.



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DUBOIS
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CONSULTING ENGINEERS

STRUCTURAL ○ FORENSIC

Project Design Criteria

Project Name: McD's Portland, ME
Project Number: 0705b

Design Code: 2003 IBC w/ City Amendments

Wind Loads:

- 3 Second Gust: 110 MPH
- Basic Wind Speed: 90 MPH
- Exposure: B
- Pressure: 14.2 #/Ft²

Snow Loads:

- Ground Snow Load: N/A
- Roof Snow Load: 50 #/Ft²
- Exposure Factor: 1.0
- Importance Factor: 1.0
- Ct: 1.0

Earthquake Design:

- Ss or ~~As~~: 0.40
- S1 or ~~Av~~: 0.10
- Hazard Group: I
- Performance Category: I
- Structural System: Bearing Wall System
- Soil Pressure:
- R: 6½
- Cd: 4
- Analysis: Light frame walls w/ shear panels - wood structural panels.

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JOB 108 Main St Portland, ME
SHEET NO. 1 OF
CALCULATED BY TEA DATE 8-7-07
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SCALE

2003 IBC with City Amendments

Roof loading:

Roof: Live load = 50 #/ft²
Dead load = 20 #/ft²
Total load = 70 #/ft²

Wall: Wood framing = 10 #/ft²
Brick Veneer = 40 #/ft²
Total load = 50 #/ft²

Beam B1

W_{Roof}: 70 #/ft² (18.61') = 1302.7 #/ft

W_{WALL} = 50 #/ft² (5') = 250 #/ft

Drifting = .5 (1.15 (w)^.33 − 1.5) = .5 (1.15 (37.22)^.33 − 1.5) = 1.15'

Width of Drift = 8H = 8(1.15') = 9.2'

γ = .13 (pg) + 14 = .13 (50 #/ft²) + 14 = 20.5 #/ft³

Max Intensity = 20.5 #/ft³ (1.15') = 23.58 #/ft²

W Drift load = $\frac{1.15' \times 9.2'}{2}$ × 20.5 #/ft³ = 108.45 #/ft

$W_{total} = W_{ROOF} + W_{WALL} + W_{DRIFT}$ = 1302.7 #/ft + 250 #/ft + 108.45 #/ft = 1661.15 #/ft

Moment Required: $M_R = \frac{WL^2}{8} = \frac{1661.15\ \#/ft\ (16.5')^2}{8}$ = 56531.01 Ft# ⇒ 678372.13 in# ⇒ 56.53 Ft-K

Section Modulus Req'd: $\frac{M_R}{F_b} = \frac{678372.13\ in\#}{33000\ \#/in^2}$ = 20.56 in³

F_b = 50000 #/in² × .666 = 33300 #/in²

Allowable Deflection = $\Delta = \frac{L}{480} = \frac{16.5'(12)}{480}$ = .41"

Moment of Inertia Req'd: $I = \frac{5WL^4}{384E\Delta} = \frac{5(1661.15\ \#/ft)(16.5')^4(12)^3}{384(29000000\ \#/in^2)(.41")}$ = 232.99 in⁴

Requirements:		W16x26 Allowables:	
M_R = 56.53 Ft-K	<	M_A 106 Ft-K	OK
S_R = 20.56 in³	<	S_A 38.4 in³	OK
I_R = 232.99 in⁴	<	I_A 301 in⁴	OK

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Beam B2

$W = 1661.15\ \#/ft$ (SEE BEAM B1 FOR INFO)

$M_R = \frac{1661.15\ \#/ft\,(8.17')^2}{8} = 13859.99\ ft\# \Rightarrow 166319.9\ in\# \Rightarrow 13.86\ ft\,k$

$S_R = \frac{166319.9\ in\#}{33000\ \#/in^2} = 5.04\ in^3$

$\Delta = \frac{8.17'(12)}{480} = .2"$

$I = \frac{5(1661.15\ \#/ft)(8.17')^4(12)^3}{384(29000000\ \#/in^2).2"} = 28.71\ in^4$

Requirements		W16x26		
$M_R = 13.86\ ft\,k$	<	$M_A = 106\ ft\,k$	OK	
$S_R = 5.04\ in^3$	<	$S_A = 38.4\ in^3$	OK	
$I_R = 28.71\ in^4$	<	$I_A = 301\ in^4$	OK	

Beam B3 Worst Case = 16.5' Span

$W_{ROOF} = 70\ \#/ft^2(2.83') = 198.33\ \#/ft$

Drifting $= .5(1.15(5.7)^{.33} - 1.5) = .27'$

Width of Drift $= 8(.27) = 2.17'$

$\gamma = 20.5\ \#/ft^3$ (SEE BEAM B1)

Max Intensity $= 20.5\ \#/ft^3(.27') = 5.54\ \#/ft^2$

$W_{Drift} = \frac{.27' \times 2.17'}{2} \times 20.5\ \#/ft^3 = 6.01\ \#/ft$

$W_{total} = W_{ROOF} + W_{DRIFT} = 198.33\ \#/ft + 6.01\ \#/ft = 204.34\ \#/ft$

$M_R = \frac{204.34\ \#/ft\,(16.5')^2}{8} = 6953.79\ ft\# \Rightarrow 83445.5\ in\# \Rightarrow 6.95\ ft\,k$

$S_R = \frac{83445.5\ in\#}{33000\ \#/in^2} = 2.53\ in^3$

$\Delta = .41"$ (From Beam B1)

$I_R = \frac{5(204.34\ \#/ft)(16.5')^4(12)^3}{384(29000000\ \#/in^2).41"} = 28.66\ in^4$

		W10x12		
$M_R = 6.95\ ft\,k$	<	$M_A = 30\ ft\,k$	OK	
$S_R = 2.53\ in^3$	<	$S_A = 10.9$	OK	
$I_R = 28.66\ in^4$	<	$I_A = 53.8$	OK	

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Beam B4 Worst Case = 26'

$W_{roof} = 70\ \#/ft^2 (18.61') = 1302.7\ \#/ft$

$W_{wall} = 10\ \#/ft^2 (4.75') = 47.5\ \#/ft$

$Drift_{High\ roof} = 1.15(23')^{.33} - 1.5 = 1.51$ ← Governs

$Drift_{Low\ roof} = .5(1.15(37.22')^{.33} - 1.5) = 1.15'$

Width of Drift $= 4(1.51') = 6.05'$

$\gamma = 20.5\ \#/ft^3$ (See beam B1)

$W_{Dr.ft} = \frac{1.51 \times 6.05'}{2} \times 20.5\ \#/ft^3 = 93.64\ \#/ft$

$W_{total} = 1302.7\ \#/ft + 47.5\ \#/ft + 93.64\ \#/ft = 1443.84\ \#/ft$

$M_R = \frac{1443.84\ \#/ft (26)^2}{8} = 122004.48\ ft\# \Rightarrow 1464053.76\ in\# \Rightarrow 122.01\ ft\,k$

$S_R = \frac{1464053.76\ in\#}{33000\ \#/in^2} = 44.37\ in^3$

$\Delta = \frac{26'(12)}{360} = .87"$

$I_R = \frac{5(1443.84\ \#/ft)(26)^4(12)^3}{384(29000000\ \#/in^2).87"} = 588.41\ in^4$

W18x40

$M_R = 122.01\ ft\,k \quad < \quad M_A = 188\ ft\,k$ OK

$S_R = 44.37\ in^3 \quad < \quad S_A = 68.4\ in^3$ OK

$I_R = 588.41\ in^4 \quad < \quad I_A = 612\ in^4$ OK

Beam B5

Vertical Loads

$W_{wall} = 50\ \#/ft^2 (3') = 150\ \#/ft$

$W_{Low\ roof} = 70\ \#/ft^2 (.666') + 6.01\ \#/ft = 52.63\ \#/ft$
(Drift SEE beam B3)

$W_{Trellis} = 70\ \#/ft^2 (4') = 280\ \#/ft$

$Drift = 1.15(24.666')^{.33} - 1.5 = 1.81'$

Width of Drift $= 4(1.81') = 7.24'$

$\gamma = 20.5\ \#/ft^3$ (SEE BEAM B1)

$W_{Drift} = \frac{1.81' \times 7.24'}{2} \times 20.5\ \#/ft^3 = 134.32\ \#/ft$

$W_{total} = 52.63\ \#/ft + 280\ \#/ft + 134.32\ \#/ft + 150\ \#/ft = 616.95\ \#/ft$

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Beam B5 Cont

$M_R = \frac{616.95\ \#/ft\ (5.666')^2}{8} = 2475.79\ Ft\# \Rightarrow 29709.43\ in\# \Rightarrow 2.48\ FtK$

$S_R = \frac{29709.43\ in\#}{30000\ \#/in^2} = .99\ in^3$

$F_b = 46000\ \#/in^2 \times .666 = 30636\ \#/in^2$

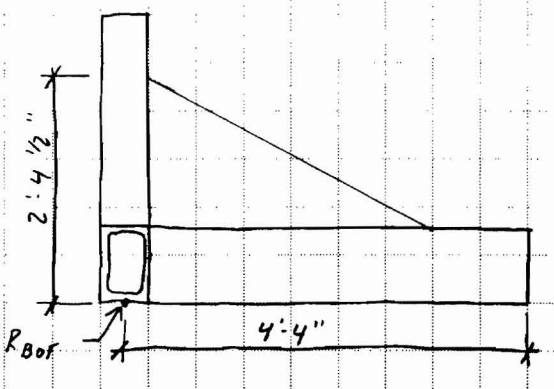
$\Delta = \frac{5.666(12)}{480} = .14"$

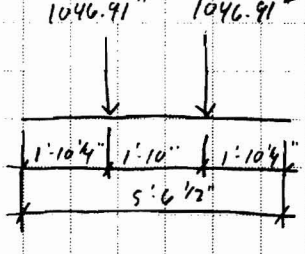
$I_R = \frac{5(616.95\ \#/ft)(5.666')^4(12)^3}{384(29000000\ \#/in^2).14"} = 3.52\ in^4$

HSS 8x6x1/4

$M_R = 2.48\ FtK < M_A = 3.75\ FtK$ OK
$S_R = .99\ in^3 < S_A = 15.0\ in^3$ OK
$I_R = 3.52\ in^4 < I_A = 60.1\ in^4$ OK

Beam B5 Horizontal





Trellis Load = 103.58 #/ft² (SEE SHEET 4)

$\frac{103.58\ \#/ft^2\ (4.333')\ (2.77')\ (2')}{2.375'} = \frac{R_{Top}\ (2.375')}{2.375'} = 1046.91\ \#$

$M_R = P_a = 1046.91\ \#\ (1.85') = 1936.79\ Ft\# \Rightarrow 23241.48\ in\# \Rightarrow 1.94\ FtK$

$S_R = \frac{23241.48\ in\#}{30000\ \#/in^2} = .78\ in^3$

$\Delta = \frac{5.54'(12)}{480} = .14"$

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Beam B5 cont

$I_R = \frac{P_a}{24E\Delta}(3L^2 - 4a^2) = \frac{1046.91^{\#}(1.85')(12)}{24(29000000\ ^{\#}/in^2).14"}(3(5.54')^2(12)^2 - 4(1.85')^2(12)^2) = 2.69\ in^4$

HSS 8x6x1/4

M_R 1.94 Fek < M_A = 32.25 Fek OK

S_R .78 in^3 < S_A = 12.9 in^3 OK

I_R = 2.69 in^4 < I_A = 38.6 in^4 OK

Beam B6

$W = 70\ ^{\#}/ft^2(18.80') = 1316\ ^{\#}/Ft$

$M_R = \frac{1316\ ^{\#}/Ft(23')^2}{2} = 87020.5\ Fe^{\#} \Rightarrow 1044246\ in^{\#} \Rightarrow 87.02\ Fek$

$S_R = \frac{1044246.in^{\#}}{33000\ ^{\#}/in^2} = 31.64\ in^3$

$\Delta = \frac{23'(12)}{360} = .77"$

$I_R = \frac{5(1316\ ^{\#}/Ft)(23')^4(12)^3}{384(29000000\ ^{\#}/in^2).77"} = 371.07\ in^4$

W16x31

M_R = 87.02 Fek < M_A = 130 Fek

S_R = 31.64 in^3 < S_A = 47.2 in^3

I_R = 371.07 in^4 < I_A = 375 in^4

Beam B7

$W = 50\ ^{\#}/ft^2(6') = 300\ ^{\#}/Ft$

$M_R = \frac{300\ ^{\#}/Ft(14.666')^2}{8} = 8065.93\ ^{\#}Ft \Rightarrow 96791.2\ in^{\#} \Rightarrow 8.07\ Fek$

$S_R = \frac{96791.2\ in^{\#}}{30000\ ^{\#}/in^2} = 3.23\ in^3$

$\Delta = \frac{14.666(12)}{480} = .37"$

$I_R = \frac{5(300\ ^{\#}/Ft)(14.666')^4(12)^3}{384(29000000\ ^{\#}/in^2).37"} = 29.1\ in^4$

HSS 8x6x 3/8

M_R = 8.07 Fek < M_A = 80.12 Fek

S_R = 3.23 in^3 < S_A = 20.9 in^3 OK

I_R = 29.1 in^4 < I_A = 83.7 in^4 OK

8.07 Fek < M_A =

3.23 in^3 < S_A =

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Beam B8

$W_{w.window} = 8\ \#/ft^2\ (6.333') = 50.66\ \#/ft$

$W_{wind} = 19.2\ \#/ft^2\ (6.17') = 118.47\ \#/ft$ ← Governs

$M_R = \frac{118.47\ \#/ft\ (14.666')^2}{8} = 3185.24\ ft\#$ ⇒ $38222.85\ in\#$ ⇒ $3.19\ ft\,k$

$S_R = \frac{38222.85\ in\#}{30000\ \#/in^2} = 1.27\ in^3$

$\Delta = .37'$ (see beam B7)

$I_R = \frac{5(118.47\ \#/ft)(14.666')^4(12)^3}{384\,(29000000\ \#/in^2)(.37'')} = 11.49\ in^4$

HSS 6x6x1/4

$M_R = 3.19\ ft\,k$	<	$M_A = 38.72\ ft\,k$	OK
$S_R = 1.27\ in^3$	<	$S_A = 10.1\ in^3$	OK
$I_R = 11.49\ in^4$	<	$I_A = 30.3\ in^4$	OK

Beam B9 Worst Case Bearing Side w/Drift

$Drift_{Low} = .5(1.15(23.333')^{.33} - 1.5) = .88'$

$Drift_{High} = 1.15(45.5')^{.33} - 1.5 = 2.55'$ ← Governs

$\gamma = 20.5\ \#/ft^3$ (From Beam B1)

