

City of Biddeford
Mayor's Downtown Task Force
June 22, 2018 8:00 AM Mayors Office

- 1. Adjustments to the Agenda**
- 2. New Business**
 - 2.1. Parking Garage: On-Call Parking Structure Administrative Review Services RFQ Results
 - [Walker Consultants - RFQ Response](#)
 - [Becker Structural Engineers - RFQ Response](#)
 - 2.2. Parking Garage: Review of 30% Concept Plan Package
 - [Garage - Basis of Design](#)
 - [Garage - Concept Plan Outline Specifications](#)
 - [Garage - Conceptual Isometric Rendering](#)
 - [Garage - Concept Plan Package Drawings](#)
 - [Garage - Geotechnical Review Report](#)
 - [Garage - Working Code Analysis - DRAFT](#)
- 3. Executive Session - *Executive Session: MRSA 405(6)(C) - Disposition of Property***
- 4. Unfinished Business**
- 5. Adjourn**



BUILDING ENVELOPE
CONSULTING
FORENSIC RESTORATION
PARKING DESIGN
PLANNING

PROPOSAL FOR ON-CALL PARKING STRUCTURE ADMINISTRATIVE REVIEW SERVICES

PREPARED FOR THE CITY OF BIDDEFORD, MAINE

June 8, 2018



WALKER
CONSULTANTS₂



June 8, 2018

James A. Bennett
City Manager
City of Biddeford
205 Main Street, Suite 107
PO Box 586
Biddeford, ME 04005

Re: Proposal for On-Call Parking Structure Administrative Review Services
Biddeford, ME

Dear James:

Walker Consultants is pleased to submit this proposal for On-Call Parking Structure Administrative Review Services to support the City of Biddeford throughout the planning, design, and possible construction of the City's first parking structure. There are a number of factors that differentiate Walker from other firms. First and foremost is our depth of experience. Walker is the largest parking consulting firm, and this has driven us to become unequalled experts in the field of parking. The firm's high percentage (90%) of repeat clients is a testimony to our ability to meet and exceed our client's expectations. Walker has the expertise and local knowledge to meet your objectives. For example:

[Similar Experience](#)

Walker has designed over 5,000 parking facilities. We understand the importance of delivering a facility that is efficient, cost effective, requires minimal maintenance, and is durable. The Boston office has worked directly with over 35 municipalities throughout New England.

[Expertise](#)

Walker can steer you through the process of planning, financing, designing, and operating a parking garage. We are parking experts, and we know more about it than anyone. We will help make the process enjoyable.

The following proposal demonstrates that we meet all criteria specified within the RFP.

We appreciate the opportunity to work on this project for the City of Biddeford. Please do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

WALKER CONSULTANTS

Brandon Schrenker, PE (MA)
Project Manager

Arthur G. Stadig, PE
Vice President

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01 INTRODUCTION & EXECUTION



INTRODUCTION & EXECUTION

OVERVIEW OF CONSULTANT'S SERVICES

Walker Consultants is pleased to submit this proposal to the City of Biddeford. Walker understands that the City of Biddeford is seeking a consulting firm to provide on-call parking administrative review services related to the City's first parking structure.

Walker understands that services may include, but are not limited to review of:

- Municipal parking structure design;
- Municipal parking structure materials of construction;
- Municipal parking structure construction methods;
- Municipal parking structure financing, financial modeling, and cash flow;
- Municipal parking structure project scheduling;
- Review of engineering calculations and assumptions;
- Review of architectural calculations and designs;
- Preparation of opinion documents;
- Interpretation of inspection reports and data;
- General on-call consultation services related to the municipal parking garage project.

Walker brings over 50 years of expertise and experience in the planning/design of new parking facilities, and we are capable of addressing all challenges and capturing all opportunities related to the Biddeford parking project.

CONTACT INFO

Walker Consultants
Arthur G. Stadig, PE
Vice President
20 Park Plaza, Suite 1202
Boston, MA 02116
617.350.5040
astadig@walkerconsultants.com

The submission of this signed "Statement of Qualifications" indicates acceptance by the consultant/firm/group of the stipulations contained in the Request for Qualifications and the terms and conditions mentioned herein.

Arthur G. Stadig, PE
Vice President

June 7, 2018



02 QUALIFICATIONS

COMPANY PROFILE

Established in 1965 as a structural engineering firm, Walker rapidly grew into a transportation, design and consulting firm, and by the 1980s led the industry as the most experienced parking consulting firm in the United States.




TODAY, WALKER CONSULTANTS IS A GLOBAL CONSULTING FIRM WITH 18 DOMESTIC OFFICES AND 1 INTERNATIONAL OFFICE. OUR STAFF OF OVER 300 HAS EXPERIENCE WORKING IN ALL 50 STATES.

We are proud of the impact our firm and our people have had on the transportation industry and specifically on the planning, design and restoration of parking facilities worldwide. Many of the design elements and planning approaches that are taken for granted today are innovations developed by Walker’s professional staff. We pioneered the concept of the **mega-parking structure** at theme parks, airports and international developments, furthered the use of and improved upon the concept of **shared parking** at mixed-use developments, and were instrumental in the development of design **standards for accessible parkers**. **Walker’s first car park design (circa 1967) utilized a speed ramp and flat floors - a concept in vogue today as a solution for adaptive re-use!**

In addition to our design expertise, Walker has been a leader in the consulting area as well, being one of the first firms to demonstrate how strategic parking planning can help cities and towns promote economic development and improve the quality of life for residents. Walker served as the consultant for the **first privatization of a municipal parking asset** and has assisted with dozens of public/private partnership projects.

Walker continues to provide a full spectrum of **forensic restoration solutions** to owners. Whether for a **parking structure, building, bridge, stadium, or other specialty structure**, our state-of-the-art technical expertise will provide innovative solutions for all your restoration needs.

Looking forward to the future, Walker is well positioned to address the challenges posed by the advent of **autonomous vehicles** and to aid our clients with planning consulting for **TNCs**, such as Uber and Lyft. Our professional staff is working on improving the sustainability of our designs by using materials and building techniques that will extend the useful life of a facility and reduce the impact on the environment. We are working within the industry to examine opportunities for **adaptive reuse** of existing and future parking facilities and from a consulting standpoint, have developed **a holistic planning** approach that integrates parking into the overall master mobility solution for communities, institutions and the private sector. Walker has been a premier transportation consultant for **more than 50 years** and we will continue to focus on developing solutions that are realistic, implementable and cost-effective by utilizing cutting edge technology and the creativity of our outstanding people.

-  18 DOMESTIC OFFICES
-  1 INTERNATIONAL OFFICE
-  3⁰⁰ STAFF
-  50 STATES
-  20 COUNTRIES

- BUILDING ENVELOPE
- CONSULTING
- FORENSIC RESTORATION
- PARKING DESIGN
- PLANNING



AT A GLANCE

01

FULL SERVICE, SINGLE FOCUS

A consulting firm **dedicated to service a broad spectrum of client needs** through a **collaborative effort in planning, design and restoration.**



03

EXPERIENCED STAFF, CREATIVE MINDS

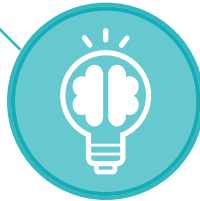
Our project teams pair industry experts with young talent to produce creative design solutions. The result? Staff at all levels who have learned from the very best in their fields, and collaborations that have led to over **100 awards for creative designs, including the first LEED certified stand-alone parking garage in the U.S.**



02

GLOBAL EXPERIENCE, LOCAL KNOWLEDGE

We've consulted on and designed projects the nationwide and around the world, **developing in-depth local knowledge of geographic markets, both domestic and international.** Our offices are within two hours of every major metropolitan area in the United States.



05

PRACTICAL EXPERIENCE, PROVEN SOLUTIONS

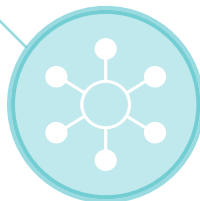
Our planning and operations consultants have completed hundreds of studies, conducting thousands of hours of research. We take special care to make technological and operational recommendations that are progressive, but also realistic and implementable. **Our focus is on solutions that can improve the patron's experience as well our client's operational efficiency and bottom line.**



04

QUALITY PROJECTS, LOYAL CUSTOMERS

We strive to continually deliver high quality projects for our clients and have consistently out-performed the industry with regards to change orders and construction re-work. The result has been a **repeat client rate of over 90% and a change order percentage 75% below the industry average.**





SERVICES

BUILDING ENVELOPE

- Building Science
- Design Peer Review
- Façade & Roofing Engineering
- Fenestration Consulting
- Façade Access Davit & Anchor Testing
- Building Envelope Testing
- Commissioning
- Construction Monitoring
- Waterproofing Design

CONSULTING

- TNC's & Autonomous Vehicle
- Car Park Management Systems
- Market & Financial Feasibility
- P3 Asset Monetization
- Due Diligence Studies
- Operational Audits, Plans & RFP's
- On-street Parking & Curb Management Plans

FORENSIC RESTORATION

- Investigations & Assessments
- Due Diligence Survey
- Asset Management Plans
- Repair Design and Construction Documents
- Expert Testimony
- Non-Destructive Evaluation
- Maintenance Programs
- Diagnostics & Testing
- Waterproofing Design
- Post-Tensioning Evaluation
- Structural Strengthening
- Disaster Recovery

PARKING DESIGN

- Parking Structures
- Design Peer Reviews
- Design-Build Project Delivery
- Functional Design
- Automated Vehicle Retrieval Systems
- Autonomous & Electric Vehicles
- Parking Management Systems
- Sustainability

PLANNING

- Airport Landside Plans
- Mobility Plans
- Parking Master Plans
- Shared Parking Plans
- Stakeholder Outreach
- Transportation Demand Management Plans





RELEVANT EXPERIENCE

NEW ENGLAND MUNICIPALITIES

WE'VE WORKED WITH:

- CITY OF AUBURN, ME
- STATE OF MAINE
- TOWN OF FREEPORT, ME
- CITY OF LEWISTON, ME
- CITY OF KEENE, NH
- CITY OF CAMBRIDGE, MA
- CITY OF BURLINGTON, VT
- CITY OF LOWELL, MA
- TOWN OF WESTERLY, RI
- TOWN OF BROOKLINE, MA
- TOWN OF HANOVER, NH
- CITY OF PORTSMOUTH, NH
- CITY OF DOVER, NH
- TOWN OF MANSFIELD, CT
- CITY OF NEW BRITAIN, CT
- CITY OF NORWALK, CT
- CITY OF NEWPORT, RI
- STATE OF CONNECTICUT
- CITY OF NEW HAVEN, CT
- TOWN OF WINDHAM, CT
- CITY OF HOLYOKE, MA
- CITY OF SOMERVILLE, MA
- CITY OF MEDFORD, MA
- CITY OF WESTFIELD, MA
- STATE OF VERMONT
- TOWN OF WINCHESTER, MA
- CITY OF SALEM, MA
- TOWN OF NATICK, MA
- TOWN OF WELLESLEY, MA
- CITY OF CLAREMONT, NH
- CITY OF NORTHAMPTON, MA

Walker has provided design, consulting, planning, and restoration services to hundreds of municipalities. A sample list of municipalities the Boston office has worked with can be found on the left. Below are relevant projects we are currently working on or that have been completed within the past 5 years:



Southern New Hampshire University: Walker was retained by the University to ensure proper design and follow-through for a proposed 1,650 space parking structure located on an existing lot and connecting via pedestrian bridge to an existing mill building. Walker was involved early in the conceptual design process to assist in functional design and definition of material requirements for the precast structure to ensure durability. Involvement continued throughout the design process, including reviewing and commenting in on all project document deliverables from design development to permitting to construction documents (example provided in Section 7). Walker worked with SNHU to define their requirements for the parking access and revenue control system and understand the operational considerations for the facility when it is complete.



City of Lowell, MA: Walker is currently designing a new 930-space, 7-level parking structure. The structure will provide parking for the planned mixed use development in the Hamilton Canal Innovation District and new Judicial Center. The project includes a parking office and retail shell space to activate the street side of the garage. The structure will have a green roof and green wall components, and extensive slurry walls to cut off water from the nearby historic canals on two sides. To reflect the idea of district as an innovation district, the structure will be clad in architectural aluminum screens and high density cement fiberboard panels.

RELEVANT EXPERIENCE

OTHER GOVERNMENT ENTITIES:

- MASSACHUSETTS BAY TRANSIT AUTHORITY
- MASSACHUSETTS PORT AUTHORITY
- MASSACHUSETTS CONVENTION CENTER AUTHORITY
- RHODE ISLAND CONVENTION CENTER AUTHORITY
- RHODE ISLAND DEPARTMENT OF TRANSPORTATION
- SPRINGFIELD PARKING AUTHORITY
- BOSTON PLANNING & DEVELOPMENT AGENCY
- COMMONWEALTH OF MASSACHUSETTS
- LAWRENCE DOWNTOWN PARKING ASSOCIATION
- HARTFORD PARKING AUTHORITY
- MASSACHUSETTS DEPT OF HOUSING
- CAPITAL DISTRICT TRANSPORTATION AUTHORITY
- ALBANY PARKING AUTHORITY
- PROVIDENCE REDEVELOPMENT AGENCY
- NORWALK REDEVELOPMENT AGENCY
- BROCKTON REDEVELOPMENT AUTHORITY
- THE STEAMSHIP AUTHORITY



City of Dover, NH: Functional/structural/architectural design and consulting for this 360-space parking structure with an attached two-story police department. The facility is Dover's first parking structure. It includes a separate level and access for police parking that connects directly to the newly designed police department. The project's intent was to consolidate the City's parking in one central location. Construction was completed in 2015.



Town of Windham, CT: 275 parking spaces on 4 levels, designed to alleviate parking issues and encourage future economic development in the town. Walker first provided a feasibility study, conceptual design, and cost estimating services to determine the Town's needs. The structure will accommodate police/public safety parking for adjacent police/fire station. Design complete, construction pending.