$Width\ of\ Drift = 4(2.55') = 10.21'$

$W_{Drift} = .52' \times 2.55' \times 20.5\ \#/ft^3 = 27.18\ \#/ft$

$W_{ROOF} = 70\ \#/ft^2\ (.52') = 36.4\ \#/ft$

$W_{WALL} = 50\ \#/ft^2\ (6') = 300\ \#/ft$

$W_{total} = 300\ \#/ft + 36.4\ \#/ft + 27.18\ \#/ft = 363.58\ \#/ft$

$M_R = \frac{363.58\ \#/ft\ (23')^2}{8} = 24041.73\ ft\#$ ⇒ $288500.73\ in\#$ ⇒ $24.04\ ft\,k$

$S_R = \frac{288500.73\ in\#}{33000\ \#/in^2} = 8.74\ in^3$

$\Delta = \frac{23'(12)}{480} = .58''$

$I_R = \frac{5(363.58\ \#/ft)(23')^4(12)^3}{384\,(29000000\ \#/in^2)(.58'')} = 136.10\ in^4$

W 10x26

$M_R = 24.04\ ft\,k$	<	$M_A = 77\ ft\,k$	OK
$S_R = 8.74\ in^3$	<	$S_A = 27.9\ in^3$	OK
$I_R = 136.10\ in^4$	<	$I_A = 144\ in^4$	OK

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Header H1 Worst case bearing side 4'-8"

$W_{Roof} = 70\ \#/ft^2 (22.5') = 1575\ \#/ft$

$W_{Wall} = 50\ \#/ft^2 (9.17') = 458.5\ \#/ft$

$Dr.ft = .5(1.15(45')^{.33} - 1.5) = 1.27'$

Width Drift $= 8(17') = 10.16'$

$\gamma = 20.5$ (see Beam B1)

$W_{Dr.ft} = \frac{1.27'(10.16')}{2} \times 20.5\ \#/ft^3 = 132.2\ \#/ft$

$W_{total} = 1575\ \#/ft + 458.5\ \#/ft + 132.2\ \#/ft = 2165.7\ \#/ft$

$M_R = \frac{2165.7\ \#/ft (4.666')^2}{8} = 5893.83\ ft\# \Rightarrow 70725.92\ in\#$

$S_R = \frac{70725.92\ in\#}{1,700\ \#/in^2} = 41.6\ in^3$

$F_b = 2,600\ \#/in^2 \times .666 = 1731.6\ \#/in^2$

$\Delta = \frac{4.666'(12)}{480} = .12"$

$I_R = \frac{5(2165.7\ \#/ft)(4.666')^4(12)^3}{384(1900000\ \#/in^2).12"} = 101.3\ in^4$

USE 5 1/4 x 9 1/4 PSL

$M_R = 5893.83\ ft\#$ < $M_A = 18,625\ ft\#$ OK
$S_R = 41.6\ in^3$ < $S_A = 131.47\ in^3$ OK
$I_R = 101.3\ in^4$ < $I_A = 346\ in^4$ OK

Header H2

10'-2" Opening: $W_R = 70\ \#/ft^2 (2B3') = 198.33\ \#/ft$ } (FROM BEAM B3)
$W_{Dr.ft} = 6.01\ \#/ft$
$W_{total} = 204.34\ \#/ft$ ← Governs.

8'-0" Opening: $W_R = 70\ \#/ft^2 (1.19') = 83.3\ \#/ft$
$Dr.ft = .5(1.15(91.333')^{.33} - 1.5) = 1.8'$
Width Drift $= 8(2B') = 14.41'$
$\gamma = 20.5\ \#/ft^3$ (from B1)
$W_{Drift} = 1.8'(1.19')20.5\ \#/ft^3 = 43.91\ \#/ft$
$W_{total} = 83.3\ \#/ft + 43.91\ \#/ft = 127.21\ \#/ft$

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Header H2 Cont.

$M_R = \frac{204.34\ \#/ft\ (10.17')^2}{8} = 2641.83\ Ft\# \Rightarrow 31701.99\ in\#$

$S_R = \frac{31701.99\ in\#}{1400\ \#/in^2} = 16.69\ in^3$

$\Delta = \frac{10.17'(12)}{480} = .25"$

$I_R = \frac{5(204.34\ \#/ft)(10.17')^4(12)^3}{384(2000000\ \#/in^2).25"} = 98.37\ in^4$

USE 5 1/4 x 9 1/4 PSL (SAME AS H1)

$M_R = 2641.83\ Ft\#$ < $M_A = 18,625\ Ft\#$ OK

$S_R = 16.69\ in^3$ < $S_A = 131.47\ in^3$ OK

$I_R = 98.37\ in^4$ < $I_A = 346\ in^4$ OK

Header H3

$W = 10\ \#/ft^2\ (6') = 60\ \#/ft$

$M_R = \frac{60\ \#/ft(8.17')^2}{8} = 500.62\ Ft\# \Rightarrow 6007.4\ in\#$

$S_R = \frac{6007.4\ in\#}{21000\ \#/in^2} = .29\ in^3$

$\Delta = \frac{8.17(12)}{480} = .20"$

$I_R = \frac{5(60\ \#/ft)(8.17)^4(12)^3}{384(29000000\ \#/in^2).20"} = 1.04\ in^4$

(2) 6 CSI 18

$M_R = 6007.4\ in\#$ < $M_A = 33528\ in\#$ OK

$S_R = .29\ in^3$ < $S_A = 1.59\ in^3$ OK

$I_R = 1.04\ in^4$ < $I_A = 4.63\ in^4$ OK

Exterior Stud Design

$W = 19.2\ \#/ft^2\ (1.33') = 25.54\ \#/ft$

$M_R = \frac{25.54\ \#/ft(12.96')^2}{8} = 536.73\ Ft\# \Rightarrow 6433.6\ in\#$

$S_R = \frac{6433.6\ in\#}{1000\ \#/in^2} = 6.43\ in^3$

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Exterior Studs Cont.

$\Delta = \frac{12.96'(12)}{480} = .33"$

$I_R = \frac{5(25.54\#/ft)(12.96')^4(12)^3}{384(1300000\#/in^2).33"} = 37.79 in^4$

$M_R = 536.13\ Ft\#$ < $M_A = 1260\ Ft\#$ OK

$S_R = 6.43 in^3$ < $S_A = 15.12 in^3$ OK

$I_R = 37.79 in^4$ < $I_A = 41.6 in^4$ OK

Truss Bearing on Studs

Roof load = $70\#/ft^2$

$P = 70\#/ft^2 \times 2.666' \times 22.5' = 4198.95\#$

$\#\ Stud\ Req'd = \frac{4198.95\#}{300\#/in^2} = \frac{14 in^2}{5.5} = \frac{2.55"}{1.5"} = 1.7$ or 2 studs OK

(Crushing of wood) (width of stud) (Thickness of stud)

Shear Wall "A"

$P = 19.2\#/ft^2(34')(9.125') = 5956.8\#$

$\frac{5956.8\#}{27.08'} = 219.97\#/ft < 240\#/ft$ OK

Shear Wall "B"

$P = 19.2\#/ft^2(17.3')(9.125') = 3030.96\#$

$\frac{3030.96\#}{26.333'} = 115.10\#/ft < 240\#/ft$ OK

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Shear Wall "C"

$P = 19.2\ \#/ft^2\ (9.175')(22.5') = 3942\ \#$

$\frac{3942\ \#}{40.333'} = 97.74\ \#/ft < 240\ \#/ft$ OK

Shear Wall "D" & F

$P = 19.2\ \#/ft^2\ (9.125')(18.48) = 3237.7\ \#$

$\frac{3237.7\ \#}{16.666'} = 194.27\ \#/ft < 240\ \#/ft$ OK

Shear Wall "E"

$P = 19.2\ \#/ft^2\ (6.67)\ 32' = 4098.05\ \#$

$\frac{4098.05\ \#}{17.81'} = 230.10\ \#/ft < 240\ \#/ft$ OK

Shear Wall "C"

$P = 19.2\ \#/ft^2\ (9.125')(11.5') = 2014.8\ \#$

$\frac{2014.8\ \#}{10.333'} = 194.99\ \#/ft < 240\ \#/ft$ OK

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SLAB DESIGN

$f'_c = 4000\ \#/in^2$

Dead load: $160\ \#/ft^2 \times 1.4 = 224\ \#/ft^2$

Live load: $100\ \#/ft^2 \times 1.7 = 170\ \#/ft^2$

Ultimate load: $394\ \#/ft^2$

$W_u = 394\ \#/ft^2\ (1') = 394\ \#/ft$

$M_{UR} = \frac{394\ \#/ft\ (15')^2}{8} = 11081.25\ ft\#$

$\rho_b = \frac{0.85 f'_c \beta_1}{f_y} \times \frac{87{,}000}{87{,}000 + f_y} = \frac{0.85(4000\ \#/in^2)\,0.85}{60{,}000\ \#/in^2} \times \frac{87{,}000}{87{,}000 + 60{,}000\ \#/in^2} = .02851$

$\beta_1 = .85$ (for 4000 #/in² conc. and lower)

$f_y = 60{,}000\ \#/in$

$\rho_{max} = 0.75\,\rho_b = 0.75(.02851) = .02138$

$\rho_{min} = \frac{200}{F_y} = \frac{200}{60{,}000} = .00\overline{3}$

$\frac{M_u}{\phi b d^2} = \phi \rho f_y b d^2 \left(1 - 0.59 \frac{\rho f_y}{f'_c}\right) = \frac{11081.25\ ft\#\ (12)}{.90(12'')(5'')^2} = 492.5\ in$ $\rho = 0.0089$ (From Table A.14)

$\phi = .90$ for reinforced conc.

$\rho = \frac{A_s}{bd} \Rightarrow A_s = \rho b d = .0089(12'')(5'') = .534\ in^2$ (1) #7 = $.60\ in^2$ OK

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SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

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SCALE _____

Exterior Foundation Wall Design

$f'c = 4000\ \#/in^2$

Ultimate load: $394\ \#/ft^2$ (From page 11)

$W_U = 394\ \#/ft^2\ (11.5') = 4531\ \#/ft$

$M_{UR} = \frac{4531\ \#/ft\ (13.25)^2}{8} = 99434.2\ Ft\#$

$\rho_b = .02851$ (From page 11)

$\rho_{max} = .75\,\rho_b = .75(.02851) = .01138$

$\rho_{min} = .003$ (From page 11)

$\frac{M_U}{\phi bd^2} = \frac{99434.2\ Ft\#\ (12)}{.9\ (12")\ 43.992")^2} = 57.09$ $\rho = 0.0033$ (From Chart A.14)

$A_S = \rho bd = 0.0033(12")(43.992") = 1.74\ in^2$ L (4) #6 Bar $= .4 \times .44 = 1.76\ in^2$ OK

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STRUCTURAL CALCULATIONS

FOR

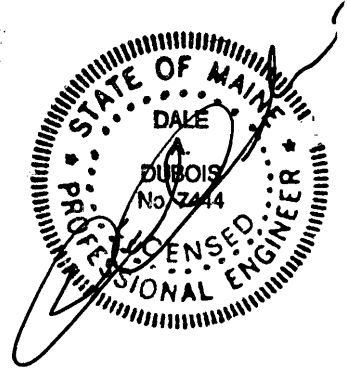
McDonald's Restaurant

332 St. John Street
Portland, ME

Prepared for:

LANDRY ARCHITECTS

389 Main Street
Salem, NH 03079



August 15, 2007
Project #07056

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August 15, 2007

Project #07056

Mr. Thomas B. Duff, RA
Landry Architects
389 Main Street
Salem, NH 03079

RE: Structural Calculations
McDonald's Restaurant
332 St John Street
Portland, ME

Dear Thom:

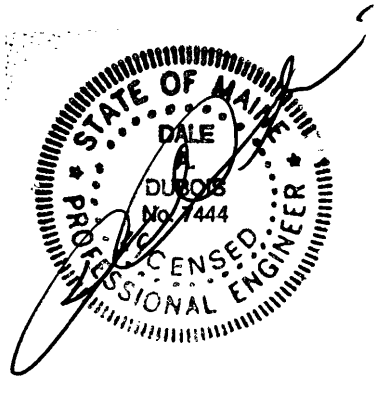
I respectfully submit the following set of structural calculations for the design of the new McDonald's restaurant to be constructed on 332 St John Street in Portland, ME. These calculations were used to as a basis of the design of the structure for this restaurant.

The calculations were developed in accordance with the 2003 International Building Code as required and good engineering practices.

If you should have any questions regarding this matter or require additional information, please call at your convenience.

Sincerely,

Dale A. Dubois, P.E.



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Project Design Criteria

Project Name: McD's Portland, ME
Project Number: 0705b

Design Code: 2003 IBC w/ City Amendments

Wind Loads:

- 3 Second Gust: 110 MPH
- Basic Wind Speed: 90 MPH
- Exposure: B
- Pressure: 14.2 #/Ft²

Snow Loads:

- Ground Snow Load: N/A
- Roof Snow Load: 50 #/Ft²
- Exposure Factor: 1.0
- Importance Factor: 1.0
- Ct: 1.0

Earthquake Design:

- Ss or ~~As~~: 0.40
- S1 or ~~Av~~: 0.10
- Hazard Group: I
- Performance Category: I
- Structural System: Bearing Wall System
- Soil Pressure:
- R: 6½
- Cd: 4
- Analysis: Light frame walls w/ shear panels - wood structural panels.

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JOB [illegible] Mercy Housing

SHEET NO. 1 OF

CALCULATED BY TEA DATE 8-7-07

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SCALE

2003 IBC with City Amendments

Gravity loading:

Roof: Live load = 50 #/ft²
Dead load = 20 #/ft²
Total load = 70 #/ft²

Wall: Wood framing = 10 #/ft²
Brick Veneer = 40 #/ft²
Total load = 50 #/ft²

Beam B1

$W_{Roof} = 70\ \#/ft^2 (18.61') = 1307.7\ \#/ft$

$W_{WALL} = 50\ \#/ft^2 (5') = 250\ \#/ft$

Drifting: $.5(1.15(w)^{.33} - 1.5) = .5(1.15(37.22)^{.33} - 1.5) = 1.15'$

Width of Drift = $8H = 8(1.15) = 9.2'$

$\gamma = .13'(pg) + 14 = .13'(50\ \#/ft^2) + 14 = 20.5\ \#/ft^3$

Max Intensity = $20.5\ \#/ft^3 (1.15') = 23.58\ \#/ft^2$

$W_{Drift\ load} = \frac{1.15' \times 9.2'}{2} \times 20.5\ \#/ft^3 = 108.45\ \#/ft$

$W_{total} = W_{ROOF} + W_{WALL} + W_{DRIFT} = 1302.7\ \#/ft + 250\ \#/ft + 108.45\ \#/ft = 1661.15\ \#/ft$

Moment Required: $M_R = \frac{wL^2}{8} = \frac{1661.15\ \#/ft (16.5')^2}{8} = 56531.01\ ft\# \Rightarrow 678372.13\ in\# \Rightarrow 56.53\ ft\text{-}k$

Section Modulus Req'd: $\frac{M_R}{F_b} = \frac{678372.13\ in\#}{33000\ \#/in^2} = 20.56\ in^3$

$F_b = 50000\ \#/in^2 \times .666 = 33300\ \#/in^2$

Allowable Deflection = $\Delta = \frac{L}{480} = \frac{16.5'(12)}{480} = .41"$

Moment of Inertia Req'd: $I = \frac{5wL^4}{384E\Delta} = \frac{5(1661.15\ \#/ft)(16.5')^4(12)^3}{384(29000000\ \#/in^2).41"} = 232.99\ in^4$

Requirements:		W16x26 Allowables:		
$M_R = 56.53\ ft\text{-}k$	<	M_A 106 ft-k	OK	
$S_R = 20.56\ in^3$	<	S_A 38.4 in^3	OK	
$I_R = 232.99\ in^4$	<	I_A 301 in^4	OK	

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SHEET NO. 2 OF _____

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Beam B2

$W = 1661.15\ \#/ft$ (SEE BEAM B1 FOR INFO)

$M_R = \frac{1661.15\ \#/ft\,(8.17')^2}{8} = 13859.99\ ft\# \Rightarrow 166319.9\ in\# \Rightarrow 13.86\ ft\,K$

$S_R = \frac{166319.9\ in\#}{33000\ \#/in^2} = 5.04\ in^3$

$\Delta = \frac{8.17'(12)}{480} = .2"$

$I = \frac{5(1661.15\ \#/ft)(8.17')^4(12)^3}{384(29000000\ \#/in^2).2"} = 28.71\ in^4$

Requirements		W16x26	
$M_R = 13.86\ ft\,K$	<	$M_A = 106\ ft\,K$	OK
$S_R = 5.04\ in^3$	<	$S_A = 38.4\ in^3$	OK
$I_R = 28.71\ in^4$	<	$I_A = 301\ in^4$	OK

Beam B3 Worst Case = 16.5' Span

$W_{ROOF} = 70\ \#/ft^2(2.83') = 198.33\ \#/ft$

Drifting $= .5(1.15(5.7)^{.33} - 1.5) = .27'$

Width of Drift $= 8(.27') = 2.17'$

$\gamma = 20.5\ \#/ft^3$ (SEE BEAM B1)

Max Intensity $= 20.5\ \#/ft^3(.27') = 5.54\ \#/ft^2$

$W_{Drift} = \frac{.27' \times 2.17'}{2} \times 20.5\ \#/ft^3 = 6.01\ \#/ft$

$W_{Total} = W_{ROOF} + W_{DRIFT} = 198.33\ \#/ft + 6.01\ \#/ft = 204.34\ \#/ft$

$M_R = \frac{204.34\ \#/ft\,(16.5')^2}{8} = 6953.79\ ft\# \Rightarrow 83445.5\ in\# \Rightarrow 6.95\ ft\,K$

$S_R = \frac{83445.5\ in\#}{33000\ \#/in^2} = 2.53\ in^3$

$\Delta = .41"$ (From Beam B1)

$I_R = \frac{5(204.34\ \#/ft)(16.5')^4(12)^3}{384(29000000\ \#/in^2).41"} = 28.66\ in^4$

		W10x12	
$M_R = 6.95\ ft\,K$	<	$M_A = 30\ ft\,K$	OK
$S_R = 2.53\ in^3$	<	$S_A = 10.9$	OK
$I_R = 28.66\ in^4$	<	$I_A = 53.8$	OK

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SHEET NO 3 OF _____

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SCALE _____

Beam B4 Worst Case = 26'

$W_{roof} = 70\ \#/ft^2 (18.61') = 1302.7\ \#/ft$

$W_{wall} = 10\ \#/ft^2 (4.75') = 47.5\ \#/ft$

Drift High Roof $1.15 (23')^{.33} - 1.5 = 1.51$ ← Governs

Drift Low Roof $.5 (1.15 (37.22')^{.33} - 1.5) = 1.15'$

Width of Drift $4 (1.51') = 6.05'$

$\gamma = 20.5\ \#/ft^3$ (See beam B1)

$W_{Dr.ft} = \frac{1.51' \times 6.05'}{2} \times 20.5\ \#/ft^3 = 93.64\ \#/ft$

$W_{total} = 1302.7\ \#/ft + 47.5\ \#/ft + 93.64\ \#/ft = 1443.84\ \#/ft$

$M_R = \frac{1443.84\ \#/ft (26')^2}{8} = 122004.48\ ft\# \Rightarrow 1464053.76\ in\# \Rightarrow 122.01\ ft\,k$

$S_R = \frac{1464053.76\ in\#}{33000\ \#/in^2} = 44.37\ in^3$

$\Delta = \frac{26'(12)}{360} = .87"$

$I_R = \frac{5 (1443.84\ \#/ft)(26')^4 (12)^3}{384 (29000000\ \#/in^2) .87"} = 588.41\ in^4$

W18x40

$M_R = 122.01\ ft\,k \quad < \quad M_A = 188\ ft\,k$ OK

$S_R = 44.37\ in^3 \quad < \quad S_A = 68.4\ in^3$ OK

$I_R = 588.41\ in^4 \quad < \quad I_A = 612\ in^4$ OK

Beam B5

Vertical Loads

$W_{wall} = 50\ \#/ft^2 (3') = 150\ \#/ft$

$W_{Low\ Roof} = 70\ \#/ft^2 (.666') + 6.01\ \#/ft = 52.63\ \#/ft$

(Drift SEE beam B3)

$W_{trellis} = 70\ \#/ft^2 (4') = 280\ \#/ft$

$Drift = 1.15 (24.666')^{.33} - 1.5 = 1.81'$

Width of Drift $= 4 (1.81') = 7.24'$

$\gamma = 20.5\ \#/ft^3$ (SEE BEAM B1)

$W_{Drift} = \frac{1.81' \times 7.24'}{2} \times 20.5\ \#/ft^3 = 134.32\ \#/ft$

$W_{total} = 52.63\ \#/ft + 280\ \#/ft + 134.32\ \#/ft + 150\ \#/ft = 616.95\ \#/ft$

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Beam B5 Cont

$M_R = \frac{616.95\ \#/ft\ (5.666')^2}{8} = 2475.79\ Ft\# \Rightarrow 29709.43\ in\# \Rightarrow 2.48\ FtK$

$S_{11} = \frac{29709.43\ in\#}{30000\ \#/in^2} = .99\ in^3$

$F_{11} = 46000\ \#/in^2 \times .666 = 30636\ \#/in^2$

$\Delta = \frac{5.666'(12)}{480} = .14"$

$I_R = \frac{5(616.95\ \#/ft)(5.666')^4(12)^3}{384(29000000\ \#/in^2).14"} = 3.52\ in^4$

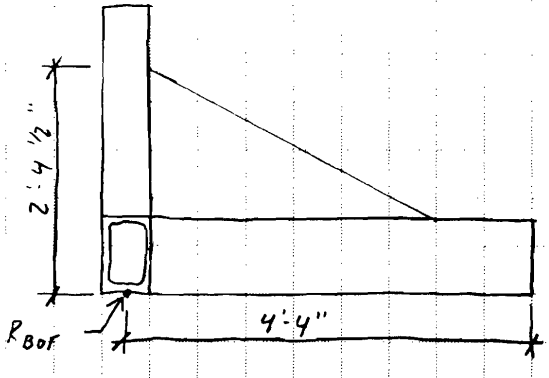
HSS 8x6x1/4

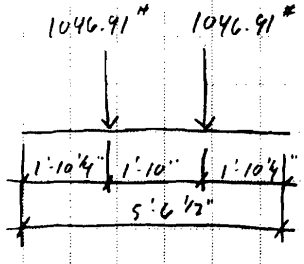
$M_R = 2.48\ FtK < M_A = 37.5\ FtK$ OK

$S_R = .99\ in^3 < S_A = 15.0\ in^3$ OK

$I_R = 3.52\ in^4 < I_A = 60.1\ in^4$ OK

Beam B5 Horizontal





Trellis Load = 103.58 #/ft² (SEE SHEET 4)

$\frac{103.58\ \#/ft^2(4.333')(2.77')}{2.375'}(2') = \frac{R_{TOP}(2.375')}{2.375'} = 1046.91\ \#$

$M_R = P_a = 1046.91\ \#(1.85') = 1936.79\ Ft\# \Rightarrow 23241.48\ in\# \Rightarrow 1.94\ FtK$

$S_R = \frac{23241.48\ in\#}{30000\ \#/in^2} = .78\ in^3$

$\Delta = \frac{5.54'(12)}{480} = .14"$

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Beam B5 Cont

$I_R = \frac{P_a}{24E\Delta}(3L^2 - 4a^2) = \frac{1046.91\#(1.85')(12)}{24(29000000\#/in^2).14"}(3(5.54')^2(12)^2 - 4(1.85')^2(12)^2) = 2.69\,in^4$

HSS 8x6x1/4

M_R 1.94 Fek < M_A = 32.25 Fek OK
S_R .78 in^3 < S_A = 12.4 in^3 OK
I_R 2.69 in^4 < I_R = 38.6 in^4 OK

Beam B6

$W = 70\#/ft^2(18.80') = 1316\#/ft$

$M_R = \frac{1316\#/ft(23')^2}{2} = 87020.5\,Ft\# \Rightarrow 1044246\,in\# \Rightarrow 87.02\,Fek$

$S_R = \frac{1044246.in\#}{33000\#/in^2} = 31.64\,in^3$

$\Delta = \frac{23'(12)}{360} = .77"$

$I_R = \frac{5(1316\#/ft)(23')^4(12)^3}{384(29000000\#/in^2).77"} = 371.07\,in^4$

W16x31

M_R = 87.02 Fek < M_A = 130 Fek
S_R = 31.64 in^3 < S_A = 47.2 in^3
I_R = 371.07 in^4 < I_R = 375 in^4

Beam B7

$W = 50\#/ft^2(6') = 300\#/ft$

$M_R = \frac{300\#/ft(14.666')^2}{8} = 8065.93\,Ft\# \Rightarrow 96791.2\,in\# \Rightarrow 8.07\,Fek$

$S_R = \frac{96791.2\,in\#}{30000\#/in^2} = 3.23\,in^3$

$\Delta = \frac{14.666(12)}{480} = .37"$

$I_R = \frac{5(300\#/ft)(14.666')^4(12)^3}{384(29000000\#/in^2).37"} = 29.1\,in^4$

HSS 8x6x3/8

M_R = 8.07 Fek < M_A = 80.12 Fek
S_R = 3.27 in^3 < S_A = 20.9 in^3 OK
I_R = 29.1 in^4 < I_R = 83.7 in^4 OK

8.71 Fek < M_A =
2.25 in^3

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Beam B8

$W_{wall} = 8\ ^{\#}/_{ft^2}(6.333') = 50.66\ ^{\#}/_{ft}$

$W_{roof} = 19.2\ ^{\#}/_{ft^2}(6.17') = 118.47\ ^{\#}/_{ft}$ ← Governs

$M_R = \frac{118.47\ ^{\#}/_{ft}(14.666')^2}{8} = 3185.24\ ft^{\#} \Rightarrow 38222.85\ in^{\#} \Rightarrow 3.19\ ft\text{-}k$

$S_R = \frac{38222.85\ in^{\#}}{30000\ ^{\#}/_{in^2}} = 1.27\ in^3$

$\Delta = .37'$ (see beam B7)

$I_R = \frac{5(118.47\ ^{\#}/_{ft})(14.666')^4(12)^3}{384(29000000\ ^{\#}/_{in^2}).37''} = 11.49\ in^4$

HSS 6x6x1/4

$M_R = 3.19\ ft\text{-}k$ < $M_A = 38.72\ ft\text{-}k$ OK

$S_R = 1.27\ in^3$ < $S_A = 10.1\ in^3$ OK

$I_R = 11.49\ in^4$ < $I_A = 30.3\ in^4$ OK

Beam B9 Worst Case Bearing Side w/Drift

$Drift_{low} = .5(1.15(23.333')^{.33} - 1.5) = .88'$

$Drift_{High} = 1.15(45.5')^{.33} - 1.5 = 2.55'$ ← Governs

$\gamma = 20.5\ ^{\#}/_{ft^3}$ (From Beam B1)

Width of Drift = $4(2.55') = 10.21'$

$W_{Drift} = .52' \times 2.55' \times 20.5\ ^{\#}/_{ft^3} = 27.18\ ^{\#}/_{ft}$

$W_{Roof} = 70\ ^{\#}/_{ft^2}(.52') = 36.4\ ^{\#}/_{ft}$

$W_{wall} = 50\ ^{\#}/_{ft^2}(6') = 300\ ^{\#}/_{ft}$

$W_{total} = 300\ ^{\#}/_{ft} + 36.4\ ^{\#}/_{ft} + 27.18\ ^{\#}/_{ft} = 363.58\ ^{\#}/_{ft}$

$M_R = \frac{363.58\ ^{\#}/_{ft}(23')^2}{8} = 24041.73\ ft^{\#} \Rightarrow 288500.73\ in^{\#} \Rightarrow 24.04\ ft\text{-}k$

$S_R = \frac{288500.73\ in^{\#}}{33000\ ^{\#}/_{in^2}} = 8.74\ in^3$

$\Delta = \frac{23(12)}{480} = .58''$

$I_R = \frac{5(363.58\ ^{\#}/_{ft})(23')^4(12)^3}{384(29000000\ ^{\#}/_{in^2}).58''} = 136.10\ in^4$

W 10x26

$M_R = 24.04\ ft\text{-}k$ < $M_A = 77\ ft\text{-}k$

$S_R = 8.74\ in^3$ < $S_A = 27.9\ in^3$

$I_R = 136.10\ in^4$ < $I_A = 144\ in^4$

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SHEET NO. 7 OF _____

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SCALE _____

Header H1 Worst case bearing side 4'-8"

$W_{Roof} = 70\ \#/ft \cdot (22.5') = 1515\ \#/ft$

$W_{Wall} = 50\ \#/ft \cdot (9.17) = 458.5\ \#/ft$

$Drift = .5(1.15(45')^{.33} - 1.5) = 1.77'$

$Width\ Drift = 8(1.77') = 10.16'$

$\gamma = 20.5$ (See Beam B1)

$W_{Drift} = \frac{1.77'(10.16')}{2} \times 20.5\ \#/ft^3 = 132.2\ \#/ft$

$W_{total} = 1515\ \#/ft + 458.5\ \#/ft + 132.2\ \#/ft = 2165.7\ \#/ft$

$M_R = \frac{2165.7\ \#/ft\ (4.666)^2}{8} = 5893.83\ ft\#$ => $70725.92\ in\#$

$S_R = \frac{70725.92\ in\#}{1,700\ \#/in^2} = 41.6\ in^3$

$F_b = 2,600\ \#/in^2 \times .666 = 1731.6\ \#/in^2$

$\Delta = \frac{4.666'(12)}{480} = .12"$

$I_R = \frac{5(7165.7\ \#/ft)(4.666')^4(12")^3}{384(1900000\ \#/in^2).12"} = 101.3\ in^4$

USE 5 1/4 x 9 1/4 PSL

$M_R = 5893.83\ ft\#$ < $M_A = 18,625\ ft\#$ OK

$S_R = 41.6\ in^3$ < $S_A = 131.47\ in^3$ OK

$I_R = 101.3\ in^4$ < $I_A = 346\ in^4$ OK

Header H2

10'-2" opening: $W_R = 70\ \#/ft^2(2.83') = 198.33\ \#/ft$ } (FROM BEAM B3)

$W_{Drift} = 6.01\ \#/ft$

$W_{Total} = 204.34\ \#/ft$ ← Governs.