MBTA On-Call: Walker has been awarded a 3-year General Engineering Contract by the MBTA for its parking facilities. Task scopes include the following: Project cost estimating on a system wide asset program basis and per project basis; Project scheduling on system wide asset program and per project basis; Operation and financial auditing of private parking operators; Review of public/private parking development projects.



Garrahy Courthouse Parking Structure: Walker designed this 1,250-space parking structure to serve court judges, staff/employees and neighborhood businesses/residents/general public. Prior to commencing design on the parking facility, Walker assisted in evaluating the project, including a traffic study, an updated market study and a report recommending the optimal garage size and configuration. Walker provided a preliminary assessment of the revenue potential of the garage and the associated expenses.



03 QUALIFICATIONS OF STAFF

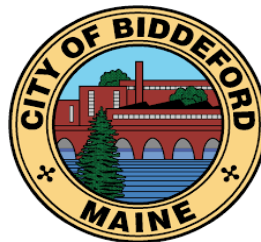


ORGANIZATIONAL CHART

The success of your project will depend upon a wide variety of factors. No factor is more important than the people that will work on the project. Walker is made up of 323 active personnel. In our Boston office, which will be the office of record, we are currently working on several projects. These projects are in various stages ranging from pre-design, construction documents and construction administration. This is handled by a staff of 7 full-time project managers, 5 structural engineers, 2 architects, 4 technicians and a dedicated clerical staff.

Because of the size of our group, we can respond to unforeseen and unfortunate events such as serious illness or accident that may remove key personnel from this project. If that occurs, we will be able to replace that team member with a person of equal or greater expertise, skills, and experience. This will minimize the downtime that would occur and allow your project and Walker to remain on schedule.

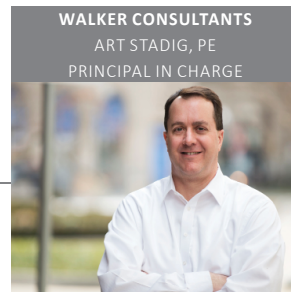
The team we have assembled for your project has been carefully selected to provide the specialized services that your project requires. Our team clearly understands your project needs and requirements. Detailed resumes for each team member are included in this section. Our project team will be organized as follows:



WALKER CONSULTANTS
BRANDON SCHRENKER, PE
PROJECT MANAGER

Brandon Schrenker, PE - Project Manager

Brandon Schrenker, PE will serve as Project Manager for the City of Biddeford's project. Brandon has been with Walker for 14 years and has worked on a variety of new design and consulting projects. Brandon is currently working with Massport, Southern New Hampshire University, and the Town of Natick. He recently served as Project Manager for a feasibility study, conceptual design, and cost estimating for a proposed parking structure for the Town of Windham, Connecticut.



WALKER CONSULTANTS
ART STADIG, PE
PRINCIPAL IN CHARGE

Art Stadig, PE - Principal In Charge

Art Stadig, PE, will serve as Principal in Charge for the City of Biddeford's parking structure review project. Art has over 35 years of parking design and consulting experience. He is currently working with Massport, Southern New Hampshire University, the Town of Brookline, and the Town of Natick. Art will be supported by a professional staff of 20 in Walker's Boston office.

ARTHUR G. STADIG, PE

Principal In Charge



EDUCATION

Bachelor of Science, Civil Engineering,
 University of Colorado, 1982

REGISTRATIONS

Licensed Professional Engineer in Colorado,
 Connecticut, Massachusetts, Maine,
 Michigan, New Hampshire, New York,
 Rhode Island, Vermont

AFFILIATIONS

American Society of Civil Engineers
 New England Parking Council
 Providence Foundation
 International Parking Institute
 Urban Land Institute
 Airports Council International-North
 America
 American Association of Airport Executives

Art Stadig is the Managing Principal for Walker Consultants' Boston office and has served as Project Manager on many of the jobs for Walker's Kalamazoo, Denver, Philadelphia, and Boston offices. Art joined Walker Consultants in 1985 after several years of experience with other design firms. As Managing Principal, responsibilities include project management, consulting, and marketing.

Art has vast experience in parking design, parking consulting and master planning. He has helped clients throughout the nation optimize their parking possibilities. He has provided parking design and study services for local developments, including the City of Dover, the City of Lowell, and the Town of Natick.

REPRESENTATIVE PROJECTS

City of Claremont

Claremont, NH
 Parking/structure type study for a two-level parking structure to accommodate approximately 100 vehicles to be located on an existing surface lot and part of a city owned parcel

Town of Brookline

Brookline, MA
 Various parking peer reviews for the Town

Delanson Circle Development

Wellesley, MA
 Parking peer review for a proposed residential development

South Boston Waterfront Transportation Center

Boston, MA
 Functional design, parking consulting, financial proforma studies, parking demand studies, PARCS design for a parking structure in the Seaport District

City of Dover Parking Structure

Dover, NH
 Functional/structural design and consulting for a new 360-space structure with an attached police department

Garrahy Courthouse Financial

Providence, RI
 Prime design of a 1,250-space parking structure in downtown Providence and a preliminary assessment of the revenue potential of the garage and associated expenses

City of Lowell

Hamilton Canal District Garage

Lowell, MA
 Prime design of a 900-space, 8-level parking facility

Town of Natick

Natick, MA
 Existing conditions analysis, feasibility assessment and general development recommendations, and conceptual site design study for a new parking structure in the Town's center

Town of Windham

Windham, CT
 Conceptual design, site analysis, and financial feasibility for a 275-space parking structure

Southern New Hampshire University

Manchester, NH
 Parking consulting services to ensure proper design and follow-through for a proposed 1,700 space facility located on an existing lot

BRANDON SCHRENKER, PE

Project Manager



EDUCATION

Bachelor of Science Degree in Civil Engineering, Northeastern University, 2004

REGISTRATIONS

Professional Engineer in the state of Massachusetts

AFFILIATIONS

American Society of Civil Engineers
 Urban Land Institute

Brandon Schrenker has fourteen years of experience in project management, structural design and restoration of parking structures.

As a Project Manager in Walker's Boston office, Brandon has been involved in a variety of projects, including providing structural design for a 1,400-space parking structure for athenahealth's headquarters in Watertown, Massachusetts, and parking consulting and planning services for the Town of Natick, Massachusetts.

Brandon's recent projects include consulting and design services for the new South Boston Waterfront Transportation Center; a 275-space parking structure for the Town of Windham, Connecticut; and parking consulting for the City of Claremont, NH.

REPRESENTATIVE PROJECTS

Town of Natick

Natick, MA
 Existing conditions analysis, feasibility assessment and general development recommendations, and conceptual site design study for a new parking structure in the Town's Center

City of Claremont

Claremont, NH
 Parking/structure type study for a two-level parking structure to accommodate approximately 100 vehicles to be located on an existing surface lot and part of a city owned parcel

Town of Windham

Windham, CT
 Conceptual design, site analysis, and financial feasibility for a 275-space parking structure

Southern New Hampshire University

Manchester, NH
 Parking consulting services to ensure proper design and follow-through for a proposed 1,700 space facility located on an existing lot

Arsenal on the Charles West Garage

Watertown, MA
 Design services for a 1,400-space, 7-level precast parking structure and pedestrian bridge

South Boston Waterfront Transportation Center

Boston, MA
 Functional design, parking consulting, financial proforma studies, parking demand studies, PARCS design for parking in the Seaport District

Medford Square

Medford, MA
 Master planning, shared parking analysis, functional design/consulting for a 200-space garage

Harvard University Projects

Cambridge, MA
 Various projects for the University including new design, consulting, parking equipment design, lighting, and study services

City of Holyoke

Suffolk Street Garage

Holyoke, MA
 Condition appraisal, base repair program documents, PARCS upgrade, construction administration

Tobey Building Garage

Concord, NH
 Conceptual design and functional design/consulting for a 2 level, 136-space structure

NOTICE OF INVESTIGATIONS OR DISCIPLINARY ACTIONS

In the last five years, Walker has performed work on the following projects that have resulted in claims and lawsuits:

PENDING MATTERS

[Presence Health/Fisher Injury](#)

In 2006, Walker was the lead architect/engineer to Pepper Construction Company for the design/build delivery of a four level, 700 space parking structure at Provena Medical Center in Joliet, IL. On February 25, 2012, Virgil Fisher allegedly slipped on ice and fell in the parking structure. Virgil and Teresa Fisher sued Presence Health Network, Pepper Construction Co., HDR, Walker and others. Discovery is ongoing.

[West Hollywood Library Parking Structure](#)

Walker was the parking consultant and production architect for the parking structure that is adjacent to a new library building in West Hollywood, CA. After completion of the project in 2011, the City presented to the prime architect a list of alleged project errors on the library building and parking structure that added costs to the project. The City filed suit against the Architect which in turn filed a cross complaint against Walker. Discovery is ongoing.

[Columbia Short Street Parking Structure](#)

Walker was the prime consultant to the City of Columbia, Missouri for the design of a 420-space parking structure. After construction was completed in November 2013, the contractor, Killian Construction, submitted a change order request to the City for delays and additional labor associated with concrete failures. Killian later filed a lawsuit naming the City, Walker and Central Concrete as defendants. Discovery is ongoing.

SETTLED MATTERS

[Memphis International Airport Consolidated Ground Transportation Center](#)

Walker was the prime consultant for design of the Consolidated Ground Transportation Center at Memphis International Airport. The Airport presented a list of Contractor change orders that it believed were caused by the design team's errors and omissions. The claim was settled through mediation.

[200 E. Delaware, Chicago, Illinois](#)

Walker was retained by the 200 E. Delaware Condo Association to investigate the deterioration and recommend repairs to the exterior brick stairs that lead to the lower level of the building. The stairs were removed and replaced with cast-in-place concrete. Rosemary Garcia alleges that she was injured on July 14, 2011 as a result of a fall on the stairs. The claim was settled through mediation.



04 FAMILIARITY/HISTORY
WITHIN REGION

FAMILIARITY/HISTORY WITHIN REGION

OTHER MAINE CLIENTS:

DESIGN:

UNUM INSURANCE COMPANY
 AUBURN MECHANICS ROW MUNICIPAL GARAGE
 UNIVERSITY OF SOUTHERN MAINE

CONSULTING:

PORTLAND INTERNATIONAL JETPORT
 BOWDOIN COLLEGE
 YORK HOSPITAL
 HALLOWELL HOUSE
 MID COAST HOSPITAL
 EASTERN MAINE MEDICAL CENTER
 MAINE MARITIME ACADEMY
 MAINE GENERAL MEDICAL CENTER
 STONE BUILDING
 COLBY COLLEGE

PLANNING:

ST. MARY'S MEDICAL CENTER
 INLAND HOSPITAL
 CITY OF LEWISTON

OPERATIONS:

UNIVERSITY OF SOUTHERN MAINE
 BOWDOIN COLLEGE
 MID COAST HOSPITAL

RESTORATION:

AUGUSTA STATE GARAGE
 MECHANICS ROW MUNICIPAL GARAGE
 UNIVERSITY OF SOUTHERN MAINE
 CENTRAL MAINE MEDICAL CENTER

Our local expertise and experience will bring added value to the City of Biddeford. Walker's Boston office has completed over 75 new design parking structures, 230 restoration and 300 consulting projects in the New England region. Among these, we have completed dozens of projects in the state of Maine. We have worked with several local government entities. Walker provided design services for the Auburn Municipal Garage and the Portsmouth Naval Shipyard in Kittery, and restoration services for the state office building garage in Augusta.

Within the **past five years**, Walker has completed work for the following **government entities** in Maine:

City of Lewiston

Walker is currently providing planning services to assist the City with parking issues.

State of Maine

Walker has worked with the State on several occasions to provide restoration services for the Augusta Office Building Garage.

Within the past 5 years Walker has also completed work for several government entities in the neighboring State of New Hampshire:

City of Dover

Walker provided functional/structural/architectural design and consulting for this 360-space parking structure with an attached two-story police department. This was the City's first parking structure.

City of Portsmouth

Walker has provided the City with restoration, study, consulting, and new design services for several years.



05 REFERENCES



REFERENCES

We urge you to contact the references below as a testament to our commitment to excellence:

CITY OF LOWELL

- Client since 1999 (19 years)
- Services: Restoration of 5 of the City's parking structures (Ayotte, Downes, Early, Leo A. Roy, and Lower Locks), and currently designing the City's newest structure in the Hamilton Canal District
- **Nick Navin, Parking Director**
978.674.4014
nnavin@lowellma.gov

TOWN OF NATICK

- Client since August 2017 (10 months)
- Services: Walker recently performed a conditions analysis, feasibility assessment, and conceptual site design study for a new parking structure in the Town's center
- **Ted Fields, Senior Planner**
508.647.6450
tfields@natickma.org

RHODE ISLAND CONVENTION CENTER AUTHORITY

- Client since 2006 (12 years)
- Services: Walker has performed numerous parking planning and financial studies for the Authority. Walker is currently designing the Garrahy Courthouse parking structure to serve downtown Providence
- **Jim McCarvill, Executive Director**
401.351.4295
Jim.Mccarvill@riccauth.com



06 TECHNICAL APPROACH

TECHNICAL APPROACH

TECHNICAL APPROACH

Walker's technical approach is based on our 50+ years of experience providing parking design and consulting services. Our experience includes working directly for municipalities providing services ranging from parking supply and demand studies, financial modeling / pro forma, conceptual design through construction documents, construction, operations, and eventual restoration. We understand there are common characteristics that drive parking facility studies and designs for municipal clients, as well as unique aspects of each municipality that distinguish it from others.

Project experience has shown that two primary drivers in municipal parking design in the northeast are cost-effectiveness and long-term maintenance. We therefore review designs, whether developed by Walker or by other consultants, both from an initial capital cost and durability perspective.

When reviewing from the initial capital cost perspective, a key component of the approach is to review the design concepts / elements and determine whether there are more cost-effective methods of achieving the design intent. For example, if an aesthetic desire is to have a brick façade on a parking structure, the use of thin-brick cast integrally into a concrete structure, as opposed to hand-laid wall assembly which is more labor intensive and costly. Other approaches include reviewing a variety of efficiency measures of a design. For example, the square foot area of structure per parking space or the number of structural elements per parking space, which are all directly related to cost, and identifying ways to improve upon those efficiencies.