8'-0" opening: $W_R = 70\ \#/ft^2(1.19') = 83.3\ \#/ft$

$Drift = .5(1.15(91.333')^{.33} - 1.5) = 1.8'$

$Width\ Drift = 8(1.8') = 14.41'$

$\gamma = 20.5\ \#/ft^3$ (From B1)

$W_{Drift} = 1.8'(1.19')20.5\ \#/ft^3 = 43.91\ \#/ft$

$W_{total} = 83.3\ \#/ft + 43.91\ \#/ft = 127.21\ \#/ft$

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SCALE _____

Header H2 Cont.

$M_R = \frac{204.34\ ^{\#}/_{Ft}\,(10.17')^2}{8} = 2641.83\ Ft^{\#} \Rightarrow 31701.94\ in^{\#}$

$S_R = \frac{31701.94\ in^{\#}}{1400\ ^{\#}/_{in^2}} = 16.69\ in^3$

$\Delta = \frac{10.17(12)}{480} = .25"$

$I_R = \frac{5(204.34\ ^{\#}/_{Ft})(10.17)^4(12)^3}{384(2000000\ ^{\#}/_{in^2}).25"} = 98.37\ in^4$

USE 5 1/4 x 9 1/4 PSL (SAME AS H1)

$M_R = 2641.83\ Ft^{\#}$ < $M_A = 18{,}625\ Ft^{\#}$ OK

$S_R = 16.69\ in^3$ < $S_A = 131.47\ in^3$ OK

$I_R = 98.37\ in^4$ < $I_A = 346\ in^4$ OK

Header H3

$W = 10\ ^{\#}/_{Ft^2}(6') = 60\ ^{\#}/_{Ft}$

$M_R = \frac{60\ ^{\#}/_{Ft}(8.17')^2}{8} = 500.62\ Ft^{\#} \Rightarrow 6007.4\ in^{\#}$

$S_R = \frac{6007.4\ in^{\#}}{21000\ ^{\#}/_{in^2}} = .29\ in^3$

$\Delta = \frac{8.17(12)}{480} = .20"$

$I_R = \frac{5(60\ ^{\#}/_{Ft})(8.17)^4(12)^3}{384(29000000\ ^{\#}/_{in^2}).20"} = 1.04\ in^4$

(2) 6 CS 5 18

$M_R = 6007.4\ in^{\#}$ < $M_A = 33528\ in^{\#}$ OK

$S_R = .29\ in^3$ < $S_A = 1.54\ in^3$ OK

$I_R = 1.04\ in^4$ < $I_A = 4.63\ in^4$ OK

Exterior Stud Design

$W = 19.2\ ^{\#}/_{Ft^2}(1.33') = 25.54\ ^{\#}/_{Ft}$

$M_R = \frac{25.59\ ^{\#}/_{Ft}(12.96')^2}{8} = 536.73\ Ft^{\#} \Rightarrow 6433.6\ in^{\#}$

$S_R = \frac{6433.6\ in^{\#}}{1000\ ^{\#}/_{in^2}} = 6.43\ in^3$

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SHEET NO. 9 OF _____

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Exterior Studs Cont.

$\Delta = \frac{12.96'(12)}{480} = .33"$

$I_R = \frac{5(25.54\#/ft)(12.96')^4(12)^3}{384(1300000\#/in^2).33"} = 37.79 in^4$

$M_R = 536.13 Ft\#$ < $M_A = 1260 Ft\#$ OK

$S_R = 6.43 in^3$ < $S_A = 15.12 in^3$ OK

$I_R = 37.79 in^4$ < $I_A = 41.6 in^4$ OK

Truss Bearing on Studs

Roof load = $70\#/ft^2$

$P = 70\#/ft^2 \times 2.666' \times 22.5' = 4198.95\#$

Stud Req'd = $\frac{4198.95\#}{300\#/in^2} = \frac{14 in^2}{5.5} = \frac{2.55"}{1.5"} = 1.7$ or 2 studs OK

(Crushing of wood) (width of stud) (Thickness of stud)

Shear Wall "A"

$P = 19.2\#/ft^2(34')(9.125') = 5956.8\#$

$\frac{5956.8\#}{27.08'} = 219.97\#/ft < 240\#/ft$ OK

Shear Wall "B"

$P = 19.2\#/ft^2(17.5')(9.125') = 3030.96\#$

$\frac{3030.96\#}{26.333'} = 115.10\#/ft < 240\#/ft$ OK

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Shear Wall "C"

$P = 19.2\ \#/ft^2\ (9.175')(22.5') = 3942\ \#$

$\frac{3942\ \#}{40.333'} = 97.74\ \#/ft < 240\ \#/ft$ OK

Shear Wall "D" & F

$P = 19.2\ \#/ft^2\ (9.125')(18.48) = 3237.7\ \#$

$\frac{3237.7\ \#}{16.666'} = 194.27\ \#/ft < 240\ \#/ft$ OK

Shear Wall "E"

$P = 19.2\ \#/ft^2\ (6.67')\ 32' = 4098.05\ \#$

$\frac{4098.05\ \#}{17.81'} = 230.10\ \#/ft < 240\ \#/ft$ OK

Shear Wall "C"

$P = 19.2\ \#/ft^2\ (9.125')(11.5') = 2014.8\ \#$

$\frac{2014.8\ \#}{10.333'} = 194.99\ \#/ft < 240\ \#/ft$ OK

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SLAB DESIGN

$f'c = 4000\ \#/in^2$

Dead load: $160\ \#/ft^2 \times 1.4 = 224\ \#/ft^2$

Live load: $100\ \#/ft^2 \times 1.7 = 170\ \#/ft^2$

Ultimate load: $394\ \#/ft^2$

$W_u = 394\ \#/ft^2\ (1') = 394\ \#/ft$

$M_{UR} = \frac{394\ \#/ft\ (15')^2}{8} = 11081.25\ ft\#$

$$\rho_b = \frac{0.85 f'c \beta_1}{f_y} \times \frac{87{,}000}{87{,}000 + f_y} = \frac{0.85(4000\ \#/in^2)\,0.85}{60{,}000\ \#/in^2} \times \frac{87{,}000}{87{,}000 + 60{,}000\ \#/in^2} = .02851$$

$\beta_1 = .85$ (for 4000 #/in² conc. and lower)

$f_y = 60{,}000\ \#/in$

$\rho_{max} = 0.75\,\rho_b = 0.75(.02851) = .02138$

$\rho_{min} = \frac{200}{F_y} = \frac{200}{60{,}000} = .00\overline{3}$

$$\frac{M_u}{\phi bd^2} = \phi \rho f_y \left(1 - 0.59 \frac{\rho f_y}{f'c}\right) = \frac{11081.25\ ft\#\,(12)}{.90(12'')(5'')^2} = 492.5\ in$$

$\rho = 0.0089$ (From Table A.14)

$\phi = .90$ for reinforced conc.

$\rho = \frac{A_s}{bd} \Rightarrow A_s = \rho bd = .0089(12'')(5'') = .534\ in^2$ (1) #7 = $.60\ in^2$ ok

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Exterior Foundation Wall Design

$f'c = 4000\ \#/in^2$

Ultimate load: $394\ \#/ft^2$ (From page 11)

$W_U = 394\ \#/ft^2\ (11.5') = 4531\ \#/ft$

$M_{UR} = \frac{4531\ \#/ft\ (13.25)^2}{8} = 99434.2\ Ft\#$

$\rho_b = .02851$ (From page 11)

$\rho_{max} = .75\,\rho_b = .75(.02851) = .02138$

$\rho_{min} = .003$ (From page 11)

$\frac{M_U}{\phi bd^2} = \frac{99434.2\ Ft\#\ (12)}{.9\ (12")\ 43.992")^2} = 57.09$ $\rho = 0.0033$ (From Chart A.14)

$A_S = \rho bd = 0.0033(12")(43.992") = 1.74\ in^2$ $\angle$ (4) #6 Bar = $4 \times .44 = 1.76\ in^2$ OK

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STRUCTURAL CALCULATIONS

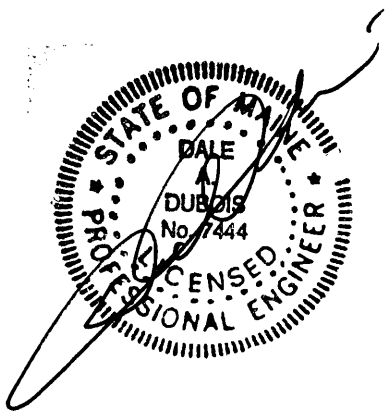
FOR

McDonald's Restaurant

332 St. John Street
Portland, ME

Prepared for:

LANDRY ARCHITECTS
389 Main Street
Salem, NH 03079



August 15, 2007
Project #07056

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August 15, 2007

Project #07056

Mr. Thomas B. Duff, RA
Landry Architects
389 Main Street
Salem, NH 03079

RE: Structural Calculations
McDonald's Restaurant
332 St John Street
Portland, ME

Dear Thom:

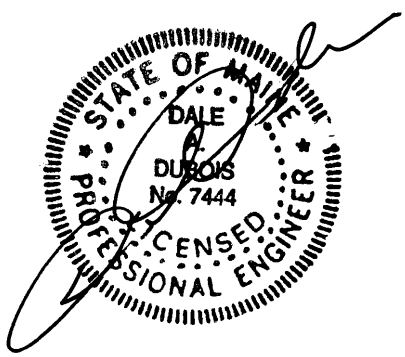
I respectfully submit the following set of structural calculations for the design of the new McDonald's restaurant to be constructed on 332 St John Street in Portland, ME. These calculations were used to as a basis of the design of the structure for this restaurant.

The calculations were developed in accordance with the 2003 International Building Code as required and good engineering practices.

If you should have any questions regarding this matter or require additional information, please call at your convenience.

Sincerely,

Dale A. Dubois, P.E.



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Project Design Criteria

Project Name: McD's Portland, ME
Project Number: 07057b

Design Code: 2003 IBC w/ City Amendments

Wind Loads:

- 3 Second Gust: 110 MPH
- Basic Wind Speed: 90 MPH
- Exposure: B
- Pressure: 19.2 #/Ft²

Snow Loads:

- Ground Snow Load: N/A
- Roof Snow Load: 50 #/Ft²
- Exposure Factor: 1.0
- Importance Factor: 1.0
- Ct: 1.0

Earthquake Design:

- Ss or ~~Aa~~: 0.40
- S1 or ~~Av~~: 0.10
- Hazard Group: I
- Performance Category: I
- Structural System: Bearing Wall System
- Soil Pressure:
- R: 6½
- Cd: 4
- Analysis: Light frame walls w/ Shear panels - wood structural Panels.

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17.

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JOB 07056 McDonald's Portland, ME
SHEET NO. 1 OF
CALCULATED BY TEA DATE 8-7-07
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SCALE

2003 IBC with City Amendments

General loading:

Roof: Live load = 50 #/ft²
Dead load = 20 #/ft²
Total load = 70 #/ft²

Wall: Wood Framing = 10 #/ft²
Brick Veneer = 40 #/ft²
Total Load = 50 #/ft²

Beam B1

$W_{Roof} = 70\ \#/ft^2 (18.61') = 1302.7\ \#/ft$

$W_{WALL} = 50\ \#/ft^2 (5') = 250\ \#/ft$

$Drifting = .5(1.15(w)^{.33} - 1.5) = .5(1.15(37.22)^{.33} - 1.5) = 1.15'$

$Width\ of\ Drift = 8H = 8(1.15') = 9.2'$

$\gamma = .13(p_g) + 14 = .13(50\ \#/ft^2) + 14 = 20.5\ \#/ft^3$

$Max\ Intensity = 20.5\ \#/ft^3 (1.15') = 23.58\ \#/ft^2$

$W\ Drift\ load = \frac{1.15' \times 9.2'}{2} \times 20.5\ \#/ft^3 = 108.45\ \#/ft$

$W_{Total} = W_{ROOF} + W_{WALL} + W_{DRIFT} = 1302.7\ \#/ft + 250\ \#/ft + 108.45\ \#/ft = 1661.15\ \#/ft$

Moment Required: $M_R = \frac{wL^2}{8} = \frac{1661.15\ \#/ft\ (16.5')^2}{8} = 56531.01\ ft\# \Rightarrow 678372.13\ in\# \Rightarrow 56.53\ ft\,K$

Section Modules Req'd: $\frac{M_R}{F_b} = \frac{678372.13\ in\#}{33000\ \#/in^2} = 20.56\ in^3$

$F_b = 50{,}000\ \#/in^2 \times .666 = 33300\ \#/in^2$

Allowable Deflection = $\Delta = \frac{L}{480} = \frac{16.5'(12)}{480} = .41"$

Moment of Inertia Req'd: $I = \frac{5wL^4}{384E\Delta} = \frac{5(1661.15\ \#/ft)(16.5')^4(12)^3}{384(29000000\ \#/in^2).41"} = 232.99\ in^4$

Requirements:		W16x26 Allowables:		
$M_R = 56.53\ ft\,K$	<	M_A 106 ft K		ok
$S_R = 20.56\ in^3$	<	S_A 38.4 in^3		ok
$I_R = 232.99\ in^4$	<	I_A 301 in^4		ok

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SHEET NO. 2 OF _____

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Beam B2

$W = 1661.15\ \#/ft$ (SEE BEAM B1 FOR INFO)

$M_R = \frac{1661.15\ \#/ft\ (8.17')^2}{8} = 13859.99\ ft\# \Rightarrow 166319.9\ in\# \Rightarrow 13.86\ ft\,k$

$S_R = \frac{166319.9\ in\#}{33000\ \#/in^2} = 5.04\ in^3$

$\Delta = \frac{8.17'(12)}{480} = .2"$

$I = \frac{5(1661.15\ \#/ft)(8.17')^4(12)^3}{384(29000000\ \#/in^2).2"} = 28.71\ in^4$

Requirements			W16x26		
$M_R = 13.86\ ft\,k$	$<$	$M_A = 106\ ft\,k$	OK		
$S_R = 5.04\ in^3$	$<$	$S_A = 38.4\ in^3$	OK		
$I_R = 28.71\ in^4$	$<$	$I_A = 301\ in^4$	OK		

Beam B3 Worst Case = 16.5' Span

$W_{Roof} = 70\ \#/ft^2(2.83') = 198.33\ \#/ft$

Drifting $= .5(1.15(5.7)^{.33} - 1.5) = .27'$

Width of Drift $= 8(.27') = 2.17'$

$\gamma = 20.5\ \#/ft^3$ (SEE BEAM B1)

Max Intensity $= 20.5\ \#/ft^3(.27') = 5.54\ \#/ft^2$

$W_{Drift} = \frac{.27' \times 2.17'}{2} \times 20.5\ \#/ft^3 = 6.01\ \#/ft$

$W_{total} = W_{Roof} + W_{Drift} = 198.33\ \#/ft + 6.01\ \#/ft = 204.34\ \#/ft$

$M_R = \frac{204.34\ \#/ft\ (16.5')^2}{8} = 6953.79\ ft\# \Rightarrow 83445.5\ in\# \Rightarrow 6.95\ ft\,k$

$S_R = \frac{83445.5\ in\#}{33000\ \#/in^2} = 2.53\ in^3$

$\Delta = .41"$ (From Beam B1)

$I_R = \frac{5(20434\ \#/ft)(16.5')^4(12)^3}{384(29000000\ \#/in^2).41"} = 28.66\ in^4$

			W10x12		
$M_R = 6.95\ ft\,k$	$<$	$M_A = 30\ ft\,k$	OK		
$S_R = 2.53\ in^3$	$<$	$S_A = 10.9$	OK		
$I_R = 28.66\ in^4$	$<$	$I_A = 53.8$	OK		

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Beam B4 Worst Case = 26'

$W_{Roof} = 70\ \#/ft^2 (18.61') = 1302.7\ \#/ft$
$W_{Walls} = 10\ \#/ft^2 (4.75') = 47.5\ \#/ft$
$Drift_{High\ Roof} = 1.15(23)^{.33} - 1.5 = 1.51$ ← Governs
$Drift_{Low\ Roof} = .5(1.15(37.22')^{.33} - 1.5) = 1.15'$
Width of Drift $= 4(1.51') = 6.05'$
$\gamma = 20.5\ \#/ft^3$ (See beam B1)
$W_{Drift} = \frac{1.51' \times 6.05'}{2} \times 20.5\ \#/ft^3 = 93.64\ \#/ft$

$W_{total} = 1302.7\ \#/ft + 47.5\ \#/ft + 93.64\ \#/ft = 1443.84\ \#/ft$
$M_R = \frac{1443.84\ \#/ft (26)^2}{8} = 122004.48\ ft\#$ ⇒ $1464053.76\ in\# \Rightarrow 122.01\ ft\,k$

$S_R = \frac{1464053.76\ in\#}{33000\ \#/in^2} = 44.37\ in^3$

$\Delta = \frac{26'(12)}{360} = .87"$

$I_R = \frac{5(1443.84\ \#/ft)(26)^4(12)^3}{384(29000000\ \#/in^2).87"} = 588.41\ in^4$

W18x40

$M_R = 122.01\ ft\,k$ < $M_A = 188\ ft\,k$ OK
$S_R = 44.37\ in^3$ < $S_A = 68.4\ in^3$ OK
$I_R = 588.41\ in^4$ < $I_A = 612\ in^4$ OK

Beam B5
Vertical Loads
$W_{Walls} = 50\ \#/ft^2 (3') = 150\ \#/ft$
$W_{Low\ Roof} = 70\ \#/ft^2 (.666') + 6.01\ \#/ft = 52.63\ \#/ft$
(Drift SEE beam B3)

$W_{Trellis} = 70\ \#/ft^2 (4') = 280\ \#/ft$
$Drift = 1.15(24.666')^{.33} - 1.5 = 1.81'$
Width of Drift $= 4(1.81') = 7.24'$
$\gamma = 20.5\ \#/ft^3$ (SEE BEAM B1)
$W_{Drift} = \frac{1.81' \times 7.24'}{2} \times 20.5\ \#/ft^3 = 134.32\ \#/ft$

$W_{total} = 52.63\ \#/ft + 280\ \#/ft + 134.32\ \#/ft + 150\ \#/ft = 616.95\ \#/ft$

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Beam B5 Cont

$M_R = \frac{614.95\ \#/ft\ (5.666')^2}{8} = 2475.79\ Ft\#$ => $29709.43\ in\#$ => $2.48\ FtK$

$S_R = \frac{29709.43\ in\#}{30000\ \#/in^2} = .99\ in^3$

$F_D = 46000\ \#/in^2 \times .666 = 30636\ \#/in^2$

$\Delta = \frac{5.666'(12)}{480} = .14"$

$I_R = \frac{5(616.95\ \#/ft)(5.666')^4(12)^3}{384\ (29000000\ \#/in^2).14"} = 3.52\ in^4$

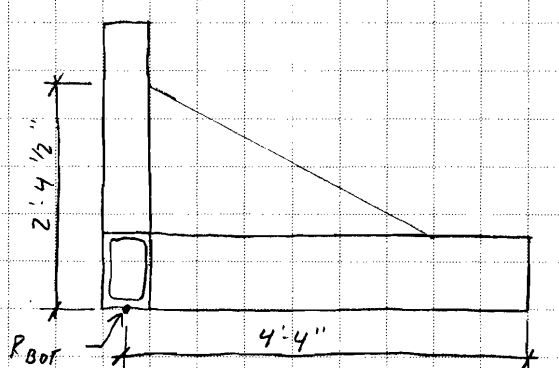
HSS 8x6x1/4

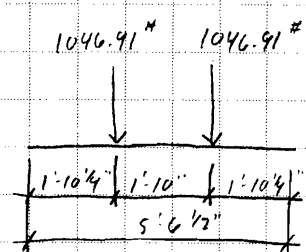
$M_R = 2.48\ FtK \le M_A = 37.5\ FtK$ OK

$S_R = .99\ in^3 \le S_A = 15.0\ in^3$ OK

$I_R = 3.52\ in^4 \le I_A = 60.1\ in^4$ OK

Beam B5 Horizontal





Trellis load = 103.58 #/ft² (SEE SHEET 4)

$\frac{103.58\ \#/ft^2\ (4.333')(2.77')}{2.375'}(2') = \frac{R_{TOP}(2.375')}{2.375'} = 1046.91\ \#$

$M_R = Pa = 1046.91\ \#(1.85') = 1936.79\ Ft\#$ => $23241.48\ in\#$ => $1.94\ FtK$

$S_R = \frac{23241.48\ in\#}{30000\ \#/in^2} = .78\ in^3$

$\Delta = \frac{5.54'(12)}{480} = .14"$

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Beam B5 Cont

$$I_R = \frac{P_a}{24E\Delta}(3L^2 - 4a^2) = \frac{1046.91^{\#}(1.85')(12)}{24(29000000\ \#/in^2).14"}(3(5.54')^2(12)^2 - 4(1.85')^2(12)^2) = 2.69\ in^4$$

HSS 8x6x1/4

$M_R = 1.94$ Fek < $M_A = 32.25$ Fek OK

$S_R = .78\ in^3$ < $S_A = 12.4\ in^3$ OK

$I_R = 2.69\ in^4$ < $I_A = 38.6\ in^4$ OK

Beam B6

$W = 70\ \#/ft^2(18.80') = 1316\ \#/ft$

$M_R = \frac{1316\ \#/ft(23')^2}{2} = 87020.5\ Ft^{\#} \Rightarrow 1044246\ in^{\#} \Rightarrow 87.02$ Fek

$S_R = \frac{1044246\ in^{\#}}{33000\ \#/in^2} = 31.64\ in^3$

$\Delta = \frac{23'(12)}{360} = .77"$

$I_R = \frac{5(1316\ \#/ft)(23')^4(12)^3}{384(29000000\ \#/in^2).77"} = 371.07\ in^4$

W16x31

$M_R = 87.02$ Fek < $M_A = 130$ Fek

$S_R = 31.64\ in^3$ < $S_A = 47.2\ in^3$

$I_R = 371.07\ in^4$ < $I_A = 375\ in^4$

Beam B7

$W = 50\ \#/ft^2(6') = 300\ \#/ft$

$M_R = \frac{300\ \#/ft(14.666')^2}{8} = 8065.93\ \#ft = 96791.2\ in^{\#} \Rightarrow 8.07$ Fek

$S_R = \frac{96791.2\ in^{\#}}{30000\ \#/in^2} = 3.23\ in^3$

$\Delta = \frac{14.666(12)}{480} = .37"$

$I_R = \frac{5(300\ \#/ft)(14.666')^4(12)^3}{384(29000000\ \#/in^2).37"} = 29.1\ in^4$

HSS 8x6x 3/8

$M_R = 8.07$ Fek < $M_A = 80.12$ Fek

$S_R = 3.23\ in^3$ < $S_A = 20.9\ in^3$ OK

$I_R = 29.1\ in^4$ < $I_A = 83.7\ in^4$ OK

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SCALE _____

Beam B8

$W_{window} = 8\ \#/ft^2\ (6.333') = 50.66\ \#/ft$

$W_{wind} = 19.2\ \#/ft^2\ (6.17') = 118.47\ \#/ft$ ← Governs

$M_R = \frac{118.47\ \#/ft\ (14.666')^2}{8} = 3185.24\ ft\#$ ⇒ $38222.85\ in\#$ ⇒ $3.19\ ft\,k$

$S_R = \frac{38222.85\ in\#}{30000\ \#/in^2} = 1.27\ in^3$

$\Delta = .37"$ (see beam B7)

$I_R = \frac{5(118.47\ \#/ft)(14.666')^4(12)^3}{384\,(29000000\ \#/in^2)\,.37"} = 11.49\ in^4$

HSS 6x6x1/4

$M_R = 3.19\ ft\,k$ < $M_A = 38.72\ ft\,k$ OK

$S_R = 1.27\ in^3$ < $S_A = 10.1\ in^3$ OK

$I_R = 11.49\ in^4$ < $I_A = 30.3\ in^4$ OK

Beam B9 Worst Case Bearing Side w/ Drift

$Drift_{Low} = .5(1.15(23.333')^{.33} - 1.5) = .88'$

$Drift_{High} = 1.15(45.5')^{.33} - 1.5 = 2.55'$ ← Governs

$\gamma = 20.5\ \#/ft^3$ (From Beam B1)

Width of Drift $= 4(2.55') = 10.21'$

$W_{Drift} = .52' \times 2.55' \times 20.5\ \#/ft^3 = 27.18\ \#/ft$

$W_{ROOF} = 70\ \#/ft^2\ (.52') = 36.4\ \#/ft$

$W_{WALL} = 50\ \#/ft^2\ (6') = 300\ \#/ft$

$W_{Total} = 300\ \#/ft + 36.4\ \#/ft + 27.18\ \#/ft = 363.58\ \#/ft$

$M_R = \frac{363.58\ \#/ft\ (23')^2}{8} = 24041.73\ ft\#$ ⇒ $288500.73\ in\#$ ⇒ $24.04\ ft\,k$

$S_R = \frac{288500.73\ in\#}{33000\ \#/in^2} = 8.74\ in^3$

$\Delta = \frac{23(12)}{480} = .58"$

$I_R = \frac{5(363.58\ \#/ft)(23')^4(12)^3}{384\,(29000000\ \#/in^2)\,.58"} = 136.10\ in^4$

W 10x26

$M_R = 24.04\ ft\,k$ < $M_A = 77\ ft\,k$

$S_R = 8.74\ in^3$ < $S_A = 27.9\ in^3$

$I_R = 136.10\ in^4$ < $I_A = 144\ in^4$

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Header H1 Worse case bearing side 4'-8"

$W_{Roof} = 70\ \#/ft^2 (22.5') = 1575\ \#/ft$

$W_{Wall} = 50\ \#/ft^2 (9.17') = 458.5\ \#/ft$

$Drift = .5(1.15(45')^{.33} - 1.5) = 1.27'$

$Width\ Drift = 8(1.27') = 10.16'$

$\gamma = 20.5$ (SEE Beam B1)

$W_{Drift} = \frac{1.27'(10.16')}{2} \times 20.5\ \#/ft^3 = 132.2\ \#/ft$

$W_{total} = 1575\ \#/ft + 458.5\ \#/ft + 132.2\ \#/ft = 2165.7\ \#/ft$

$M_R = \frac{2165.7\ \#/ft\ (4.666')^2}{8} = 5893.83\ ft\#$ => $70725.92\ in\#$

$S_R = \frac{70725.92\ in\#}{1{,}700\ \#/in^2} = 41.6\ in^3$

$F_b = 2{,}600\ \#/in^2 \times .666 = 1731.6\ \#/in^2$

$\Delta = \frac{4.666'(12)}{480} = .12"$

$I_R = \frac{5(2165.7\ \#/ft)(4.666')^4(12)^3}{384(1900000\ \#/in^2).12"} = 101.3\ in^4$

USE 5 1/4 x 9 1/4 PSL

$M_R = 5893.83\ ft\#$ < $M_A = 18{,}625\ ft\#$ OK

$S_R = 41.6\ in^3$ < $S_A = 131.47\ in^3$ OK

$I_R = 101.3\ in^4$ < $I_A = 346\ in^4$ OK

Header H2

10'-2" opening: $W_R = 70\ \#/ft^2 (2.83') = 198.33\ \#/ft$ } (FROM BEAM B3)

$W_{Drift} = 6.01\ \#/ft$

$W_{total} = 204.34\ \#/ft$ ← Governs

8'-0" opening: $W_R = 70\ \#/ft^2 (1.19') = 83.3\ \#/ft$

$Drift = .5(1.15(91.333')^{.33} - 1.5) = 1.8'$

$Width\ Drift = 8(1.8') = 14.41'$

$\gamma = 20.5\ \#/ft^3$ (From B1)

$W_{Drift} = 1.8'(1.19')\ 20.5\ \#/ft^3 = 43.91\ \#/ft$

$W_{total} = 83.3\ \#/ft + 43.91\ \#/ft = 127.21\ \#/ft$

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Header H2 Cont.