When reviewing from the durability perspective, a key part of the approach is reviewing the construction materials and waterproofing / protection systems specified for the various elements of the facility. Walker's experience in restoration / rehabilitation consulting has yielded an understanding of which materials /systems perform well in the various climates and which don't. This starts with the structural system selection and the region in which the project is located; confirming that the durability measures selected are appropriate for both. Walker has developed and maintained company-wide specifications with regionalized content to ensure our designs meet the durability requirements throughout the country. When reviewing work by others, we utilize these specifications as a guide to ensure the proper materials are specified and to make suggestions to the team when they're not appropriately addressed. Further, the Boston office's local presence has contributed to this knowledge base, as well as an understanding of which materials are most appropriate for this region.

Walker's experience extends beyond design into construction administration and operational consulting. There are a variety of applications of these services, whether reviewing construction manager's schedules to ensure reasonable time frames for specific

TECHNICAL APPROACH

activities, confirming weather dependent operations are scheduled accordingly or cold / hot weather provisions are included, or similar based on experience with construction of these structure types in the northeast. Operationally, Walker includes consultants with backgrounds in the parking operations industry, providing our clients with the necessary information when financially planning for the service life of the facility. This experience is directly applied to our review work to ensure program of operational expenses, routine scheduled maintenance, long-term repairs, and similar scope is sufficiently addressed and accounted for in financial planning.

Quality Assurance / Quality Control

Walker's internal QA/QC process includes peer review of projects at various stages of design depending on the scope, whether new design, restoration, financial, or study services. It therefore becomes an easy transition to review external consultant's progress work and deliverables to address specific issues depending on the scope of the review. An example of this is provided in Section 7 of this proposal identified as "Sample Document A - Parking Facility Document Review Comments". Walker was hired as a representative for the Owner to review the project to ensure the construction documents were being developed in the best interest of the Owner with regards to engineering systems, materials, durability, and general construction approaches. This also afforded the overall team an additional review to ensure the documents were complete and coordinated.

An important measure in Walker's QAQC process and continual improvement process involves tracking Walker-caused change orders. The intent of this is to identify areas in construction documents that are more vulnerable to changes during construction. In the past, we found that a primary vulnerability identified was coordination between scope disciplines. This identified the need to confirm that deliverables are sufficiently reviewed from the perspective of discipline coordination to identify these conditions before construction occurs. For municipal projects, a key approach is to ensure this document coordination and to verify that scope is appropriately covered to prevent change orders. This internal tracking / improvement process has yielded a Walker-caused change order value of 0.077% of project construction costs in new design work (approximately \$7B construction cost performed) and 0.064% of project construction costs in restoration work (approximately \$415M construction cost performed).

Other attributes of Walker's QAQC program include processes to facilitate continuous improvement / LEAN practices such as our CIM process (Continuous Improvement Memorandum) and LQIT group (Local Quality Improvement Team), as well as targeted task forces when necessary. The CIM and LQIT provide a vehicle to obtain answers to questions, to make recommendations to improve tools and processes, and share good ideas and best practices for all disciplines and departments within Walker. This has led directly to improvements in our standards, drawings, specifications, and project approaches.



TECHNICAL APPROACH

Technical Capabilities / Meeting Deadlines

As a design and consulting firm, Walker is experienced with industry standard technologies and software platforms to service our client's needs. From a design perspective, Walker utilizes Building Information Modeling (BIM) technology to model structures and generate construction documents, as well as having various design software platforms for structural engineering and architectural design. During construction, Walker staff routinely uses construction management software platforms such as Procore and Newforma for file management and project tracking. Walker has gained experience in emerging technologies and how they can be applied in special situations, such as drone investigations and photogrammetry documentation.

An important technology Walker has developed and maintained for years is an internal web-based intranet called Parknet. This is a platform that all staff have access to that houses Walker's specifications, standard drawings and details, design guides, checklists, financial spreadsheets, product reviews, example projects, company standards, all previous project archives from all offices, and other similar content. This technology is a knowledge-sharing tool that is routinely updated to keep all employees up-to-date on trends in the company and market and to provide easy access to the tools necessary to consult in a variety of different services.

For workload planning purposes, Walker's Boston office utilizes an internally developed workload tracking spreadsheet based on LEAN practices. The spreadsheet considers all active and upcoming projects and is used to plan workload on a daily basis for two weeks outlook and on a monthly basis for a four months outlook. Project managers and production staff fill this spreadsheet out in real-time and meet weekly to review workload projection. This ensures that project timelines are tracked, deadlines are recognized by all production staff, and that workload needs are identified in order to deliver our project according to the deadlines.

In cases where the workload projections identify high production demands in the office in the near or long-term, Walker has established a group of directors in each office that routinely communicate labor supply and demand needs between offices. This enables Walker to best utilize the approximately 300 employees in various regions of the country / internationally to meet our client's needs, as well as use the right employee for that specific need.



07 SAMPLE DOCUMENTS



Sample Document A - Parking Facility Document Review Comments

16-2828.00
20 Park Plaza, Suite 1202
Boston, MA 02116

617.350.5040
walkerconsultants.com

DATE: May 18, 2018
 TO: [REDACTED]
 COMPANY: [REDACTED]
 ADDRESS: [REDACTED]
 CITY/STATE: [REDACTED]
 COPY TO: [REDACTED]

 FROM: Brandon Schrenker, PE
 PROJECT NAME: [REDACTED]
 PROJECT NUMBER: [REDACTED]

ISSUED FOR CONSTRUCTION REVIEW COMMENTS – WALKER COMMENTS
MAY 15, 2018

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
1.		Per BF email, it is understood that future submissions will be provided for the metal panel façade, PARCS, PV, stormtech revisions, and signage. These packages shall be submitted for review when issued.	None required.	WC 2018-05-18
2.	Geotech Report	Page 12, notes that additional testing is necessary during construction to verify the soil subgrade is suitable for support of the asphalt slab-on-grade. Confirm this testing is in the project scope. Similar requirements on pages 30-31.		
3.	Geotech Report	There was an issue previous discussed and resolved by the design team regarding seismic ties for the piles (IBC 1810.3.13). Solution involved using backfill to tie caps. The requirements for this backfill should be documented		

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
		in the geotechnical report for record. Confirm the site contractor is aware of the backfill requirements if different than before.		
4.	Specs	Previous spec comments 12, 13, and 19 from the 55% CD review did not appear to be addressed.		
5.	000010	003100 – Phase 1 ESA also provided in available project info; consider adding to TOC.	None required.	WC 2018-05-18
6.	000010 / 055000	055000 Metal Fabrications included twice; specs have some overlapping scope. Consider consolidating or removing one.	None required.	WC 2018-05-18
7.	014533	Special Inspections section appears to be included twice in the spec set; the second version includes an “R2” in the footnotes. If versions are different, suggest removing the superseded version.	None required.	WC 2018-05-18
8.	014533	Special Inspections CASE form - identifies SDC as D, should be C (D would kick-in more stringent requirements). Identifies wind speed as 95 MPH, should be 115.		
9.	014533	Special Inspections CASE form – confirm whether there should be special inspections for welding structural steel.		
10.	014533	Seismic Design Category C requires certification for non-structural components; see IBC 1708.1.3, IBC 1708.4, and ASCE 7 – 13.2.1. The electrical and mechanical specs reference SDC C so this should be covered for those systems. Verify that architectural systems such as the screen façade are designed / detailed appropriately. These requirements may not govern over wind loads but it should be verified that the performance design system contractors are checking these requirements.		
11.	034100	Warranty section not included. Confirm 1 yr warranty is provided.		
12.	034100-2.18-F, 3.5	Suggest discussing the on-site review process with project representatives so pieces that do not meet the	None required	WC 2018-05-18

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
		project requirements are not erected, expectations for what is acceptable to be repaired are established, and similar.		
13.	042200	Footer has information for spec 055000	None required.	WC 2018-05-18
14.	055000(R2)	Grabb-It system is specified; no exception is taken to this system. Suggest review / coordination of stressing operations to prevent overloading the connections when seating wedges. Stressing forces required to seat wedges are typically significantly higher than design forces for these systems depending on how system is detailed. If wedged are not seated properly, strands can detension / not perform as designed.		
15.	055000(R2)-1.5-E	Recommend that barrier strand installers are required to be PTI certified.		
16.	055000(R2)-1.6	Recommend a testing agency confirms / records stressing records, specifically reporting the actual field elongations for each strand vs the calculated elongation and the actual gage pressures in each strand (if appropriate depending on stressing method).		
17.	055000(R2)-2.9-B	Notes the design load shall be applied at 1'-6" AFF. IBC 1607.7.3 also requires application of load at 2'-3" AFF. Update requirements accordingly. Also note that IBC 406.2.3 requires the vehicular barrier extend up to 2'-9" AFF. Verify system is designed accordingly.		
18.	055000(R2)-2.9-D	Confirm barrier strand type. 1/2" 1x19 is specified; 1/2" seven wire strand 270ksi is more common for vehicular barrier design. See PTI "Design of Prestressed Barrier Cable Systems" for additional information. If revised, recommend providing a reference for work to comply with to PTI "Specifications for Seven Wire Strand Barrier Cable Applications".		

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
19.	055000(R2)	Recommend specifying that cables are prestress sufficiently to take out cable sag. Typically 3K depending on spacing of supports.		
20.	071800	Products identify fiberglass mesh reinforcing strip. Recommended that this is provided above precast joints to reinforce.		
21.	071900-1.1-A	Confirm intent is to apply sealer to vertical and horizontal concrete surfaces as stated in spec; typically only horizontal surfaces.		
22.	071900-2.2-A-2	Note says “apply coating of water repellents on surfaces from ground up to top of punched opening on Level 1.” Clarify intent of comment; seems to indicate only Level 1 would receive coating, which is an asphalt surface.		
23.	074213.13, 074213.16	Spec assumed to be for the Zahner products. System is a performance design including backup framing / connection to precast. Should include requirements that the shop drawings are prepared and signed / sealed by a registered engineer in the state of NH. Should also require design calculations are submitted for review by the EoR.		
24.	074213	Recommend requiring some form of special inspections or similar requirements to elements / connections are installed correctly. Have seen cases on screen installations where bolts were missed, etc. so would benefit from a QAQC process to verify installation.		
25.	074213.16	Spec refers to Section 018113 which is not included in the documents. Confirm whether this spec is required.	None required.	WC 2018-05-18
26.	077129-1.6	Typically recommend a 5-year warranty on expansion joints.		
27.	077129-2.2-A-2 3/A-500 2/A-501	Joint Movement – did not see joint size and range requirements defined on drawings. This is particularly important for the expansion joint between the Langer building and the parking structure to prevent racking of		

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
	13&16/A-812	the buildings during normal thermal cycles and during a seismic event. Anticipated movements for both structures will need to confirmed to determine the size of the expansion joint for this location.		
28.	078413	First page calls section out as 077100 – Roof Specialties	None required.	WC 2018-05-18
29.	079200-1.1-A-1	Joint-Sealant Schedule not provided in Part 3.		
30.	079200-1.7	Confirm whether 10 yr warranty can be provided. No exception to a 10 yr warranty if that was already bought, but more typically see 5 yr for traffic bearing sealant applications. Possibly specify different warranty depending on joint type.		
31.	079200-1.7	Warranty type should be Joint and Several, identifying the responsibilities of the manufacturer and installer. This will ensure the repairs are made regardless of whether it is a material or installation problem.		
32.	079200	Recommend defining a set quantity of sealant that can be cut out by the Architect to review sealant depth / condition. In the event there are leaking problems during construction, this allows the Architect to randomly check areas to see that the installation is in accordance with the specs / manufacturer requirements.		
33.	079200-2.3-G	Sonneborn NP 2 is now BASF MasterSeal NP 2. – Note this product can take longer to cure; if timing is an issue may not want to spec. Tremco Vulkem 227 is not available. Suggest Tremco Dymeric 240 or Dymonic 100.		
34.	079200-2.3-G, H	No exception is taken to using the non-sags for horizontal applications; often get better results in some instances with having to tool the sealant. However, most installers in the northeast are accustom to self-leveling for horizontal applications. Team should consider what will be allowed. Can discuss in more detail.		

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
35.	079200-2.3-H	Walker typically does not use single component urethane sealants. They tend to have more limitation regarding joint size, temperature, and similar attributes. Recommend limiting to 2-component sealants.		
36.	079200	Confirm scope includes sealing all floor penetrations.		
37.	079513.19	There is no warranty section in spec. Spec should require a 5 yr Joint and Several warranty.		
38.	079513.19-2.3-A-4	States expansion joint shall have a fire-resistance rating not less than the adjacent construction; this would require a 2-hr rated joint. Joints in garages are typically exempt from fire rating expect when provide a separating, opposed to an element rating (IBC 714.1).		
39.	079513.19	Drawings show an Emseal Colorseal type joint for some vertical applications. Consider including in this spec to define allowable types and procedural requirements. Spec references 079200 for preformed foam joints but 079200 does not appear to include this joint type.		
40.	079513.19	Recommend adding field quality control involving the manufacturer's technical representative for periodic inspection, particularly during block out inspection, surface defect repair, and gland installation. This plays into the Joint and Several warranty and helps prevent the manufacturer from claiming all defects are the result of installation methods.		
41.	111200	Bids have been received and low bidder (HUB) selected for the PARCS system. It is assumed the bidder does not have this specification. Recommend providing this to HUB to confirm whether there are any requirements that they are currently not including in their price. Spec should be redacted to remove references to AVI, LPR, etc.		
42.	111200	Per BF email, section will be updated based on recent [REDACTED] decision to choose the Option 2 from Walker's	None required.	WC 2018-05-18

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
		previous PARCS memo (system with access control and revenue).		
43.	111200-2.5-A-3,5	[REDACTED] may choose to open gates during peak times to alleviate queuing. System should be capable deactivating / reactivating the anti-pass back technology.		
44.	142123.16-2.3-B-6-c	Drawings indicate side opening elevators; spec indicates center opening. Assumed that drawings are correct, update spec if necessary.	None required.	WC 2018-05-18
45.	231400-1.3-B-2 260700-1.5-B-1	Occupancy category listed as III; S001 identifies as II.		
46.	321723	Include requirement to coordinate between sealer manufacturer and paint manufacturer to confirm compatibility of the products in writing and which should be applied first. If products are not compatible line striping will wear prematurely.		
47.	Stair Roofs	It is assumed [REDACTED] will clean the glazed CWs with a rope descent system / boatswain chairs. Roof anchors / davits need to be provided to satisfy OSHA 1910 tie-back requirements. Provide roof anchors such as Probel Safety Tie Back Anchor or similar.		
48.	G-004 - G-006	Exit sign locations depicted on the Life Safety Plans are not coordinated with the exit sign locations depicted on the electrical lighting plans. Coordinate.		
49.	A-201-A-204	General notes identify striping paint color to be white. Precast concrete in the region is very light; most of our clients that no longer want to use white because the stripes don't contrast / stand out well; some clients have gone to black striping. Suggest yellow. Could consider a small mockup of different colors to determine which [REDACTED] prefers. Recommend yellow directional arrows in either case.		