$M_R = \frac{204.34\ \#/ft\ (10.17')^2}{8} = 2641.83\ ft\#$ ⇒ $31701.99\ in\#$

$S_R = \frac{31701.99\ in\#}{1900\ \#/in^2} = 16.69\ in^3$

$\Delta = \frac{10.17'(12)}{480} = .25"$

$I_R = \frac{5(204.34\ \#/ft)(10.17')^4(12)^3}{384(2000000\ \#/in^2).25"} = 98.37\ in^4$

USE 5 1/4 x 9 1/4 PSL (SAME AS H1)

$M_R = 2641.83\ ft\#$ < $M_A = 18{,}625\ ft\#$ OK

$S_R = 16.69\ in^3$ < $S_A = 131.47\ in^3$ OK

$I_R = 98.37\ in^4$ < $I_A = 346\ in^4$ OK

Header H3

$W = 10\ \#/ft^2 (6') = 60\ \#/ft$

$M_R = \frac{60\ \#/ft(8.17')^2}{8} = 500.62\ ft\#$ ⇒ $6007.4\ in\#$

$S_R = \frac{6007.4\ in\#}{2100\ \#/in^2} = 2.9\ in^3$

$\Delta = \frac{8.17(12)}{480} = .20"$

$I_R = \frac{5(60\ \#/ft)(8.17)^4(12)^3}{384(2000000\ \#/in^2).20"} = 1.04\ in^4$

(2) 6 CSJ 18

$M_R = 6007.4\ in\#$ < $M_A = 33528\ in\#$ OK

$S_R = 2.9\ in^3$ < $S_A = 15.9\ in^3$ OK

$I_R = 1.04\ in^4$ < $I_A = 4.63\ in^4$ OK

Exterior Stud Design

$W = 19.2\ \#/ft^2 (1.33') = 25.54\ \#/ft$

$M_R = \frac{25.54\ \#/ft(12.96')^2}{8} = 536.13\ ft\#$ ⇒ $6433.6\ in\#$

$S_R = \frac{6433.6\ in\#}{1000\ \#/in^2} = 6.43\ in^3$

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Exterior Studs Cont.

$\Delta = \frac{12.96'(12)}{480} = .33"$

$I_R = \frac{5(25.54\#/ft)(12.96')^4(12)^3}{384(1300000\#/in^2).33"} = 37.79 in^4$

$M_R = 530.13\ Ft\#$ < $M_A = 1260\ Ft\#$ OK

$S_R = 6.43 in^3$ < $S_A = 15.12 in^3$ OK

$I_R = 37.79 in^4$ < $I_A = 41.6 in^4$ OK

Truss Bearing on Studs

Roof load = $70\#/ft^2$

$P = 70\#/ft^2 \times 2.666' \times 22.5' = 4198.95\#$

$\#\text{Stud Req'd} = \frac{4198.95\#}{300\#/in^2} = \frac{14 in^2}{5.5} = \frac{2.55"}{1.5"} = 1.7$ or 2 Studs OK

(Crushing of wood) (width of stud) (Thickness of stud)

Shear Wall "A"

$P = 19.2\#/ft^2(34')(9.125') = 5956.8\#$

$\frac{5956.8\#}{27.08'} = 219.97\#/ft < 240\#/ft$ OK

Shear Wall "B"

$P = 19.2\#/ft^2(17.3')(9.125') = 3030.96\#$

$\frac{3030.96\#}{26.333'} = 115.10\#/ft < 240\#/ft$ OK

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Shear Wall "C"

$P = 19.2\ \#/ft^2\ (9.175')(22.5') = 3942\ \#$

$\frac{3942\ \#}{40.333'} = 97.74\ \#/ft < 240\ \#/ft$ OK Σ

Shear Wall "D" & "F"

$P = 19.2\ \#/ft^2\ (9.125')(18.48) = 3237.7\ \#$

$\frac{3237.7\ \#}{16.666'} = 194.27\ \#/ft < 240\ \#/ft$ OK Σ

Shear Wall "E"

$P = 19.2\ \#/ft^2\ (6.67)\ 32' = 4098.05\ \#$

$\frac{4098.05\ \#}{17.81'} = 230.10\ \#/ft < 240\ \#/ft$ OK Σ

Shear Wall "C"

$P = 19.2\ \#/ft^2\ (9.125')(11.5') = 2014.8\ \#$

$\frac{2014.8\ \#}{10.333'} = 194.99\ \#/ft < 240\ \#/ft$ OK Σ

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SLAB DESIGN

$f'c = 4000\ \#/in^2$

Dead load: $160\ \#/Ft^2 \times 1.4 = 224\ \#/Ft^2$

Live load: $100\ \#/Ft^2 \times 1.7 = 170\ \#/Ft^2$

Ultimate load: $394\ \#/Ft^2$

$W_u = 394\ \#/Ft^2\ (1') = 394\ \#/Ft$

$M_{up} = \frac{394\ \#/Ft\ (15')^2}{8} = 11081.25\ Ft\#$

$$\rho_b = \frac{0.85 f'c \beta_1}{f_y} \times \frac{87{,}000}{87{,}000 + f_y} = \frac{0.85(4000\ \#/in^2)\,0.85}{60{,}000\ \#/in^2} \times \frac{87{,}000}{87{,}000 + 60{,}000\ \#/in^2} = .02851$$

$\beta_1 = .85$ (for 4000 $\#/in^2$ Conc. and Lower)

$f_y = 60{,}000\ \#/in$

$\rho_{max} = 0.75\,\rho_b = 0.75(.02851) = .02138$

$\rho_{max} = \frac{200}{F_y} = \frac{200}{60{,}000} = .00\overline{3}$

$$\frac{M_u}{\phi bd^2} = \phi \rho f_y bd^2 \left(1 - 0.59 \frac{\rho f_y}{f'c}\right) = \frac{11081.25\ Ft\#\ (12)}{.90(12'')(5'')^2} = 492.5\ in \quad \rho = 0.0089 \text{ (From Table A.14)}$$

$\phi = .90$ for reinforced conc.

$\rho = \frac{A_s}{bd} \Rightarrow A_s = \rho bd = .0089(12'')(5'') = .534\ in^2$ (1) #7 = $.60\ in^2$ OK

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Exterior Foundation Wall Design

$f'c = 4000\ \#/in^2$

Ultimate Load: $394\ \#/ft^2$ (From page 11)

$W_u = 394\ \#/ft^2\ (11.5') = 4531\ \#/ft$

$M_{UR} = \frac{4531\ \#/ft\ (13.25)^2}{8} = 99434.2\ Ft\#$

$\rho_b = .02851$ (From page 11)

$\rho_{max} = .75\,\rho_b = .75(.02851) = .02138$

$\rho_{min} = .003$ (From page 11)

$\frac{M_u}{\phi bd^2} = \frac{99434.2\ Ft\#\ (12)}{.9\ (12")\ 43.992")^2} = 57.09$ $\rho = 0.0033$ (From Chart A.14)

$A_s = \rho bd = 0.0033(12")(43.992") = 1.74\ in^2$ L (4) #6 Bar = $4 \times .44 = 1.76\ in^2$ OK

PSI Information To Build On
Engineering • Consulting • Testing

June 27, 2007

Ms Donna Cole
Development Coordinator
McDonald's USA LLC
690 Canton St., Suite 310
Westwood MA 02092
Phone: (781) 461-4736
Email: donna.cole@us.mcd.com

Reference: Geotechnical Engineering Report
Proposed McDonald's Restaurant
332 St. John Street
Portland, Maine
PSI Project No. 446-70049

Dear Ms Cole:

We are pleased to submit this letter summarizing the results of the geotechnical engineering studies undertaken regarding the referenced McDonald's site located in Portland, Maine. This work was conducted in general accordance with our proposal to you for multiple services dated April 19, 2007. The objective of the work summarized herein was to provide geotechnical engineering recommendations to members of McDonald's design team.

Summary

Subsurface conditions at this site consist of 17 feet to 22 feet of miscellaneous fill underlain by up to 5 feet of peat / organic silt material before reached firm soil. Site stabilization or deep foundations have been recommended to support the building. Additional studies to assess site class conditions for seismic design values are required. There is unconfirmed information that the existing building might be supported on piles. Existing pile foundations will create obstructions when constructing the foundations for the proposed overlapping structure.

Background

The existing restaurant facility is located at 332 St. John St. in Portland, Maine as shown in Figure 1, Site Locus. We understand that McDonald's plans to construct a new restaurant facility on the same site thereby replacing the existing building. We understand that all new McDonald's facilities are constructed without below ground space and therefore the proposed building will be a single-story structure with slab-on-grade.

The site is currently occupied by an existing building, pavement and landscape areas. According to plans provided by McDonald's, the proposed building footprint will overlap the existing building footprint. The existing and proposed building footprints are located toward the middle of the triangular site. The site slopes gradually in a northeasterly direction toward St. John Street from approximately El. 24 at the southwestern corner to approximately El. 20 at the northeastern corner.

At the time that the explorations were conducted, the existing structure showed no obvious signs of damage that could be related to settlement. According to McDonald's representatives, plans that show the foundations for the existing building are not readily available. Therefore, we do not know the type of foundation that supports the existing building. Based on the subsurface conditions encountered during the exploration it is our opinion that the building could be supported on piles. This issue must be resolved because existing pile foundations, if they exist, could interfere with the alternative foundations discussed herein and impact construction and cost.

In accordance with McDonald's design requirements, the foundation bearing material must be capable of supporting a bearing pressure of 2000 psf for a slab-on-grade building. At the recommended design bearing pressure, the total settlement of the structure must also be limited to 1-inch with differential settlement limited to ½-inch or less.

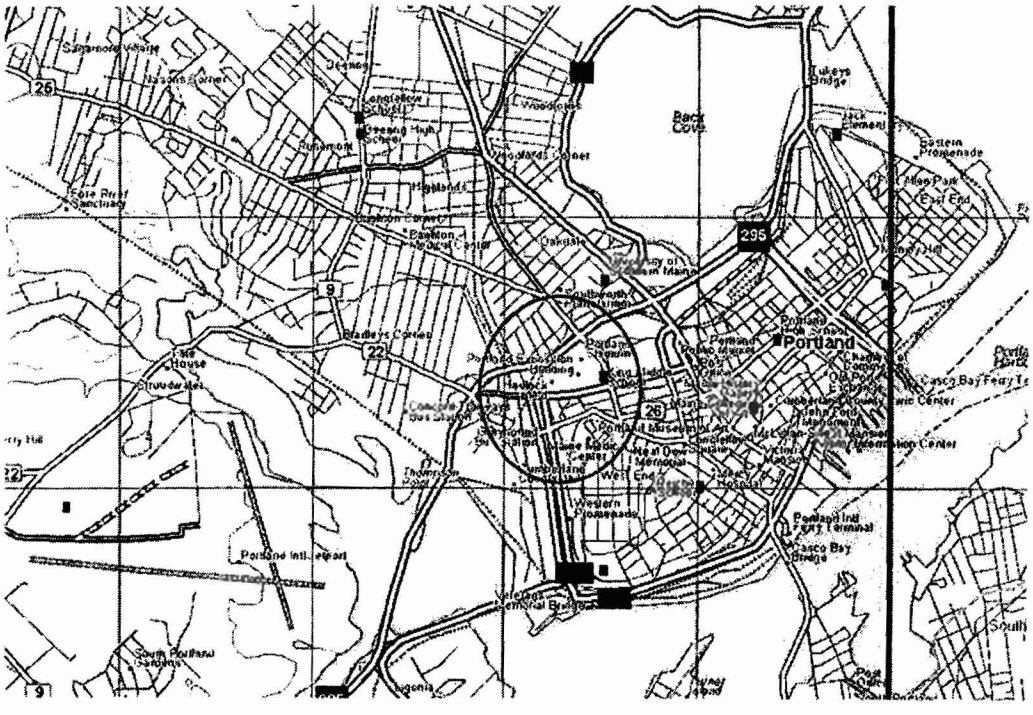


Figure 1 - Site Locus

Subsurface Explorations

Maine Test Boring, Inc. of Brewer, Maine, contracted by PSI, conducted a subsurface exploration program at the site on June 4, 2007. The initial four borehole locations were provided to PSI by McDonald's USA, LLC. In each instance the drilled location of the borehole was adjusted because of difficult access, location of underground utilities or to provide uninterrupted customer traffic. The fourth boring was deleted from the program to finish the exploration program within the one-day budget since the borings extended deeper than anticipated due to the subsurface conditions encountered. The approximate drilled location of the borings is shown in Figure 2, Exploration Location Plan.

Borings B-1 to B-3 were taken within or adjacent to the proposed building footprint depending upon the locations provided to PSI and as located on site to accommodate site and operation conditions. Prior to undertaking the fieldwork, PSI called a representative of the facility to coordinate the work and avoid disruption to the restaurant's operation.

Samples of soil were generally retrieved at the ground surface and at 5-ft intervals to provide material for a visual classification as shown on the logs. However, several samples were retrieved at intermediate intervals. The samples were retrieved using a standard split spoon sampler driven with a 140-pound weight falling 30-inches at each sampling depth. The sampler was driven a distance of 24-inches or as otherwise shown on the logs. The number of hammer blows required to drive the sampler into the soil in 6-inch increments is recorded on the logs. The sum of the hammer blows for the 6-inch to 12-inch and 12-inch to 18-inch interval provides the Standard Penetration Resistance (N) and is a measure of soil density in granular soils and stiffness in cohesive soil. When clay was encountered, a pocket penetrometer was also used to provide an index value for consistency.

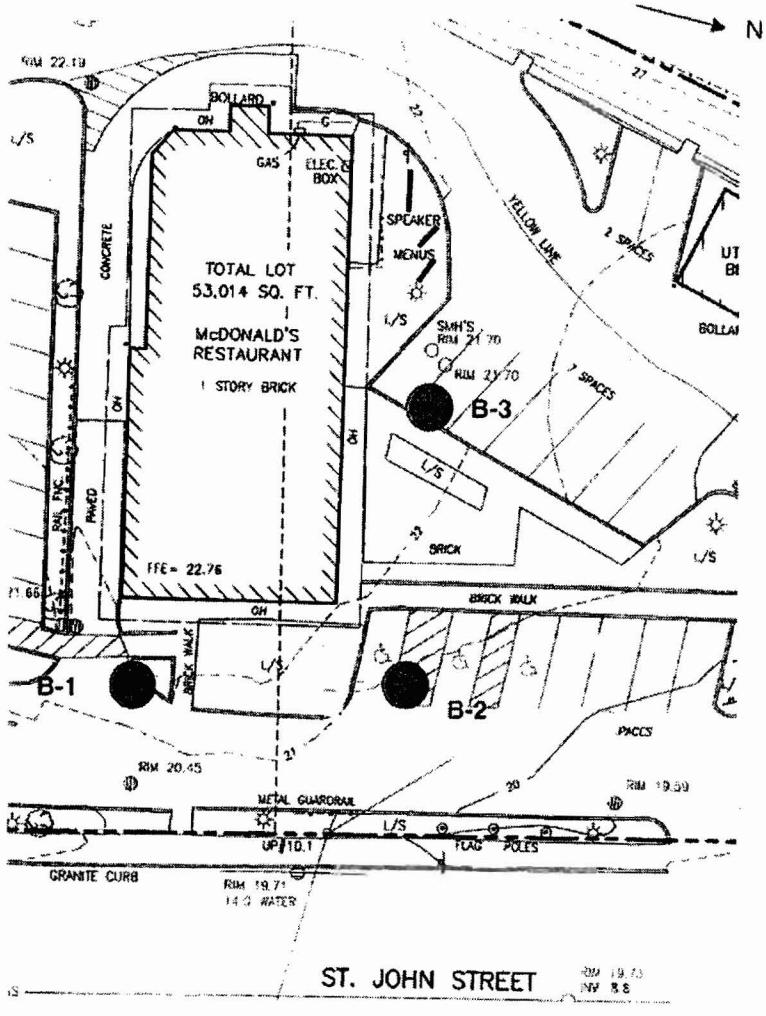


Figure 2 – Exploration Location Plan

The classification of soil strata shown on the logs is based upon PSI's interpretation of the subsurface conditions. It is possible that there might be thin layers of material lying between the sampling intervals that are not described on the logs and which might not become known until construction. Likewise, the depth to each soil stratum is considered to be approximate and may be more gradual or different in the field. Logs of the borings were prepared by PSI and are attached to this report for reference.