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
50.	A-201 - A-204	Recommend providing dimension lines to the start of striping runs from the face of a column or wall so line striper can layout stripes correctly per the design.	None required.	WC 2018-05-18
51.	1/A-300 & 2/A-407	Snow gate identified, no details provided. Is this designed / detailed by the precast contractor?		
52.	2&3/A-301	Considering how to dimension vertical mullions of bridge.	None required.	WC 2018-05-18
53.	1/A-407 & 1/A-411	The HUB PARCS system includes "Open / Full" illuminated signage at each entrance for each lane. Consider adding where these will be located on the façade / how it integrates with the signage here.	None required.	WC 2018-05-18
54.	1/A-409	Reference base condition at expansion joint. Coordinate vertical joint requirements between CIP walls and PC walls with precaster. Precaster will typically want a 2" vertical joint between CIP walls and PC walls where steps in the CIP walls occur.	None required.	WC 2018-05-18
55.	A-500	South and east walls of the elevator core are identified as CIP. Confirm if CIP or PC.	None required.	WC 2018-05-18
56.	3/A-501	See IBC 3104.5. This section of code provides design requirements for pedestrian connections between buildings. Exceptions for these requirements are provided, of which the same lot exception referencing IBC 503.1.2 appears to apply to this application (confirm that was the design intent). However, more recent editions of the IBC have clarified in code and commentary that the intent of this exception is only to apply if the two buildings on the same lot are considered one building, not separate buildings as is the case for this project. If separate buildings, one of the other compliance methods needs to be satisfied. Architect of Record to review and determine appropriate path. In meeting the intent of the code and not providing sprinklers on the bridge, the openings within 10' of the		

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
		walkway on the Langer Building would require a ¾ hour fire protection rating. It is assumed this would require replacing the surrounding window infills with a fire-rated glazing. Review and confirm.		
57.	4/A-506	Confirm reference to blindsided waterproofing. Would assume could be standards cold applied peel & stick.	None required.	WC 2018-05-18
58.	A-800	Door schedule <ol style="list-style-type: none"> 1. Door 101 – Detail 4/A-506 includes fire caulking, assuming that room therefore requires a fire rating. If so, determine appropriate label for door. 2. Doors 104 – 106 – Confirm whether rooms are required to be fire rated. Typically see ratings at electric room and elevator closets. 		
59.	17/A-811	Confirm whether steel requires fire rating (IB construction)		
60.	6/A-812	Detail calls out for a 2'-8" vehicle barrier height. IBC 406.2.4 requires 2'-9" min.		
61.	14/A-812	Assuming joint is 4" and could open more depending on deck movements, the vertical face of the column (lower part of detail) will need something to prevent 4" sphere issues. Typically upturn the expansion joint 6" then provide an aluminum plate covering the gap up to 42", bolted to one column.		
62.	S	Reviewer understands from previous emails that there will be some modifications to the pile cap depths and top reinforcement that will be issued in a future submission.	None required.	WC 2018-05-18
63.	3/S102	Confirm whether the tube steel beam connected to the precast supports the curtainwall above. Would appear the CW bears on the tube, in which case the design dead load for that connection seems light. Could be the DL of CW is picked up on level above; if that is the case is		

	DRAWING / SPEC	REVIEW COMMENT	COMMENT RESPONSE	DATE CLOSED
		should be clear that the CW is not to be built off of the steel tube to not overload connections.		
64.	4&5/S102	Somewhat confusing that "Roof Plan" includes some framing for other levels. No exception taken if coordinated with Harvey so the design intent is understood / scope adequately covered and coordinated.	None required.	WC 2018-05-18
65.	2/S200	Does not appear that detail for double angle connections for bracing top of CMU walls has been provided (previous comment on A drawings).		
66.	6/S206	Barriers on A drawings show more than 4 strands. Coordinate.		
67.	4, 5 / E-400 & 1, 2 / E-401	Tee stems contain prestressing tendons that cannot be damaged, typically with clear cover in the range of ¾" to 1". Confirm limitations with precaster and limit the attachments to screws that will not damage strands.		
68.	Civil Sheet 5 of 14	There is a low spot of 152.65' near F.5/3 that does not have a drain (comment from previous review). Provide drain or re-grade to prevent low spot from occurring.		
69.		There are two previous comments that require input from [REDACTED] to resolve; one related to storage space / rooms on Level 1 and the other related to cold water washdown hose bib locations. Walker has reached out to [REDACTED] for input on these to determine direction.		



BUILDING ENVELOPE
CONSULTING
FORENSIC RESTORATION
PARKING DESIGN
PLANNING



WALKER
CONSULTANT^C₃₇

June 8, 2018

City of Biddeford
Attn: James A. Bennett, City Manager
205 Main Street, Suite 107
Biddeford, ME 04005

RFQ: ON-CALL PARKING STRUCTURE ADMINISTRATIVE REVIEW SERVICES

Dear Mr. Bennett,

Thank you for this opportunity to provide our qualification package in response to the City of Biddeford's request for On-Call Parking Structure Administrative Review Services. We are pleased to present a team of local consultants with national experience to help the City through the design process. Collectively, the team provides many years of experience in the design, maintenance, restoration and management of parking structures. In addition, we share a vast knowledge of working with multiple Maine Municipalities to complete a broad range of successful projects throughout the course of our respective companies' history.

We understand the potential scope of this project is to provide the City with on-call services related to the design and construction of their first parking structure. The proposed on-call services are related but not limited to:

- Municipal Parking Structure Design
 - Building
 - Infrastructure
- Municipal Parking Structure material of construction
- Municipal parking structure construction methods
- Municipal parking structure financing, financing modeling, and cash flow
- Municipal parking structure project scheduling
- Review of Engineering calculations and assumptions
- Review of Architectural calculations and assumptions
- Preparation of opinion documents
- Interpretation of inspection reports and data
- General on-call consultation services related to the municipal parking garage project

Our team will include **Woodard & Curran** (W&C) to assist with the infrastructure questions and **SP+** to assist with the financial aspect of parking and managing your structured and on-street parking. **Becker Structural Engineers, Inc** (BSE) will lead the team and provide assistances and review of the proposed construction, material selection, schedule and garage design.

The submission of this signed "Statement of Qualifications" indicates acceptance by Becker Structural Engineers, Inc., of the stipulations contained in the Request for Qualifications and the terms and conditions mentioned herein.

As requested we have attached references, resumes, our rate schedule (in separate envelope) and sample documents for your review. We look forward to sharing our experience with the City of Biddeford.

Sincerely,

BECKER STRUCTURAL ENGINEERS, Inc.



Todd M. Neal, P.E.
Vice President

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SECTION 2

Qualifications

The team we have assembled to support the City have built a partnership through one of the largest parking garage design projects to occur in Maine in the last decade. Currently, the team of BSE, W&C and SP+, are **working together on the design of a 2,500-car parking garage for Maine Medical Center**. BSE is the lead design professional for the structure, W&C is the lead on the site/civil design and SP+ is MMC's parking garage management service. Having recently completed schematic design and working towards a Site Plan submittal, information regarding structural systems options, current construction cost and schedule limitations are fresh in our minds. We offer introductions to our respective companies through this response submittal and will expand upon our services when presented the opportunity through the interview process.



BECKER was founded in 1995. We have built a successful practice by providing practical, cost-effective and innovative solutions on a wide range of challenging projects in three practice areas: buildings, parking structures and bridges. We serve a diverse clientele including architects, contractors, developers, industry and government entities. Our substantial experience with contemporary building design is complemented by an extensive background renovating and restoring historic structures.

We have grown steadily since our inception and are currently a staff of 26, which includes 16 professional engineers, 2 engineering interns, 6 drafters/detailers and 2 administration team members. This staff size makes us the largest structural engineering firm in Northern New England. Our staff allows us to deliver high quality service on multiple projects simultaneously.

Our garage design experience includes the design of new structures, feasibility studies, and a significant amount of garage restoration throughout the northeast. Our experience with garage projects have led to long term relationships with our clients, including the Cities of Portland, Bangor, Westbrook and Auburn, that span decades. In the case of Portland and Westbrook this relationship includes the design of new parking structures, maintenance planning, life-cycle cost analysis and maintenance projects. Our extensive restoration experience influences our new design and informs our decisions on materials, construction methods and our ability to help our clients manage and plan for the costs of maintain a new parking structure.

Our most relevant experience to this project is the Peer reviews we provide for the City of Portland for their most recent terminal expansion and the first phase of the parking structure. Our work on the first phase of the parking structure lead to BSE as engineer of record for the second phase of the parking structure design.



Woodard & Curran is an integrated engineering, science, and operations company. Privately held and steadily growing, we serve public and private clients locally and nationwide.

Talented people are at the heart of our firm. Our company was founded in 1979 on a simple business concept: provide an enjoyable place to work with opportunity, integrity, and commitment, and we will attract talented people. It happened. At the heart of our company are people who are experts in their fields and passionate about what they do, showing a level of

commitment and integrity that drive results for our clients. You experience this power every day in our actions, our solutions, and our promises kept.

Our commitment is reflected in the personal attention, collaborative resources, and dedication to results that we devote to each project. We assign the right people with the right expertise to the job, and provide clients with easy accessibility to senior experts.

Our work is characterized by responsiveness, resourcefulness, and willingness to do what it takes to get the job done properly. Examples range from helping communities garner state and federal funding for wastewater treatment system improvement to managing a multi-vendor manufacturing project through a major snowstorm and getting production lines up and running. We are experts at navigating the complexities of environmental regulations and have been involved in transforming many brownfields sites into marketable properties. In defining moments like these, it is commitment that brings our clients results.

Our integrity impacts our decision-making at all junctures of our work — from the openness of our communication to the fairness of our prices to placing your interests above our pocketbook. We hire people who share our values of honesty, respect, and fairness and who want to do the right thing. They, in turn, treat everyone — our people, our clients, regulators, and stakeholders — respectfully and honestly.

Our integrity and commitment are matched only by the depth of our expertise. Our staff are specialists in their fields, offering in-depth understanding of cutting-edge technology, astute problem-solving, multidisciplinary engineering, and expert regulatory guidance. The firm has received numerous honors and awards, and we have ranked among Engineering News-Record's top 100 environmental firms every year since 2000.

We have been serving cities, towns, and state governments for over 38 years. Today, we offer services beginning with studies, concept, and design on through construction and operations to address our clients' solid waste, wastewater, water, stormwater, and civil engineering needs.

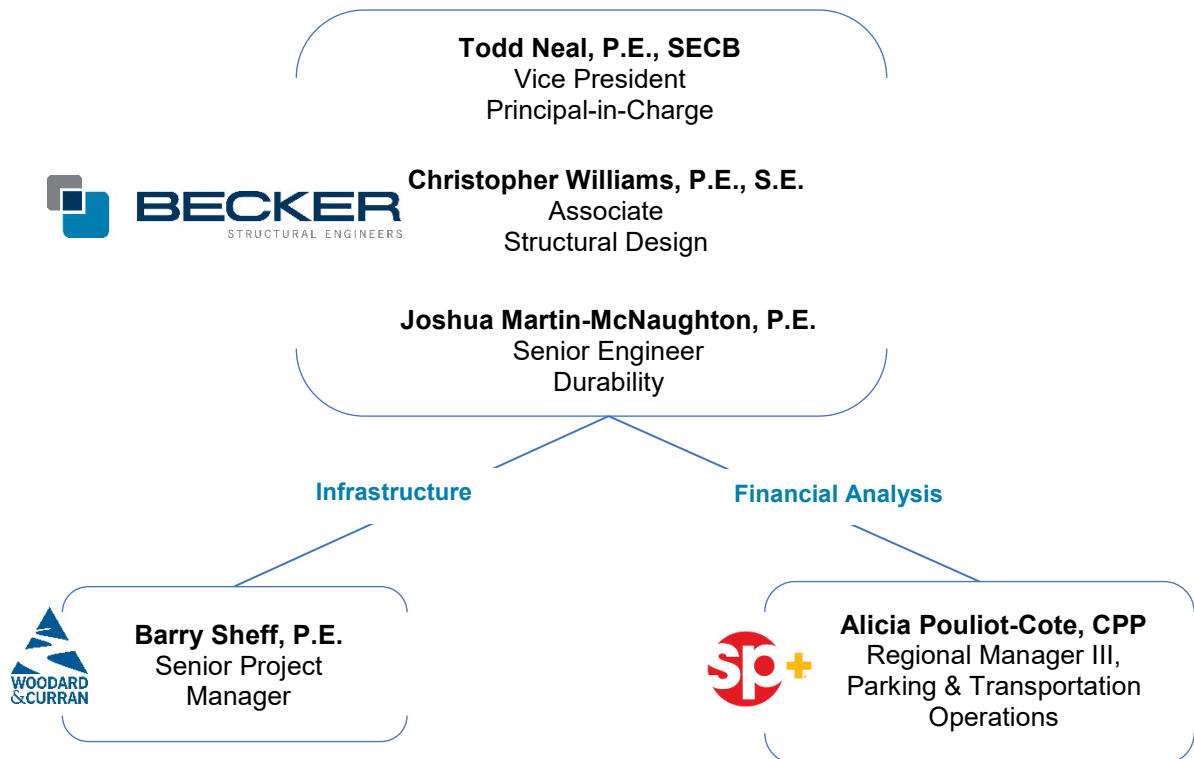


SP+ is the leading provider of professional parking management services throughout North America. We specialize in maximizing parking profitability for our clients while at the same time making the parking experience a first-class, enjoyable one for parking customers.