Subsurface Conditions

The subsurface conditions encountered during the exploration program are described herein. Refer to the soil test boring logs for details and reference.

Soil

From the ground surface down, soil conditions vary. Borings B-1 to B-3 show that the site is underlain by approximately 17 feet to 21 feet of loose to very dense miscellaneous fill having a standard penetration resistance (N-value) ranging from 4 blows per foot (bpf) to 73 bpf. Thereafter the fill is underlain by up to approximately 5 feet of peat and organic silt having an N-value ranging from 16 bpf to 22 bps indicating that the material has been compressed under the weight of the fill. Thereafter, very soft to hard clay or silty sand was encountered as depicted in boring B-1. The three borings terminated within the lower clay or silty sand layer. According to the deepest boring (B-2) the very soft material lays below a depth of approximately 34 feet BGS. The entire thickness of the clay was not determined due to time restrictions.

Groundwater

Groundwater was measured at a depth of approximately 7 feet to 10 feet BGS as indicated on the logs. These conditions are applicable to the time when the readings were made. The level of groundwater below the ground surface fluctuates based on conditions such as season, temperature and amount of precipitation that may be different from the time when the observations were made. Therefore, the groundwater levels may be higher or lower during construction and during the life of the structure. This fact should be taken into consideration when preparing foundation design and developing earthwork procedures.

Laboratory Testing

Sample S-3 from boring B-1 at a depth of 1-foot to 3-feet BGS was selected for gradation testing. The results of the testing are summarized below.

Location	Depth (ft)	% Passing #200 Sieve	USCS Designation
B-1	1-3	7.2	SW-SM

Recommendations

Recommendations are presented in the following sections.

Foundations

The subsurface conditions encountered at this site consist of approximately 17 feet to 21 feet of loose to dense miscellaneous fill that is underlain by medium dense (stiff) peat with organic silt. In our opinion, these subsurface conditions are not suitable for supporting the proposed building without stabilizing the existing fill or providing a deep foundation system. An alternative to excavate and replace the fill has been excluded because of the thickness of the fill and peat / organic silt layer and shallow foundations have been excluded without stabilizing the underlying poor soil conditions. One method of stabilizing the fill, using a preload to pre-compress the soil, requires an import and export of fill along with time for settlement which could be several weeks to stabilize. In our opinion, the methods described above are not feasible for this site and are discussed no further.

Based upon our assessment of the existing subsurface conditions, it is our opinion that the proposed structure should be supported on rammed aggregate piers (Geopiers) or deep foundations such as timber, concrete or pipe piles. The pile foundations would derive their support by friction / cohesion within the material below the organics silt. One consideration with respect to pile is the apparent presence of very soft material below a 12 foot thick mantle of medium dense silty sand or clay. Therefore low capacity piles would be installed to avoid penetrating into the very soft soil depicted on the logs as "weight of rod" soil. Additional subsurface explorations would be required to assess the pile foundation alternative further. We recommend considering the rammed aggregate pier alternative (RAP) for supporting the building. We can provide additional services to discuss this alternative with you and the Geopier Foundation Company.

With the use of RAPs, the proposed building could be supported on shallow spread and / or continuous footings with slab-on-grade resting on the RAPs. The RAPs improve the weak soil by placing crushed stone in piers installed by augering 2- to 3-foot diameter holes and then backfilling the hole by placing and ramming crushed stone in layers to provide a firm zone within the foundation stress layer. It is our opinion that the RAPs would extend to a depth of approximately 22 feet BGS and just below the peat and organic silt material. Each pier would have a diameter of about 2.5 feet and spaced of about 10 feet apart or as necessary to support the building foundation and slab based on design considerations.

The design bearing pressure for a McDonald's restaurant with a slab-on-grade is 2000 psf (1 tsf) which is a relatively light load and the RAPs would be design to support this load and the proposed building configuration. The RAPs are a propriety element and the system must be designed and installed by an agent of the Geopier Foundation Company (Geopier). The final number, layout, size and depth of the RAPs must be provided by a professional engineer registered in the State of Maine working for the Geopier Foundation Company. A RAP modulus test will be required before the start of production RAPs to prove the design values.

RAPs would be designed to limit total and differential settlement to McDonald's requirements of less than 1-inch and ¾-inches respectively.

Depth of Footings / Pile Caps

We recommend that the exterior footings or pile caps be placed at least 4 feet below exterior grade for frost protection.

Proofrolling

We expect that the existing building will be removed in its entirety including all foundations and utilities. If the existing building is supported on piles, then the piles must be selectively removed and backfilled with soil if above the groundwater or crushed stone if below the groundwater level so the piles do not become and obstruction. This could become difficult if the voids collapse. Voids resulting from the excavation to removed other parts of the below ground structure and utilities should be backfilled with granular borrow fill compacted to the requirement stated herein or otherwise provided in the contract documents.

We recommend that the entire building footprint and pavement areas be proofrolled by making at least 10 passes using self-propelled vibratory drum compactor having a weight of at least 10 tons at the drum. This proofrolling should be completed before placing grading fill such as the pavement base course layer require to construct the site and building to grade. Soft or weak soil should be removed and replace with compacted fill where they are observed in pavement areas. Separate stabilization or deep foundation methods will be used within the building footprint.

When the wall footings are excavated, we recommend that the bottom of the footing excavation receive additional proofrolling by making at least 4 passes using a self-propelled vibratory drum roller having a weigh of at least 1000 pounds.

Moisture

Since the structure will be constructed at grade, and therefore a without basement, damproofing or waterproofing below ground walls does not apply.

Concrete Slab

Subsurface soil conditions are suitable for supporting a slab-on-grade provided that the site has been stabilized using a rammed aggregate pier alternative as designed and installed by the Geopier Foundation Company. If the proposed structure is supported on a deep foundation system such as piles, then we recommend constructing a structural slab supported by the deep foundations.

We recommend constructing the slab over a 6-inch thick layer of gravel base course material as specified herein that has been compacted to 95 percent of the maximum dry density determined in accordance with ASTM D1557.

For the design of the floor slabs bearing on compacted fill with the RAP alternative, we recommend using a modulus of subgrade reaction, k_{s1}, of 500 tons per cubic foot (tcf) for dense material compacted to the requirements specified in this report.

The values of k_{s1} are for a 1 x 1 square foot area. These values should be adjusted for larger areas using the following expression:

$$Modulus\ of\ Subgrade\ Reaction\ (k_s) = k_{s1} * \left(\frac{B+1}{2B}\right)^2$$

where: k_s = Coefficient of vertical subgrade reaction for loaded area,
k_{s1} = Coefficient of vertical subgrade reaction for 1 x 1 square foot area, and
B = Width of area loaded, in feet.

Cosmetic cracking of slabs-on-grade is normal and should be expected. Cracking can occur not only as a result of heaving or compression of the underlying soil, but also as a result of concrete curing stresses. To reduce the potential for cracking, the precautions listed below should be closely followed for construction of all slabs-on-grade:

- We recommend installing construction joints between the floor slab and the walls and columns to account for differential settlement between the footings and slab. Concrete slabs should be jointed according to the American Concrete Institute (ACI) requirements, or other suitable code.

- All backfill in areas supporting slabs should be moisture conditioned and compacted. Backfill in all interior and exterior water and utility line trenches should be carefully compacted.

- Exterior slabs should be isolated from the building. These slabs should be constructed to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.

Foundation Drains

Since the proposed structure will be constructed without a basement, foundation drains are not necessary.

Seismic Considerations

The project site is located in a municipality that employs the 2003 edition of the IBC. As part of this code, the design of structures must consider dynamic forces resulting from seismic events. These forces are dependent upon the magnitude of the earthquake event as well as the properties of the soils that underlie the site.

Part of the IBC code procedure to evaluate seismic forces requires the evaluation of the Seismic Site Class, which categorizes the site based upon the characteristics of the subsurface profile within the upper 100 feet of the ground surface.

The soil properties are not known in sufficient detail to a depth of 100 feet to determine the site class. Since boring B-2 encountered very soft clay, which could be quick clay, the site class could be classified as F, which requires a site specific assessment. In order to complete this work an additional boring to a depth of 100 feet is required to provide the additional information and to verify site F or better conditions.

Earthwork

In the preceding sections we have outlined several recommendations for earthwork. Below, we provide additional recommendations, which should be incorporated into the structural design and Contract Documents.

1. All fill placed within and below the structure must be compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM D1557. Lifts must be controlled so that they do not exceed 6-inches in confined areas and 12-inches in open areas where larger compactors can be utilized. Use hand-operated equipment within 10-ft behind retaining walls and do not over-compact the backfill material.

2. All excavations shall be stabilized by cutting back the side slopes or using shoring and bracing as required by 29 CFR 1926 Subpart P, Excavations. Plans and specifications should make reference to this requirement so that Contractors are aware of their responsibility.

3. Remove the existing structure and utilities in their entirety and backfill the excavations with compacted granular fill. If deep foundations are removed, backfill the voids with coarse soil.

4. Drainage must not be directed onto adjacent property either during construction or as part of the design grading especially if this would affect groundwater and / or moisture conditions on the adjacent parcel.

Construction Dewatering

The explorations encountered groundwater at a depth of approximately 7 feet to 10 feet BGS as shown on the logs. At this expected depth, we do not expect groundwater to be encountered during construction except where excavation to remove existing structure or utilities might extend deep. Water resulting from groundwater of precipitation seeping into the excavations can be removed by pumping from the bottom of the excavation.

Pavement

Limited information was provided during the exploration program to provide an assessment of the entire site. In our opinion, miscellaneous fill probably extends to areas beyond the proposed building area and lies beneath the proposed pavement sections. This is the basis for the recommendations provided herein.

We have provided a recommended minimum pavement section based on the typical traffic conditions provided in McDonald's Minimum Soil Testing Requirements. We have assumed that all areas to receive new pavement and base course material will be thoroughly proofrolled to verify that the underlying material below subgrade is firm and unyielding. Where new fill is placed, such as the base course, it must be compacted to at least 95% of the maximum dry density determined in accordance with ASTM D1557.

Based on the results of the gradation test retrieved from a representative sample of subgrade soil where explored, we recommend the following minimum pavement section:

Layer	Thickness (inches)	
	Light Duty Areas	Heavy Duty Areas
Bituminous Top Course	1-1/2	1-1/2
Bituminous Binder	1-1/2	2
Granular Base Course Material	6	9

The recommended base course material shall meet the requirements for the Maine Department of Transportation Standard, Section 703.06 Aggregate for Base and Subbase – Type B

Materials

We recommend that the following material gradations and names be used be used for consistency on the drawings and in the earthwork specifications. All material must be well graded between the limits shown herein and be capable of being compacted to the required degree of density. The material shall have sufficient fines so that it does not shove and remains stable. We also recommend that the specifications not allow the use of recycled material such as reprocessed building demolition material.

Common Borrow

Friable natural soil containing no gravel greater than 2/3 loose lift thickness and free of trash, snow, ice, organics, roots, tree stumps and no more than 35 percent passing the No. 200 sieve. Common borrow can be used as general backfill provided it can be compacted and stabilized for the intended purpose.

Granular (Structural) Fill

Use below the building slab base course layer and below footings.

U.S. Sieve No.	Percent Finer by Weight
3-inch	100
10	30-95
40	10-70
200	0-15

Dense Graded Crushed Stone:

Use for base course material below slabs.

Sieve Size	Percent Finer
2-inch	100
1-1/2-inch	70 - 100
¾-inches	50 - 85
No. 4	30 - 55
No. 50	8 - 24
No. 200	3 - 10

Additional Services During Design

Based on the subsurface conditions encountered and described herein, we recommend that one additional boring be taken to a depth of 100 feet, as determined by the engineer, to provide information to select a site specific seismic site class.

If RAPs are considered feasible for supporting the building, additional engineering services are recommended to study this alternative and incorporate information and requirements in the contract documents. If RAPs are not feasible, then additional studies are recommended to select pile alternatives and prepare specifications.

Review of Plans and Specifications

We recommend that we be allowed the opportunity to review the plans and specifications for geotechnical issues prior to completing the Contract Documents. The purpose of this is to verify that the intent of our recommendations have been correctly interpreted and included.

Services during Construction

We recommend that PSI be engaged to observe subsurface conditions at the bottom of the foundations prior to casting the footings. The purpose of this is to verify that the expected conditions are present and to provide recommendations should actual conditions differ. We also recommend that PSI be engaged to provide services to assess the degree of compaction attained when placing structural fill to support the building.

Limitations

This report is delivered subject to the following limitations:

1. The recommendations presented herein reflect our opinions and are based upon engineering studies conducted using the available subsurface information as stated herein along with our understanding of the building configuration and grades. If other information becomes available, especially information related to the existing structure, or if conditions change we must be notified. The recommendations will be reviewed in

context with the new information and we reserve the right to modify our recommendations as necessary.

2. The studies and recommendations summarized herein are based upon generally accepted geotechnical engineering practices. No other warranty, expressed or implied is made. These recommendations apply specifically to this project since they are based on site specific conditions. Hence, they are not transferable.

3. This report has been prepared solely for design purposes and shall not be incorporated by reference of other means into the Contract Documents. If this report is included in the Project Manual, it shall be for information only. Earthwork specification clauses shall take precedence.

4. PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminates in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. Client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Client further acknowledges that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

5. The geotechnical scope of services did not provide any service to investigate or detect the presence of contamination in the subsurface environment.

If you have any questions regarding this report, please do not hesitate to call.

Very truly yours,

PROFESSIONAL SERVICE INDUSTRIES, INC.