SECTION 3

Qualifications of Staff

The City's direct contact for this project will be Todd Neal of BSE, who will bring in the appropriate BSE staff or consultants required to address the tasks requested as they arise. The following is an organizational chart and list of potential scope associated with each team member.



Project Work Engagements

- Municipal Parking Structure Design
 - Building: **Becker Structural Engineers**
 - Infrastructure **Woodard & Curran**
- Municipal Parking Structure material of construction **Becker Structural Engineers**
- Municipal parking structure construction methods **Becker Structural Engineers**
- Municipal parking structure financing, financing modeling, and cash flow **SP+**
- Municipal parking structure project scheduling **Becker Structural Engineers**
- Review of Engineering calculations and assumptions **Becker Structural Engineers
Woodard & Curran**
- Review of Architectural calculations and assumptions **Becker Structural Engineers**
- Preparation of opinion documents **Becker Structural Engineers
Woodard & Curran
SP+**
- Interpretation of inspection reports and data **Becker Structural Engineers
Woodard & Curran**
- General on-call consultation services related to the municipal parking garage project **Becker Structural Engineers
Woodard & Curran
SP+**

Resumes

Todd M. Neal, P.E., SECB Vice President



A principal of Becker Structural Engineers, Todd is a Maine native and has worked at BSE for the past 19 years. He has extensive experience in the design and fabrication of precast/prestressed concrete garages, building components, bridge components, architectural precast concrete. Specialty topics include repair and maintenance of parking structures. He offers expertise in construction management, structural testing and administration of special inspection programs in accordance with the IBC Codes. Todd is currently an active member on the PCI Parking Structure Design Committee and Joint Sealant Sub-Committee and contributed to the publication of the PCI "Maintenance Manual for Precast Parking Structures" and the PCI Committee Report "Joints in Precast Parking Structures". He has been a featured speaker at several parking garage maintenance seminars.

EDUCATION

University of Maine
Bachelor of Science, 1994, Civil Engineering

Wentworth Institute of Technology
Architectural Engineering Technology, 1988

PROFESSIONAL REGISTRATION

Registered Professional Engineer in the State of Maine (#9406), Connecticut (#27306), Massachusetts (#51354) West Virginia (#20277), New Brunswick, Canada (#L5173), Nova Scotia Canada (#11330), Certified in the Practice of Structural Engineering (#2639-0708)

PROFESSIONAL ASSOCIATIONS

American Institute of Steel Construction
American Concrete Institute
Architectural Precast Association
Precast/Prestressed Concrete Institute - Parking Structures Committee
Structural Engineers Association of Maine - Past President
New England Parking Council - Past Board Member
International Parking Institute
International Concrete Repair Institute – Past New England Chapter President
Sealant, Waterproofing & Restoration Institute

Christopher G. Williams, P.E., S.E.
Associate



Christopher joined Becker Structural Engineers after attaining his Bachelor of Science degree in Civil Engineering from the University of New Hampshire. He is a licensed engineer in the State of Maine with experience in the design of steel, timber, reinforced concrete and reinforced masonry for both commercial and residential projects. He also has experience in structural and architectural precast concrete, ranging from the design of prestressed and post-tensioned parking structures to the design of architectural precast cladding and facade elements. He has served as a design engineer and project manager on projects with construction costs up to \$40 million. Christopher is proficient in software including AutoCAD, REVIT, RAM Structural System, RAM Elements, RISA 3D and LEAP.

EDUCATION

University of New Hampshire
Bachelor of Science, 2007, Civil Engineering

**PROFESSIONAL
REGISTRATION**

Registered Professional Engineer in the State of Maine (#12854)

**PROFESSIONAL
ASSOCIATIONS**

American Society of Civil Engineers
American Institute of Steel Construction

Joshua Martin-McNaughton, P.E.

Senior Engineer



Joshua joined Becker Structural Engineers in 2013 after working in the Washington, D.C. metro area for over four years. He is a licensed Engineer in the State of Maine. His experience includes investigating, designing, performing condition surveys on existing buildings, parking garages, historical structures and remediating their building envelope and structural deficiencies. Building envelope experience includes roofing (flat and steep), flashings, plaza/garage/foundation waterproofing systems and air/vapor barriers. His goal is to not only bring back the aesthetic quality of the building but to also provide a long-term solution to the building failures.

EDUCATION

Wentworth Institute of Technology
Bachelor of Science, 2008, Civil Engineering Technology

**PROFESSIONAL
REGISTRATION**

Registered Professional Engineer in the State of Maine (#13551)

**PROFESSIONAL
ASSOCIATIONS**

American Society of Civil Engineers



BARRY SHEFF, PE **CIVIL ENGINEERING SR. PROJECT MANAGER**

Professional Profile

Barry is a Senior Principal and Senior Project Manager with over 25 years' experience working with the public sector on infrastructure planning and implementation, and with the private sector on urban revitalization projects. He is responsible for design and project management, with expertise engaging and facilitating stakeholder processes. His project work has involved utility infrastructure with focus on stormwater and wastewater utility planning studies, evaluations, and engineering; green infrastructure; master development planning and site design; and environmental/land-use permitting at the local, state, and federal levels. Barry focuses his work on sustainable environmental design and is committed to collaborating with owners and stakeholders to develop practical solutions to complex problems. He has been involved in numerous projects with high-performance buildings and LEED certification and was a member of a national ASCE/EWRI task force evaluating green infrastructure in street/highway applications. Barry is currently a member of APWA's National Water Resources Management Committee. Barry has strong cost estimating experience, a track record of understanding client expectations, consistent budget controls and excellent communication skills that enable him to drive the success of small and large projects of varying complexities.

Related Experience

Maine Medical Center, Portland, ME – Parking Garage. Principal-in-Charge for the permitting and design of the new 2,000+ car parking garage in St. John Valley neighborhood of Portland. The project is the result of a partnership between a private land-owner and Maine Medical Center (MMC) as part of the hospital's major campus expansion. Woodard & Curran's work involves site options analysis, land-use and environmental permitting, site/civil engineering and utility infrastructure design for the multi-level parking structure to serve MMC employees. Focus areas of the project involve the coordination with employee shuttle services, and the need for accommodating employee commuting patterns and routes while reducing demand on the existing urban street network surrounding the hospital campus. The parking garage is scheduled for ground breaking in early 2019.

Lowell Regional Transit Authority, Lowell, MA – Gallagher 1 Garage Modernization. Principal-in-Charge for Woodard & Curran's work as the Transit Authority's Owner's Project Manager (OPM) for coordination, management, and monitoring adherence to the construction schedule, budget, design, and project specifications for this parking garage modernization. The role of OPM was defined and as required in Massachusetts by Chapter 193 of the Acts of 2004, the Public Construction Reform Law, for any building project over \$1.5 million. The modernization project included removal and replacement of four stories of concrete deck slabs, vehicle ramps, roofing, drainage system, fire alarm system, and emergency lighting.

Education

- Bachelors, Civil / Environmental Engineering, University of Vermont

Registrations

- Registered Professional Engineer - ME, #9708
- NCEES License - National, 60366
- Maine DOT Local Project Administration Tier 1 Certification

Professional Associations

- American Society of Civil Engineers
- American Public Works Association
- New England Water Environment Association (NEWEA)
- Order of the Engineer



Alicia Pouliot-Cote, CPP
Regional Manager III, Parking and Transportation Operations

SP+ (SP Plus)

Jul 2015 – Present • 3 yrs

Greater Boston Area

Currently, I lead the operations for over 130 commercial, healthcare, university, and municipal parking properties, with revenue valued at over \$110 million. Provide oversight of 650+ direct and indirect employees, prepare budgets, and continually analyze profit margins in order to achieve organizational goals. I regularly engage customers, negotiate contracts, and drive sales efforts. In order to maximize revenues or reduce costs, I also utilize dashboards to assess opportunities for innovation and introduce process improvement initiatives.

- ★ Awarded Regional Manager of the Year (2017) and Contract Renewal of the Year (2017).
- ★ Led national charitable effort to raise \$15,000 for American Heart Association.
- ★ Developed 86% of annual new business target (\$178,000) within first two months of 2017.
- ★ Improved 2013 Net Operating Income by 62% over prior year and improved budget by 10% each subsequent year.

Notice of Investigations or Disciplinary Action

To the best of our knowledge we are not aware of any investigations or disciplinary action taken or known to be pending by national, state, county or local regulatory bodies against the firms or individuals employed by the firms listed in this document. Any additional staff required from any firm will be vetted for this project to the best of our ability.

SECTION 4

Familiarity/History within the City/Region

Becker Structural Engineers has been working in the State of Maine for over 23 years and has worked with many local municipalities on projects that include garages, garage restoration, k-12 schools, libraries and public safety. Local to the Biddeford area, we are currently working on the renovations to the **old Post Office**, the new **York County Courthouse** and have completed many projects on the **UNE campus**. Our municipal experience extends throughout New England.

Over the past 23 years we have been fortunate to work with several municipalities on many of their facilities and have developed strong relationships with their staff. We have great historical information on many structures and experiences with buildings, parking garages, and bridges throughout the State. We continue to work successfully with the Cities of Bangor, Auburn, Westbrook and Portland and look forward to the opportunity to grow our municipal clients to include the City of Biddeford.

We believe that our history with multiple municipalities is a good indication of our ability to work with a client that uses in-house personnel to complete work on projects. Our goal is to be a partner in these projects and be as committed as the City's staff in a successful completion of the project at hand. We endeavor to be a trusted resource to any member of the City staff who can approach us with questions, suggestions, or recommendations.

Recent Municipal Projects

Bangor Public Library Renovation & Addition, Bangor, ME
Beverly Police Station, Beverly, MA
Boothbay Region Ambulance Emergency Response Center, Boothbay, ME
Burlington Fire Station, Burlington, MA
Casco Bay Ferry Terminal Renovation, Portland, ME
Central Fire Headquarters Slab Review & Repairs, Auburn, ME
Central Lincoln County YMCA, Damariscotta, ME
Falmouth Bucknam Road Fire Station, Falmouth, ME
Falmouth Library Feasibility Study, Falmouth, ME
Falmouth Public Safety Building, Falmouth, ME
Falmouth River Point Bridge, Falmouth, ME
Framingham Fire Station, Framingham, MA
Gorham Public Safety Building Additions & Renovations, Gorham, ME
Hartford Central Fire Station Expansion & Renovation, Augusta, ME
Leicester Fire and EMS Headquarters, Leicester, MA
Newton Fire Headquarters, Newton, MA
North Andover Central Fire Station, North Andover, MA
Portland Dept. of Public Works Facility, Portland, ME
Saco Fire Station, Saco, ME
Southborough Public Safety Building, Southborough, MA
Springvale Library, Springvale, ME
Stewart Memorial Library Clock Tower Masonry Review, Corinna, ME
Tyson Pavilion, AMHI, Augusta, ME
Walpole Central Fire Station, Walpole, MA
Waterville Police Station, Waterville, ME
Westbrook Public Safety Building, Westbrook, ME
Westford Fire Station, Westford, MA

Recent Municipal Parking Projects

City of Auburn, ME

Mechanics Row Garage - Assessment & 3 Phases of Restoration

Central Fire Station - Slab Assessment & PT Repair

City of Bangor, ME

Pickering Square Garage - Assessment & 7 Phases of Restoration

Columbia St. Garage- Assessment & Replacement Study

Pickering Square Garage Entrance Re-location

Pedestrian Bridge – Assessment

City of Portland, ME

Casco Bay Garage - Assessment, Stair Tower Reconstruction

4 Phase of Deck Restoration

Temple St. Garage - Assessment & Multiple Phases of Restoration

Spring St. Garage - Assessment & 3 Restoration Projects

Jetport Garage - Assessment & 3 Phases of Restoration

Elm St. Garage- Assessment & 2 Phases of Restoration

City of Fall River, MA

3rd St. Garage - Preliminary Assessment

Pearl St. Garage - Preliminary Assessment

City of Westbrook, ME

Riverfront Garage - Assessment & 2 Phases of Restoration

Maine Medical Center, Portland, ME

Gilman St. Garage - Assessment & 7 Phases of Restoration

Patient/Visitor Garage - Assessment & 2 Phases of Restoration

Local Parking Structure Designs

84 Marginal Way M.O.B. and Parking Structure, Portland, ME

66 Danforth Street Parking Garage, Portland, ME

Maine Health Bayside Parking Garage, Portland, ME

Maine Medical Center Employee Parking Garage, Portland, ME

Midtown Parking Garage, Portland, ME

Portland International Jetport Parking Garage - Phase 2, Portland, ME

Westbrook Parking Garage, Westbrook, ME

Local Parking Structure Feasibility Studies

1 Marginal Way Parking Garage, Portland, ME

1 & 2 Portland Square Parking Garage, Portland, ME

511 Congress Street Parking Garage, Bangor, ME

Bayside Parking Garage Study, Portland, ME

Brown Street Parking Garage, Portland, ME

Columbus Street Parking Garage, Bangor, ME

Maine Medical Center Visitor Parking Garage Expansion, Portland, ME

Maine Medical Center Gilman Block Parking Garage, Portland, ME

St. Mary's Hospital Parking Garage, Lewiston, ME

University of New England - Portland Campus, Portland, ME

SECTION 5

References

Mr. John Peverada, Parking Manager

City of Portland
Room 20, City Hall
389 Congress, St.
Portland, ME 04101

Email: jbp@portlandmaine.gov

Phone: 207-756-8529

Services Provided: Garage Restorations, Assessments, and Construction Administration, 2007-Current

Mr. John Theriault, City Engineer

City of Bangor
73 Harlow St.
Bangor, ME 04401

Email: john.theriault@bangormaine.gov

Phone: 207-992-4250

Services Provided: Garage Restorations, Assessments, and Construction Administration, 2003-Current

Mr. Jeffrey Sanders, Executive Vice President, COO

Maine Medical Center
20 Bramhall St.
Portland, ME 04101

Email: sandej4@mmc.org

Phone: 207-662-2964

Services Provided: New Garage Design, Garage Restorations, Assessments, and Construction Administration, 2006-Current

SECTION 6

Technical Approach

We believe in competency and character as our defining values. We are pro-active and interactive in our approach. Our dedicated staff and our investment in technology allows us to deliver high quality service on projects small and large, providing innovative solutions to complex design challenges. We embrace an engineering approach to projects which combines classical engineering theory and practical experience, paired with the versatility and efficiency of Autodesk Revit to create structural models which interact and coordinate with architectural and mechanical models to define the comprehensive building system. This approach advances the design and coordination of our projects.