STATE OF MAINE
RICHARD PAUL WEBER
No. 3933
LICENSED PROFESSIONAL ENGINEER

Richard P. Weber, P.E.
Principal Consultant and Manager

Jennifer A.C. MacGregor
Project Reviewer

Attachments:

Appendix A - Soil Test Boring Logs
Gradation Test Results

CC: Ms Nancy Dittmeier, Development Coordinator

APPENDIX A

Boring Logs
Gradation

BORING LOG

 Boring No.: **B-1**

Project:	McDonald's Restaurant, Portland, ME		
Client:	McDonald's USA LLC	PSI Project No.:	446-70049
Drilling Subcontractor:	Maine Test Boring	Date Started:	6/4/07
Drilling Foreman:	Mike	Date Completed:	6/4/07
PSI Engineer:	Alan Smith	Location:	Southeast corner of proposed building
Ground Surface Elev.	21.5 ft. Est. from existing conditions plan	Total Depth:	26 ft.
Ground Water Depth:		Drill Rig Type:	Mobile B-53 on trailer
	9.6 ft. after pulling augers	Drilling Method:	3" hollow stem augers
Hammer Weight:	140 lbs.	Split Spoon Diameter:	ID- 1.375", OD- 2"
Hammer Type:	Donut	Rock Core Barrel Size:	N/A
Drop:	30"		

Depth (ft)	SAMPLE No.	SAMPLE Depth (ft)	SAMPLE Pen./ Rec. (in)	SAMPLE * Blows Per Six Inches/ RQD (%)	DESCRIPTION OF SAMPLES (Classification)	Remarks	Soil Strata	N VALUE (bpf) ▲ 20 40 60 80	PID (ppm)
					4", Bituminous Pavement.		Pavement		
		1.0			S1 Fine to Coarse SAND, trace Silt, some fine Gravel, brown, moist.				
2.0	S1		24/17	48-43-30-28				▲73	
		3.0			S2 COAL ASH, Sand and Gravel size, little Silt, black and gray, moist.				
4.0	S2		24/13	15-12-10-6				▲22	
		5.0			S3 Top 6", Similar to S2. Bottom 7", Fine to Medium SAND, little Silt, dark brown, moist.				
6.0	S3		24/13	3-3-1-2				▲4	
		7.0							
8.0									
		9.0			S4 Moderately plastic CLAY, some fine to medium sand lense, gray, wet.	▽	Fill		
10.0	S4		24/5	3-2-3-5				▲5	
		11.0			11.7 to 13.3 ft - hard augering, driller thought material may be wood.				
12.0									
14.0		14.0			S5 Fine to Coarse SAND, some clay, some Gravel, gray, wet.				
	S5		24/5	7-17-22-31				▲39	
16.0		16.0							
18.0						1			
		19.0			S6 Fiberous PEAT and ORGANIC SILT, brown, wet.				
20.0	S6		24/18	1-8-8-11			Peat	▲16	
		21.0							
22.0						1			

Remarks: 1 Strata change assumed.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the middle two increments of penetration is termed the standard penetration resistance, N. RQD = Rock Quality Designation. WOH = Weight of Hammer. WOR = Weight of drilling Rods.

BORING LOG

 Boring No.: B-1

Project: McDonald's Restaurant, Portland, ME

Client: McDonald's USA LLC PSI Project No.: 446-70049

Depth (ft)	SAMPLE No.	Depth (ft)	Pen./ Rec. (in)	* Blows Per Six Inches/ RQD (%)	DESCRIPTION OF SAMPLES (Classification)	Remarks	Soil Strata	N VALUE (bpf) ▲ 20 40 60 80	PID (ppm)
	S7	24.0	24/20	2-7-8-12	S7 Fine SAND and SILT, slightly plastic, organic odor, gray, wet.		Sand & Silt	▲15	
26.0		26.0			Bottom of boring at 26 ft. Backfilled with cuttings. Topped with cold patch.				
28.0									
30.0									
32.0									
34.0									
36.0									
38.0									
40.0									
42.0									
44.0									
46.0									
48.0									
50.0									
52.0									
54.0									

Remarks: 1 Strata change assumed.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the middle two increments of penetration is termed the standard penetration resistance, N. RQD = Rock Quality Designation. WOH = Weight of Hammer. WOR = Weight of drilling Rods.

BORING LOG

 Boring No.: **B-2**

Project:	McDonald's Restaurant, Portland, ME		
Client:	McDonald's USA LLC		PSI Project No.: 446-70049
Drilling Subcontractor:	Maine Test Boring	Date Started:	6/4/07
Drilling Foreman:	Mike	Date Completed:	6/4/07
PSI Engineer:	Alan Smith	Location:	Northeast corner of proposed building
Ground Surface Elev.	20.7 ft. Est. from existing conditions plan	Total Depth:	36 ft.
Ground Water Depth:		Drill Rig Type:	Mobile B-53 on trailer
	10.3 ft. after pulling augers	Drilling Method:	3" hollow stem augers
Hammer Weight:	140 lbs.	Split Spoon Diameter:	ID- 1.375", OD- 2"
Hammer Type:	Donut	Rock Core Barrel Size:	N/A
Drop:	30"		

Depth (ft)	SAMPLE No.	SAMPLE Depth (ft)	SAMPLE Pen./ Rec. (in)	SAMPLE * Blows Per Six Inches/ RQD (%)	DESCRIPTION OF SAMPLES (Classification)	Remarks	Soil Strata	N VALUE (bpf) ▲ 20 40 60 80	PID (ppm)
					2½", Bituminous Pavement.		Pavement		
2.0		2.0							
	S1		24/8	47-29-55-30	S1 Fine to Coarse SAND, little silt, some gravel, brown, moist.			84	
4.0		4.0							
	S2		24/12	4-4-3-2	S2 COAL ASH, sand and gravel size, little silt, black and gray, moist.			7	
6.0		6.0							
8.0									
		9.0							
10.0	S3		24/8	4-10-13-13	S3 Fine to Coarse SAND, some Silt, some fine Gravel, dark brown, wet.	▽	Fill	23	
		11.0							
12.0									
14.0		14.0							
	S4		24/4	2-11-16-5	S4 Fine to coarse SAND, little Silt, some Gravel, dark brown, wet.			27	
16.0		16.0							
18.0									
		19.0							
20.0	S5		24/24	2-3-5-8	S5 Top 6", Fine to Medium SAND, little silt, gray, wet.			8	
		21.0			Bottom 18": fiberous PEAT and ORGANIC SILT, brown, wet.		Peat		
22.0						1			

Remarks: 1 Strata change assumed.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the middle two increments of penetration is termed the standard penetration resistance, N. RQD = Rock Quality Designation. WOH = Weight of Hammer. WOR = Weight of drilling Rods.

BORING LOG

 Boring No.: **B-2**

Project: McDonald's Restaurant, Portland, ME

Client: McDonald's USA LLC PSI Project No.: 446-70049

Depth (ft)	SAMPLE No.	SAMPLE Depth (ft)	SAMPLE Pen./ Rec. (in)	SAMPLE * Blows Per Six Inches/ RQD (%)	DESCRIPTION OF SAMPLES (Classification)	Remarks	Soil Strata	N VALUE (bpf) ▲ 20 40 60 80	PID (ppm)
	S6	24.0	24/20	2-11-11-18	S6 Fine SAND and SILT at top transistions to moderately plastic CLAY with silt and sand lenses. PP- 2.5, 2.0, 3.0 tsf		Sand & Silt	▲22	
26.0		26.0							
28.0		29.0							
30.0	S7		24/20	6-18-20-21	S7 Moderately plastic CLAY, brown, wet, a few sand lenses near top. PP- 3.0, 3.5, 3.0, 4.0 tsf		Clay	▲38	
32.0		31.0							
34.0	S8	34.0	24/18	WOR/24"	S8 Moderately plastic CLAY, gray, wet.				
36.0		36.0			Bottom of boring at 36 ft, Backfilled with cuttings, Topped with cold patch.				
38.0									
40.0									
42.0									
44.0									
46.0									
48.0									
50.0									
52.0									
54.0									

Remarks: 1 Strata change assumed.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the middle two increments of penetration is termed the standard penetration resistance, N. RQD = Rock Quality Designation. WOH = Weight of Hammer. WOR = Weight of drilling Rods.

BORING LOG

 Boring No.: **B-3**

Project:	McDonald's Restaurant, Portland, ME		
Client:	McDonald's USA LLC	PSI Project No.:	446-70049
Drilling Subcontractor:	Maine Test Boring	Date Started:	6/4/07
Drilling Foreman:	Mike	Date Completed:	6/4/07
PSI Engineer:	Alan Smith	Location:	Interior northwest corner of proposed building
Ground Surface Elev.	22.2 ft. Est. from existing conditions plan	Total Depth:	26 ft.
Ground Water Depth:	6.9 ft. after pulling augers	Drill Rig Type:	Mobile B-53 on trailer
		Drilling Method:	3" hollow stem augers
Hammer Weight:	140 lbs.	Split Spoon Diameter:	ID- 1.375", OD- 2"
Hammer Type:	Donut	Rock Core Barrel Size:	N/A
Drop:	30"		

Depth (ft)	SAMPLE No.	SAMPLE Depth (ft)	SAMPLE Pen./ Rec. (in)	SAMPLE * Blows Per Six Inches/ RQD (%)	DESCRIPTION OF SAMPLES (Classification)	Remarks	Soil Strata	N VALUE (bpf) ▲ 20 40 60 80	PID (ppm)
2.0					12", Topsoil. 1 to 2.5 ft - cobbles and boulders.				
4.0		4.0							
	S1		24/16	34-54-38-27	S1 Fine to Coarse SAND, trace Silt, some Gravel, brown, moist.			▲ 92	
6.0		6.0				▽			
8.0					6.7 to 7.3 ft - difficult augering.				
		9.0			S2 Similar to S-1, except wet.				
10.0	S2		24/6	2-4-12-14				▲ 16	
		11.0					Fill		
12.0									
14.0		14.0			S3 Similar to S-1, except wet, 1 ft of sand blew into augers, pulled augers a few inches and sand fell out.				
	S3		24/6	11-25-18-13				▲ 43	
16.0		16.0							
18.0									
		19.0							
	S4	19.8	9/3	2-100/3"	S4 Fine to Medium SAND, trace coarse, trace Silt, gray, wet, 1 ft of sand blew into augers, pulled augers a few inches and sand fell out.				
20.0						1			
					19.5 to 21 ft - difficult augering.				
22.0							Peat		

Remarks: 1 Strata change assumed.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the middle two increments of penetration is termed the standard penetration resistance, N. RQD = Rock Quality Designation. WOH = Weight of Hammer. WOR = Weight of drilling Rods.

BORING LOG

 Boring No.: **B-3**

Project: McDonald's Restaurant, Portland, ME

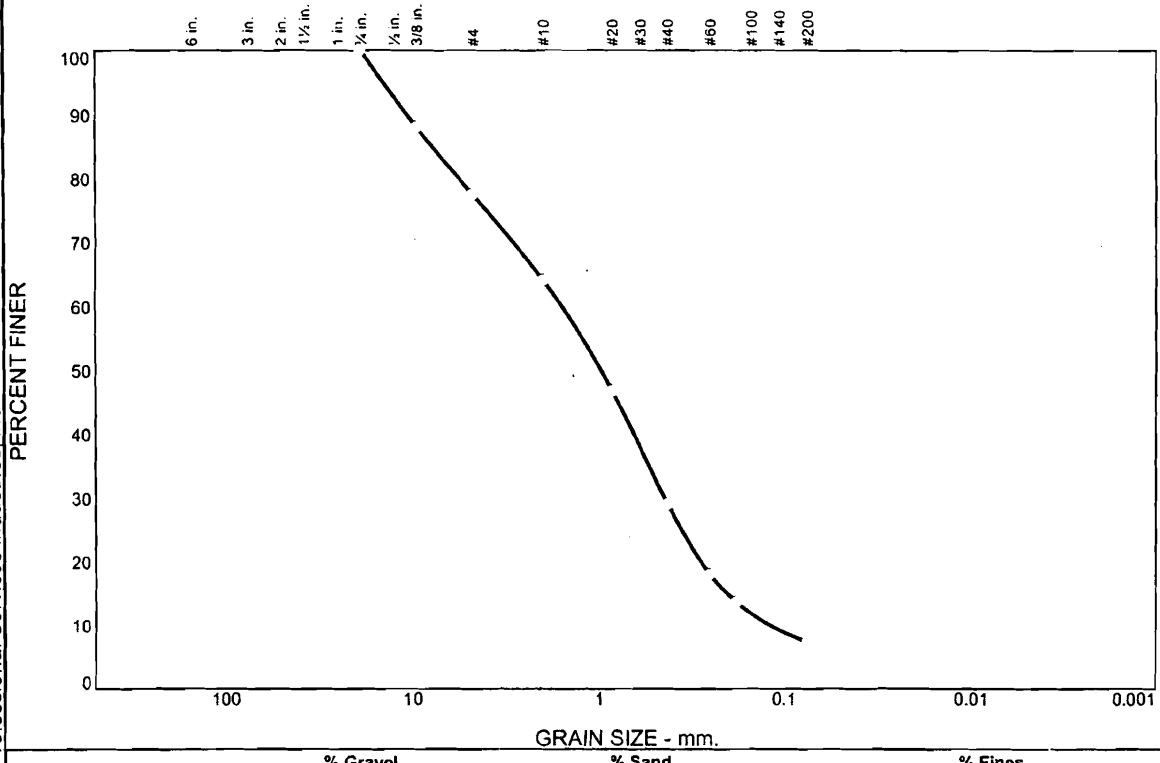
Client: McDonald's USA LLC PSI Project No.: 446-70049

Depth (ft)	SAMPLE No.	SAMPLE Depth (ft)	SAMPLE Pen./ Rec. (in)	SAMPLE * Blows Per Six Inches/ RQD (%)	DESCRIPTION OF SAMPLES (Classification)	Remarks	Soil Strata	N VALUE (bpf) ▲ 20 40 60 80	PID (ppm)
		24.0			S5 Top 6". Fiberous PEAT and ORGANIC SILT.				
	S5		24/18	17-45-47-67	brown, wet.				
					Bottom 12", moderately to highly plastic CLAY.		Clay	▲ 92	
26.0		26.0			brown, wet.				
					PP- +4.5 tsf				
					Bottom of boring at 26 ft.				
28.0					Backfilled with cuttings.				
					Topped with topsoil.				
30.0									
32.0									
34.0									
36.0									
38.0									
40.0									
42.0									
44.0									
46.0									
48.0									
50.0									
52.0									
54.0									

Remarks: 1 Strata change assumed.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 24 inches in four 6" increments. The sum of the middle two increments of penetration is termed the standard penetration resistance, N. RQD = Rock Quality Designation. WOH = Weight of Hammer. WOR = Weight of drilling Rods.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	23	13	35	22	7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
3/8"	88		
#4	77		
#10	64		
#20	47		
#40	29		
#60	18		
#80	13		
#200	7.2		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 7.8927 D_{60}= 1.6016 D_{50}= 0.9813
D_{30}= 0.4452 D_{15}= 0.2056 D_{10}= 0.1204
C_u= 13.30 C_c= 1.03

Classification

USCS= AASHTO=

Remarks

Sample Number: Lab# -
Source of Sample: B-1/S-1 **Depth:** 1' - 3' **Date:** 06/26/07

PROFESSIONAL SERVICE INDUSTRIES

Canton, Massachussetts

Client: McDonald's Restaurant
Project: McDonald's
Portland, ME
Project No: 446-70049

Figure