Our design capabilities are complemented by our construction management services, which include construction reviews for general conformance and implementation and administration of the IBC Special Inspections Program. We believe a strong job site presence contributes to enhanced quality and improved construction efficiency. Working with the owner, architects, contractor and testing agencies, our office provides a full range of construction monitoring capabilities.

On many of our restoration projects we are the sole design professional and administer the contract requirements for the owner, including; shop drawing reviews, response to RFI's, review of pay requisitions and drawdowns, project meetings, substantial completion reviews and punch lists.

In today's economy, specifically in the construction field, more is expected with less. Less time and information make it difficult to forecast and evenly distribute workloads. We feel that our investment in technology and our staff size give us effective tools to manage our client's expectations and our staff's work load. Based on these trends, we foresee continued increase in activity for the foreseeable future. Preparing for this growth in work load, we recently added three additional staff members and continue to look for talented professionals who can bolster our staff and support our client needs.

In almost all of our projects the approach is similar regardless if it is a new design or restoration. To design an effective and efficient solution you must identify the problem, establish the cause, and use that information to formulate a cost-effective solution.

Our goal in this project is to protect the City's interest without becoming an adversary to the design team. This type of work can make design professional defensive. Knowing many of the firms in the industry we will strive to keep the interaction positive and professional while maintaining the best interest of the City as the guide. Fully understanding the parameters that have been given to the design team will be key to understanding their designs and where we can assist.

For our team, success in this project will be helping the City of Biddeford build the most cost effective, durable, user friendly parking structure they can without the public knowing we were even there.

SECTION 7
Sample Documents

On the flash drive provided we have included this document, additional project information and sample peer review documents for your review.

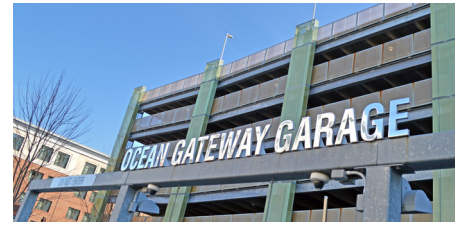


WOODARD & CURRAN

PARKING GARAGE PROJECTS

Maine Medical Center Parking Garage, Portland, ME

Woodard & Curran is providing the permitting and design of the new 2,000+ car parking garage in St. John Valley neighborhood of Portland. The project is the result of a partnership between a private land-owner and Maine Medical Center (MMC) as part of the hospital's major campus expansion. Woodard & Curran's work involves site options analysis, land-use and environmental permitting, site/civil engineering and utility infrastructure design for the multi-level parking structure to serve MMC employees. Focus areas of the project involve the coordination with employee shuttle services, and the need for accommodating employee commuting patterns and routes while reducing demand on the existing urban street network surrounding the hospital campus. The parking garage is scheduled for ground breaking in early 2019.



Ocean Gateway parking garage.

The Watermark and Ocean Gateway Garage, Portland, ME

Woodard & Curran was contracted to complete the site design, permitting, and construction administration for The Watermark and Ocean Gateway Garage, a private, mixed-use development project on roughly three acres of land on Portland's eastern waterfront including a 750-car parking garage, boutique hotel, condominiums, and retail space.

Woodard & Curran's site/civil work included layout, grading, drainage, erosion and sedimentation control, street reconstruction, utility design, and construction administration to accompany the architect's building design and developer's vision. The land-use and environmental permitting included City Site Plan, Subdivision, Historic Preservation, and Maine DEP environmental permits, including stormwater. The permitting effort was completed in an unprecedented time-frame for a project of this size.

Woodard & Curran was able to lead the project quickly through the challenging permitting process via extensive public outreach, including back-to-back public workshops that led right into a public hearing. This effort helped the developer bring the project to the market as rapidly as possible. The Ocean Gateway Garage was constructed while the remainder of the mixed use development stalled given the economic downturn in 2008.

University of Southern Maine, Portland, ME

To cope with rising enrollment and an increased demand for parking and classroom space, the University of Southern Maine developed a LEED gold-certified, 15,000-square-foot building that will include office space and classrooms, a 400+ seat lecture hall; and a five level, 1,200 car parking garage. The center is located at its Portland campus, adjacent to I-295.

Woodard & Curran worked through Einhorn Yaffee Prescott Architecture and Engineering to provide preliminary site evaluations; SLOD and Local Site Plan permitting, including site, stormwater, public utility and roadway design, structural, design; and assistance with a public outreach and participation program.



University of Southern Maine parking garage.

Street discontinuances and alterations were an important component of the planning process. Receiving permit approval for the parking garage was also key. The University built a significant addition to its bioresearch facility and could not occupy it until the new parking garage was permitted. Woodard & Curran worked to ensure that all necessary information was submitted to the city, and as a result, all pertinent permits were received with no surprises.

Bayside Garage, Portland, ME

Woodard & Curran teamed with several other consultants selected by the City of Portland for site planning and design services associated with urban brownfield redevelopment of seven acres in the City's Bayside neighborhood. Bayside is undergoing tremendous urban renewal and the city is taking a lead role in developing the area. The project team assisted the city in transitioning from Bayside's master planning to the development phase, with a dominant portion of the project encompassing the permitting of a 700-space parking garage.

Woodard & Curran provided support during the development of conceptual plans of the parking garage, including data gathering and analysis. Survey results were used to assess the need for additional utility upgrades and/or extensions, as well as potential stormwater impacts and capacity specifically relating to tidal influences in the city's storm sewers. Woodard & Curran also evaluated the development parcels, structured parking, and the integration of a trail and its associated components as they relate to traffic capacity, circulation, and access.

Lowell Regional Transit Authority, Lowell, MA

The Lowell Regional Transit Authority provides public transportation to 14 communities around the Greater Lowell area. The main hub of these services runs through the Gallagher Intermodal Transportation Center in downtown Lowell, which opened in 1983. The Gallagher I Garage Modernization project represents the first major renovation for this facility in over 30 years. The Transit Authority selected Woodard & Curran to act as the OPM for the \$9.1 million upgrade.

Scheduled for a 12.5-month construction period, the project was completed in just 10 months. The reduced schedule represented a significant benefit to commuters. The project, which blocked access to the adjacent Gallagher II Garage, had temporarily displaced 525 parking spaces.

Woodard & Curran was responsible for providing project management services to facilitate, coordinate and manage the project and to monitor adherence to the construction schedule, budget, design and project specifications.

MaineHealth, Portland, ME

Woodard & Curran was hired by MaineHealth's architect to perform site/civil engineering and land-use and environmental permitting for a 6-story, 84,000-square-foot office building and 700-car parking garage on a 4-acre piece of property that it intended to purchase from the City. The project was complicated by flood related issues and municipal infrastructure with limited capacity. All local site plan and state stormwater permits were secured and the design was completed in a 4-month period to meet the Purchase and Sale Agreement conditions. The project was not built because of financing challenges

“Woodard & Curran did an exceptional job with the public process and building consensus around the Bayside garage project. The firm's commitment was evident from start to finish.”

– Jack Lufkin, former Economic Development Director, City of Portland



MaineHealth parking garage.



NEW PARKING STRUCTURE DESIGN

84 Marginal Way M.O.B. and Parking Structure, Portland, ME
 66 Danforth Street Parking Garage, Portland, ME
 351 Water Street - Consultant, Saint John, Newfoundland, CN
 Maine Health Bayside Parking Garage, Portland, ME
 Maine Medical Center Employee Parking Garage, Portland, ME
 Midtown Parking Garage, Portland, ME
 Portland International Jetport Parking Garage - Phase 2, Portland, ME
 Veterans Administration Parking Garage, West Roxbury, MA
 Westbrook Parking Garage, Westbrook, ME



PRECAST/PRESTRESSED PARKING STRUCTURE DESIGN

222 Glenwood Parking Garage, Raleigh, NC
 Abernathy and Barfield Parking Garage, Atlanta, GA
 BMC Parking Garage, Pittsfield, MA
 Northern Westchester Hospital Parking Garage, Mount Kisco, NY
 Connecticut River Academy Parking Garage, East Hartford, CT
 Cooper Street Parking Garage, Waltham, MA



PARKING STRUCTURE FEASIBILITY STUDIES

1 Marginal Way Parking Garage, Portland, ME
 1 & 2 Portland Square Parking Garage, Portland, ME
 511 Congress Street Parking Garage, Bangor, ME
 Bayside Parking Garage Study, Portland, ME
 Brown Street Parking Garage, Portland, ME
 Columbus Street Parking Garage, Bangor, ME
 Maine Medical Center Visitor Parking Garage Expansion, Portland, ME
 Maine Medical Center Gilman Block Parking Garage, Portland, ME
 St. Mary's Hospital Parking Garage, Lewiston, ME
 University of New England - Portland Campus, Portland, ME

“This experience in combination with their years of work in the Northeast allows them to coordinate building materials and construction types with aggressive construction schedules to provide their clients with an economical structure for their projects.”

- OSCO Construction Group

Structural Review for the city of Portland of:
CAR RENTAL FACILITY & PEDESTRIAN RAMP
Structural Engineer of Record: [REDACTED]

General Questions:

1. Who is responsible for the design of the soldier piles/tiebacks?
2. Clarify which structural steel members are to be painted, primed, galvanized, etc. Specifications declare which structural steel is considered architecturally exposed, however, it does not specify which gets painted or galvanized.
3. If structural steel members cannot be shipped in one piece, provide note on structural drawings for the contractor to coordinate and submit locations of splice for structural engineer to review.

WS0-1 Questions:

1. Note number 11 of the General Notes: Should you include "Contractor shall report any discrepancies to the architect and engineer"?
2. We calculate the flat roof snow load to be greater than 35 psf. Verify snow load.
3. Indicate parameters for wind and seismic loads.
4. Are shear connector studs equally spaced on steel beams? Are they ever put in two rows? Specify placement criteria for contractor.
5. Reference geotechnical report and note allowable soil bearing pressures in General Notes on drawings.

WS0-3 Questions:

1. 15/WS0-3: Are stiffeners required in column to prevent localized bending?

WS1-1 Questions:

1. Should control joint spacing be tightened to approximately 30 times the slab thickness in feet, approximately 12 to 13 ft oc? Architectural tile joints should coincide with slab-on-grade joints. See A9-1.
2. Shall control joints be specified at slab on grade inside of tower?
3. Is reinforcement for tower foundation wall and footing per 5/WS0-2? WS1-1 indicates straight segments of a 9 1/2" wall with footings which are parallel with circular grid Y. 5/WS0-2 gives reinforcement for a 10" wall with constant heel and toe footing dimensions?
4. Architectural A8-1 shows 36'-3" from grid 13 to work-point of tower while structural shows 36'-2 7/8".
5. Shall a foundation wall and wall footing be added near grid RR between grid 13 and 16 (see WS2-1), where slab on grade transitions between interior and exterior, to prevent heaving of interior slab?
6. Shall a foundation wall and wall footing be added at grid 12, where slab on grade transitions between interior and exterior to prevent heaving of interior slab?
Please coordinate with [REDACTED]
7. Dimension to edge of slab on grade parallel to grid E, off of grid E.

SER: [REDACTED]

8. Coordinate with architect for support of trench drain cover. Clarify items to be cast in the concrete.
9. 1B1 along grid 14 does not coincide with 10/WS5-5 and beam schedule WS6-1.

WS1-2 Questions (questions may also apply to floors above):

1. How will connections at intersection of circular grid Y and grid E work? Verify clearance for connection of W18x40 framing into TS14x10 beams (2 places).
2. Verify section cut 13/WS5-2 shown in tower on WS1-2. How does corner at intersection of W8x21 and L6x4x5/16 stay up on grid Y? What do L6x4x5/16 connections to steel beams look like?
3. Verify all details are shown regarding note "TS10x10x.25 INSTALLED BETWEEN FLOORS" on grid Y at approximately grid D.8.
4. Why are W10x112's, which hang posts for platform, horizontal on grid Y? What does the connection for hanger look like at the horizontal beam? Is it similar to 1/WS5-4?
5. Clarify connections and details for outriggers W8x21 along grids 14 and E. Show moment connections on plans. Explain size difference with W14 beam.
6. Were the TS10x10x.625 columns on grid Y assumed to be braced perpendicular to the Y axis?
7. The elevator rails apply horizontal loads on the TS4x14x.5's perpendicular to the TS webs thereby causing inconsistent horizontal movements between the TS4x14's. Coordinate differential horizontal deflections with the elevator supplier.
8. Do CMU walls, located just outside circular grid Y inside the car rental facility, shown on A8-1, brace back horizontally to steel beams?
9. Are the CMU walls on top of the beams (ie: W24x55 at approximately grid D.8) non-load-bearing CMU walls? If so, what does the connection look like which provides lateral support at the top of the wall while enabling vertical movement between the subsequent floors?
10. The cold-formed framing shown on 3/A8-13 frames vertically between which structural members?

WS1-3 Questions (questions may apply to other levels):

1. Is W8x21 of the Platform Level Framing Plan located beneath the slab on metal deck or is an L5x3 required similar to 13/WS5-4?
2. Along grids V and 14, supporting frames on WS4-1 and WS4-2: Did structural engineer use assumption that columns are not braced, in direction perpendicular to beams, for the design of the columns?

WS1-5 Questions (questions may apply to other levels):

1. Note 5 states that the contractor is to coordinate with the mechanical drawings for all required beam web penetrations. Mechanical engineer should provide this information to the structural engineer for review so that structural engineer can reinforce beams and provide details accordingly prior to fabrication.

2. The horizontal cross-bracing, which braces trusses #1 through 8 near grid V, is not shown on the architectural plans or sections. Verify coordination of structural and architectural drawings.
3. Is W36x280 connection to column, at grids D2 and 14, per typical detail 15/WS0-3 or is the work-point at the face of the column flange?

WS1-7 Questions:

1. Section 1/WS1-7 shows slip connection for TS8x4 posts. What does bottom connection look like? Elevator Penthouse Framing Plan specifies TS8x4x.375 column down between floors. Is this typical between all floors, or just between this level and the Sixth Level?
2. Provide section through grid E at elevator.
3. Provide details for double beam condition, TS10x10 & TS14x10, in 2 places on circular grid of tower?

WS1-8 Questions:

1. How are doubly curved C6x10.5 sections fabricated? Have you consulted and coordinated with steel fabricators? Any local sources?
2. Identify vertical supports for C6 across tower.
3. 1/WS1-8: Show the curved channel and MC7 in this detail?
4. 5/WS1-8: Can the straight TS6x6x5/16 be in same plane as the C6x10.5 while following the roof's contour? Clarify interface between different pieces.
5. 5/WS1-8: Continue column up and TS6x6 beyond column to show interface.
6. L6x6x5/8x1'-2" is only shown in 3/WS1-8 and not in other sections. Clarify. Is this a beam seat?
7. Will geometry of doubly curved roof be the responsibility of the fabricator? Will fabricator have access to a 3-dimensional model that renders steel shapes (ie: catia program, etc) to assist in detailing structural steel?

WS2-1 Questions:

1. Since soldier piles temporary, has surcharge from the adjacent building footings been accounted for?
2. Review notes about different garage phases.
3. Section cuts for WS2-2 are called out as WS2-1.
4. Add soldier piles to sections on this page.
5. A conflict exists between 6'-0" dimension called out on 5/WS2-1, the Foundation Plan on WS2-1 and 3/WS2-2.
6. The footings shown on 4 and 5/WS2-1 are extremely eccentric. Have bearing pressures been verified for temporary and permanent loads?
7. Why does 5/WS2-1 need to be eccentric? What is the obstruction?
8. What use are the 1B2 beams serving? Why not use a wall footing?
9. A conflict exists between concrete beam 1B2 (shown in plan as both 12x36 and 12x24) on WS2-1 and the concrete beam schedule on WS6-1 (12x60). Please clarify.

WS2-2 Questions:

1. Provide section through trench drain depicting reinforcement and dimensions.
2. Location of trench drain does not match architectural A10-1.
3. Could you use a 4" or 5" slab-on-grade instead of 8"?
4. Clarify 5/WS2-2 at grid RC by showing relationship with soldier piles.
5. 5/WS2-2: How is wall on grid RF designed; as a retaining wall, or does it span horizontally between walls on grids 15 and 16 or shall it be tied into a slab so that it acts as a basement wall which is pinned at both the top and bottom?
6. 5/WS2-2: How is wall on grid RC designed; similar to wall on grid RF or does it rely on the permanency of the soldier piles?
7. A conflict exists between concrete beam 1B1 (24x27) on WS2-2 and the concrete beam schedule on WS6-1.
8. 2/WS2-2: Verify that there will not be a frost heave problem at the vault slab. Should you insulate walls around vault and slab of vault?
9. Coordinate with the architect; ramp elevations do not match architectural elevations shown on A10-1 and A10-3.
10. Architectural shows handrails on each side and in the middle of the ramp. Verify slab was checked to take load.
11. Control joints in slab-on-grade not shown. Section H-H/ A10-3 indicates architect will locate them. Coordinate locations with structural engineer to minimize unwanted cracks.
12. A10-2 and A10-3 shows architectural grill. Were columns designed for lateral loads resulting from wind on the grill?
13. Section cut 2/WS2-2 is shown on plan to show elevation along grid 16. This section does not exist.
14. 4/WS2-2: Verify 23'-9 3/4" dimension. Unable to locate it on the architectural.
15. The plan shows an expansion joint between grids RL and RM. What purpose does this serve (the roof does not have an expansion joint on WS2-3)? Also, WS2-4 shows control joints. Maybe construction joints are more appropriate in the concrete walls and slabs.
16. 3/WS2-2: What is the waterproofing detail for the wall on grid 15?

WS2-3 Questions:

1. Top of steel elevations not shown.
2. Dimension required to end of steel between grids RR and E. Is an expansion joint required? Clarify with detail.

WS2-4 Questions:

1. Retaining wall gets rather high in WS2-4. Does design account for this?
2. Should section 13/WS5-5 be cut on WS2-4?

WS2-5 Questions:

1. Do columns along grid 16 resist lateral loads in both directions via frame action, pinned at the bottom of steel?
2. Did geotechnical engineer recommend caissons for the foundation?
3. Two 6'-0" deep caissons are approximately 2'-3" apart. Was this coordinated with the geotechnical engineer?
4. Reference "Developed Elevation of Screen Framing": What braces the TS5x5 suspended vertical member, above the pedestrian roof, 4'-3 1/4" from grid RD, in the direction into/out-of the page?

WS3-1 Questions (Questions may be applicable to other trusses in WS3 series):

1. Trusses will require splices for shipping and fabrication purposes. The structural engineer should locate splices and provide guidelines or details. Coordinate with contractor.
2. 7/WS3-1: Verify material grade of bolts and welding compatibility.
3. Truss #1 Elevation: Finish referencing 3'-6" diameter pier at the base of the truss.
4. Truss #1 Elevation: Reference 7/WS5-5 for pier and S0-1 for retaining wall.
5. Outside anchor bolts should be galvanized.

WS3-8 Questions:

1. Clarify TS14x6x1/2 beam at elevation 17.5'? Unable to find it on the plans.

WS3-9 Questions (Crown Truss):

1. Does TS20x4 provide end of truss restraint in X, Y, and Z directions? Does design account for this?
2. 3/WS3-9 Developed Elevation: Detail doesn't match 13/WS5-2.
3. Detail A: Verify bolt grade and welding compatibility.
4. How is TS20x8 supported at grid T8 (end of crown truss)?
5. Webs of crown truss do not meet at a common work-point, thus inducing a moment in bottom chord.
6. Note to contractor: Contractor to shore trusses as required during construction.

WS4-1 Questions (Questions may be applicable to WS4-2):

1. Provide cap plate details at grid V at top of frame.

WS4-2 Questions:

1. Provide detail 13/WS5-1. Should this be 1/WS5-1?
2. Provide dimension to interior canopy supports at elevation 21'-9"
3. Detail atypical moment connections similar to 5/WS5-3 (ie: 1. Beams frame into column web at different elevations- are extra stiffener plates required in column?
2. One beam frames into column- stiffener plates required on each side of column web).
4. Provide structure for support of precast panels and detail concept for use by precaster. Coordinate with architect.

WS5-1 Questions:

1. Discrepancy on 2/WS5-1 as to which truss is referenced. Should be truss #1.

WS5-2 Questions:

1. 5, 6, 7 and 10/WS5-2: Do fillet welds transfer moment sufficiently or would complete penetration welds (at beam flanges and column stiffener plates) be more appropriate to develop the tensile strength of the flanges?
2. 10/WS5-2: Verify interference between full depth stiffener plate and bottom horizontal plate used to transfer compression force in the bottom flange of beam. The stiffener may not want to be full depth. Do two bolts transmit the bottom flange compression load sufficiently per 12/WS5-2 or should (4) bolts or a full penetration weld be specified?
3. 13/WS5-2: Indicate which angles are curved.
4. 13/WS5-2: Beams take torsional loads. Stiffener plate sizes and welds missing.
5. 13/WS5-2: According to 5/A9-4, the L4x4x3/8 at the outward edge of the canopy is only located between two end beams (each end). This angle should be continuous. Provide note on the structural drawings and coordinate with architect.
6. 13/WS5-2: Review the canopy shown on the architectural drawings for structural accuracy.

WS5-3 Questions:

1. Do the steel beams and columns above the Fifth Level Framing Plan, shown in Partial Plan A, resist lateral loads via frame action? If so, are the connections capable of transferring the moments? Reference WS1-5.
2. Section 1/WS5-3 shows the metal deck discontinuous. Is there an opening on the 5th Level?
3. Sections 10 and 11/WS5-3: Should 3/4" plates be welded to steel beams to stiffen plates and prevent buckling? Do plates work for buckling without weld?
4. 6/WS5-3: Are stiffeners required for C6 sections and angles over TS supports to prevent rolling or web crippling?

WS5-4 Questions:

1. Reference details on this page from plans.
2. Details appear to be still in progress.
3. Should more stiffeners be added to resolve different loads?
4. 9/WS5-4: How does 3/8" bent plate get fastened?
5. 13/WS5-4: Why is beam up higher than slab support? Can beam take torsion?
6. 8/WS5-4: Provide vertical slip for bolts not taking gravity loads (ie: slotted insert in precast, etc).
7. Verify coordination of precast with architectural plans and specifications. Does precast meet out-of-plane width-span ratio per ACI? Verify panel can span distance and meet bowing criteria.

WS5-5 Questions:

1. 2 & 3/WS5-5: Wall reinforcement is specified as #6 spaced at 12" oc horizontal and vertical. However, 3/WS2-1 specifies #4 @ 12" horizontal. Please clarify.
2. 5/WS5-5: Clarify 3-#4 bars. What do they look like? Do they fit in 6" deep circular section of 3/WS5-5?
3. 8/WS5-5: Were gravity and lateral loads coordinated with [REDACTED]?
4. 7/WS5-5: Retaining wall, between trench and pier imposes moment on top of footing. Should the footing have top reinforcing?
5. 10/WS5-5 does not coincide with beam schedule on WS6-1. Provide spacing of smooth dowels.
6. 13/WS5-5: Does wall within knock-out panels and around knock-out panels resist earth loads in addition to other imposed loads? Are water stops required?

WS5-6 Questions:

1. Top of slab denotes a 1/2" difference between elevator corridor and stair corridor. However, WS1-2 indicates a 3" deck + 3 1/4" L.W. concrete topping (t=6 1/4") over both areas. Unable to find where slab in elevator corridor is held 1/2" below finish floor elevation in architectural drawings.
2. Architectural drawing at Level 2, A8-1, shows a slope 1/4" per foot at elevator corridor. Coordinate with architectural.

WS5-9 Questions:

1. 2/WS5-9: Why is one side of trench held down?

WS6-1 Questions:

1. 4/WS6-1: Why not set anchor bolts in pier? Verify compatibility of SS rods with galvanized plate.
2. 1B1 is called out along grid 14 on WS1-1 and between grids RD and RE on WS2-2.
3. Review entire beam schedule.
4. 2/WS6-1: Review edge distances of epoxy bolts.

September 14, 2001

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MOMENT FRAME PLATE EVALUATION
████████████████████ GARAGE REVIEW SERVICES
████████████████████

Dear ██████

We have reviewed the moment frames and associated details depicted on drawing S-2.6 for the parking structure. Frames F-1, F-2, and F-3 feature pairs of plates, acting as beam elements in the moment frames. In our review comments, we expressed concern about the buckling capacity of these plates. Generally, plates without stiffening or bracing elements subjected to a bending moment are susceptible to out-of-plane buckling. We have developed lateral loads and analyzed the frames, to review deflections and forces. We found the maximum story deflections under BOCA 99 code applied seismic loads to be approximately 1.3 inches in the north-south direction. The maximum deflection at the top of the structure was approximately 5.6 inches. These deflections are considered to be within the accepted range for a structure of this type. Our analysis of the plate buckling, however, was inconclusive as to whether the plates without stiffening elements are adequate to resist the applied loads. The provisions of the American Institute of Steel Construction do not explicitly address out-of-plane buckling for plates loaded in such a manner. We have analyzed the plates using classical analysis theories, but cannot be certain they apply to a plate with such a large depth-to-thickness ratio. As a result, we recommend providing stiffened elements for the beam members in these moment frames. This may be accomplished either by adding stiffeners to the plates shown, or by providing wide flanged sections oriented with the weak axis in the direction of resistance in place of the plates. Please discuss this item with ████████████████████. We are available for a conference call if desired.

Please feel free to contact me with any questions you might have regarding this matter.

Sincerely,
BECKER STRUCTURAL ENGINEERS, INC.

████████████████████
████████████████████

PARKING GARAGE

Structural Engineer of Record: [REDACTED]

General Questions:

1. Identify design loads and/or parameters (live, snow, wind, seismic) on the structural drawings for easy reference by others. Indicate which codes were used in design.
2. Clarify who is responsible for the design of the tie-back/ soldier pile system.
3. Per our telephone conversation 8/22/01 at 11:45 am, you indicated that your updated structural drawings reference [REDACTED] structural drawings for General notes. Please consider having your set of structural drawings separate from [REDACTED]. Consider including the following information: A) Inconsistencies/ discrepancies between drawings shall be brought to the attention of the architect and engineer. B) Consult other drawings for sizes of mechanical/electrical/plumbing openings in slabs, walls, etc. C) Verify existing as-built dimensions in the field prior to commencing construction or fabrication. D) The building is stable and self-supporting only after it is completed. All shoring, means and methods of construction are the responsibility of the contractor until the building is completed.
4. Shall foundations bear on undisturbed soils only? In the case where a footing has been overexcavated, shall the footing bear on a compacted backfill or on lean concrete/flowable fill? Shall soils be protected from changing and adverse weather conditions?
5. Concrete compressive strengths for elevated cast-in-place concrete slabs are not shown on the structural drawings. They are indicated in the specifications. However, this information is useful as a quick reference when located in the drawings.
6. What are lap splices of concrete reinforcing? What is the concrete cover? What does concrete reinforcing look like around corners, at openings in walls, slabs, etc?
7. Clarify which structural steel members are to be painted, primed, etc? Specifications declare which structural steel is considered architecturally exposed, however, it does not specify which gets galvanized. Also, the structural steel in the parking garage is exposed to weather though not considered part of the architectural structural steel package. Reference specifications Section 05120, 2.4B.
8. Per our telephone conversation today, you indicated the expansion joint was less than twice the top story drift. Please provide reference in UBC code for provision.

S-1.0 Questions:

1. Coordinate with [REDACTED] and architect. Add foundation wall and wall footing at grid 12, where slab on grade transitions between interior and exterior to prevent heaving of interior slab.

2. Detail at grids D.2 and 13 reference detail A on this page instead of B.

S-1.1 Questions:

1. What size are anchor bolts? Are they galvanized?
2. Column is not shown welded onto the baseplate.

S-1.2 Questions:

1. Which lines are control joints and which are construction joints? Drawings and/or specifications should state that the contractor shall submit proposed locations of construction joints and control joints to architect/ structural engineer for approval. (If CJ's are all control joints then additional cracks may form in slab where control joints intersect at a T rather than a cross).

S-1.3 Questions:

1. Sections are on hold at bottom of page.
2. Soldier piles: Were soldier piles designed with surcharges from adjacent footings?
3. 2/S-1.3: Is wall designed for moment from corbel loads?
4. Can footings accommodate future loads?
5. A/S-1.3 Drilled Mini-Pile Section: Clarify location of these footings on plans.

S-1.4 Questions:

1. You indicated in our conversation today that the helix is comprised of steel frames with partially restrained connections.
2. Cracks may form in slab-on-grade where jointing pattern abruptly terminates at/within helix.
3. Discrepancy between 1'-3" diameter pilasters shown on this page and 16" diameter pilasters detailed on S-1.1.
4. Second Level: Cut section through W16x26 and W18x35 just south of grid A near grid 4.7?
5. Second Level: Designate what the hatching on top of W16x67 for?
6. Second Level: There are double beams and columns on the circular helix grid south of grid B. What are the beam sizes? Is there an expansion joint here since there is one down grid 6.5 south of the helix? Provide sections to clarify.
7. Second Level: What are the elevations of the steel beams just as the slab is elevated off of the 5" slab on fill?
8. Second Level: In 5/29/01 set of drawings- some columns are shown as above only are shown with beams framing into them rather than a beam picking up the columns. Our updated set is half-size and too small to decipher. Therefore, verify which columns are above and which are below.
9. Second Level: The elevated concrete slab needs to be attached to the steel beams to resolve lateral (diaphragm) loads. How will the slab be attached? We recommend shear connector studs?
10. Second Level: Provide additional sections to clarify how beams go together.

11. 2/S-1.4: 5/16-inch and 3/8-inch welds are both called out. Please clarify.
12. A/S-1.4: Clarify detail. What holds up concrete wall in section?

S-1.5 Questions:

1. Sixth Level: T/C @ 55.9' is 5.36' above where highest beam frames into it. Is this correct?
2. Third Level: NE and NW corners of the helix have a W16x26 beam with cantilever. Does the cantilever pick up the other W16x26 beam? Provide section at this location through the expansion joint.
3. 1/S-1.5: Verify reinforcing in 6" slab. Which way is the slab designed to span? The bottom reinforcement spans in the long direction.
4. 1/S-1.5: Notes reads #4's at 18" oc centered on beam with top bar length = 2/3 x chord. Clarify.
5. 1/S-1.5: Is this curb designed for a vehicular impact load?

S-2.1 Questions:

1. What does the connection look like to the CRF provided by [REDACTED] [REDACTED]? Is there a gap between the two buildings?
2. Define extent of moment frames. Should a moment connection symbol be used to verify locations?
3. Are W21x44's on grids 1 and 13 part of the moment frames? If so, they are not included in the "Frame column to beam connections" table.
4. B & 3/S-2.1: There should be a break in the cables between grids 6 and 7. Are cables only on grid D?
5. Where is the information on the pretopped double tees? Section 1/S-2.1 shows a constant 2'-10" depth with varying dimensions above and below the steel beam. How will the contractor determine exact dimensions? What is the reinforcement in the double tees? Who is responsible for the design? Who is supplying them? Is the rebar epoxy coated?
6. Alignment may be an issue for pretopped double tees due to joint alignment, beam deflections and beam cambers. May cause problems for snow plows, etc.
7. Near grids F and 11.5: Detail condition/ connection into existing garage. Recommend cast-in-place filler strip. Provide note to contractor not to cut spandrels until shoring is in place. Provide installation procedures.
8. Is deflection a problem for the cantilevered double tees at grid E.5 at the soldier piles? What is the upward deflection limit at the cantilevers?
9. What will happen to the cantilevers in Phase II of the garage?

S-2.2 Questions:

1. Canopy not shown between grids C and D at grid 1. 1/S-3.2 shows support beam is W30x99 at Third Level. S-2.2 shows supporting beam on grid 1 as W24 and supporting beam on grid 13 as W21. Clarify.

2. 4/S-2.2: Can shear flow be transferred between the precast and cast-in-place concrete joint to enable the 4" deep slab to act as a cantilever?
3. 5/S-2.2 shows 4" expansion joints at grid 8.3, while plan says 2".
4. 3/S-2.2: Is web crippling a problem where double tees load steel beams?

S-2.3 Questions:

1. 1/S-2.3 shows 6" expansion joint at this level. However, the level above has a 4" expansion joint.
2. 2/S-2.3: Supporting beam is shown as W30x99. Plans show different beam sizes. Also, section says to omit canopy at section 2A. Canopy is shown on the plans at Third Level at this location. Verify top of steel beam elevation.
3. Identify section cut number on east side of garage.
4. 3/S-2.3: Clarify section.
5. 4/S-2.3: 2" expansion joint shown. Is this enough? Would a slide bearing connection be appropriate at this location?
6. 4/S-2.3: Can new W14 column take the weak axis bending from corbel? Detail corbel.

S-2.4 Questions:

1. Sections 1/S-2.4: Section shows 6" expansion joint. Plans show 6" expansion joints at the helix and 4" expansion joint at grid 6.5. Please clarify.

S-2.5 Questions:

1. Sections 1/S-2.4: Section shows 6" expansion joint. Plans show 6" expansion joints at the helix and 4" expansion joint at grid 6.5. Please clarify.
2. 2&3/S-2.5: Is concrete in 6'-0" x 6'-0" area at floor drain cast-in-place? If so, what supports it?
3. Were connections designed for lightposts?

S-2.6 Questions:

1. Frame F-5 is called out as F13 on plans. Where is frame F-6 on plans?
2. F1 nomenclature for frames has the same nomenclature for footing call-outs.
3. Provide plan view/ details of how tees integrate at columns.
4. Verify buckling capacity of vertical plates between columns. Can plates be stiffened? Provide connection to column.
5. F-1: Stiffener plates called out on column at each level to match beam flange. Where is beam? Inclusion of beams, tees, etc would help clarify this frame detail.

S-3.1 Questions:

1. Section cuts are shown but detailing is not finished.
2. What is landing constructed of? 3" concrete on 3" metal deck? What gage deck? What is reinforcement in slab?
3. A/S-3.1: How is L2.5x2.5 attached to HSS12x8?

4. Does curved HSS12x8 cantilever over/ through supporting column? Provide details.
5. What system resists lateral forces of the stair tower? Show details.
6. Verify curved beam is HSS12x4 at roof while at lower levels is HSS12x8.

S-3.2 Questions:

1. Canopy is detailed for grid 13. Do details apply to canopy at grid 1?
2. Sections 1 and 2/S-3.2 indicate the canopy attaches to W30x99. The plans show different beam sizes at the Third Level. Is the beam designed to take vertical and horizontal loads? Is the beam designed for local bending of the flanges?
3. Where are the design provisions for the space frame canopy? Loads?
4. The U-bolt is in bending for the support of the canopy. Could welded pipe stub-outs be used instead? What size is the U-bolt for the connection back to the structure?
5. What do the connections between the cables and canopy look like?
6. What does the connection between the TS beams and columns look like?
7. Is the TS beam above elevation 86.71' designed to withstand torsional, horizontal and vertical loads? Is deflection a problem here?
8. How is the orsogrill supported?

S-3.3 Questions:

1. Why does section 3 show a 12-inch expansion joint, while section 4 shows an 8-inch gap?
2. 3/S-3.3 shows a 12-inch expansion joint. Are you expecting this much movement?
3. Are canopy members and their connections designed for uplift wind forces?
4. How are lateral wind and seismic forces resolved? Are moment frames supposed to take lateral forces down?
5. What are the horizontal cross-bracing members? Why is there both horizontal cross-bracing and metal deck? Why is the horizontal cross-bracing discontinuous?
6. What is connection between W24x55 curved beams and W24x68 supporting beams? Are stiffeners needed? Is the top of the column braced with the diaphragm?
7. Was the canopy designed for a cold roof snow load? Were beam deflections checked?
8. What is connection between C6 and W24x55? Are top of steel elevations the same for these two members?
9. Are columns at B2 and B12 braced in both directions at the top?
10. Can W24x55 member shown in 1 and 2/S-3.3 be fabricated and shipped in one piece? If not, provide noted on structural drawings for contractor to coordinate and submit location of splice for structural engineer to review.
11. 2/S-3.3: Is W14 braced in both directions at the bottom of the post?

December 9, 2009

[REDACTED]

[REDACTED] – **STRUCTURAL PEER REVIEW**

Dear [REDACTED]

At the [REDACTED]'s request we have completed an independent structural review of the above noted project. Our review was completed based on the drawings and specifications prepared by [REDACTED] dated October 26, 2009 noted as "Issued for Permit" and the "Report on Geotechnical Design Recommendations, [REDACTED]" prepared by [REDACTED] dated November 11, 2008.

As per our proposal we have completed the following items:

1. Review of design loads for conformance with the 2003 International Building Code (IBC 2003).
2. Review design criteria and design assumptions, for conformance with IBC 2003.
3. Review geotechnical report and implementation of recommendations.
4. Review organization of the structure is conceptually correct.
5. Independent calculations for a representative fraction of systems, members, and details to check their adequacy.
6. Review Structural Specifications.

The attachment includes a list of specific items that we have noted for review on the drawings and in the specifications. The following is a summary of the tasks listed above.

In our review of the design loads, criteria, and assumptions noted on S00.00 we found that these items are in conformance with IBC 2003. Our review of the seismic analysis concludes conformance to current practices for load transfer and lateral force resisting elements and is in conformance with IBC 2003 and the recommendations of the "Geotechnical Design Recommendations".

In our review of the structural concept we have several observations/comments that relate to the economy, durability and performance of the structure. These items do not indicate that the structure design is insufficient as currently designed. We noticed that the structured floor framing and parts of roof level consist of non-composite steel framing and cast-in-place lightweight concrete decks. We would expect for floors decks of this size and with the span lengths required that there would be some economy in designing these levels with the framing composite with the decks. We would also consider adding camber to the beams to compensate for construction deflections as the beams are loaded with concrete to reduce the amount of concrete required and aid the slab

finishing. We also have a concern about the fire protection/treatment of the wood framed and decked roof structure. Fire ratings and combustibility requirements are typically reviewed by an Architect, and are not within our scope or specialty; however, we reviewed the framing based on our experience that fire (and some preservatives) treatments can negatively impact the capacity of the wood framing. Our review of the framing revealed some discrepancies regarding the type of treatment and combustibility requirements that should be reviewed by the design team. In reviewing the slabs-on-grade we would suggest looking at the slabs that the tugs drive on as exterior slabs, and modifying the design to meet the durability requirements of ACI 362 due to the exposure to de-icing chemicals and the tug traffic.

In order to perform task number five we opted to re-create a majority of this structure in a RAM Structural System model which allowed us to check individual members as well as the lateral system. In general, our analysis confirms that this structure is adequate for the applied loads. We did not find any members that were overstressed; however, we have noted in the attach list areas where there appears to members with deflections that exceed the Code maximums.

In summary, it is our opinion that the overall structural design of the proposed terminal expansion meets the intent of IBC 2003. We have attached a list items that we have noted through our review of the drawings and specifications. Many of these items are coordination items with only a handful that have an implication on the design of the structure.

Our review is cursory in nature; while we made a reasonable review of the project for conformance to Code and industry standards, the review was not comprehensive and non-compliance items may still exist. The structural engineer of record shall retain sole responsibility for the structural design, and the activities and reports of Becker Structural Engineers shall not relieve the structural engineer of record of this responsibility.

We trust this letter and attach list address your needs at this time and we look forward to meeting with you and your design team on December 10, 2009 to review our comments.

Sincerely,
BECKER STRUCTURAL ENGINEERS, INC.

[Redacted signature block]

[Redacted signature block]

Attachment: Review Comments

Peer Review

Comments – December 9, 2009

* indicates comment added after 12/4/09 preliminary review

Drawing Review

Design Requirements/Code Review

Drawing		BSE Comment
Design Parameters	1	Suggest reviewing project with composite construction for economy.
	2	Verify design and construction costing had considered ponded concrete. Verify cambered construction is not necessary.
A00.10	1	Building Code Analysis: The construction classification for this building is Type 1B, Non-combustible, protected. The notes in this section indicate that in order for the roof framing to meet the non-combustibility requirement that the roof framing would need to be fire-treated. We found no reference to fire treatment for the wood roof framing/decking in the drawings or specifications.
S00.00, S02.RP.06	1	Components & Cladding Wind Loads: We were not able to duplicate the indicated loads and our calculated loads were less than indicated. We would suggest providing C&C wind loads for design tributary areas.
S00.00	2	Design Loads, Dead Load, Roof (Low): The roof construction is comparable to the typical floor construction, yet they dead loads vary (60 psf for floor vs. 90 psf for floor). Verify roof dead load.
	3*	Testing & Inspection: Verify no CMU Testing is required.
	4*	Testing & Inspection: Verify no wood diaphragm inspection is required.
	5*	Testing & Inspection: Coordinate testing/inspection with IBC Chapter 17 requirements, provide Statement of Special Inspections.
	6*	Steel deck note 7: Verify if this note is applicable.
	7*	Steel deck note 8: Verify deck is designed as unshored.

Foundation Plans

S02.01.03	1	Sheet Notes: LP appears to be a circular reference with the architectural drawings.
	2	Should the slab that the tugs will be driving on be considered an exterior slab with an increased f'c and air content to improve durability?
	3	What are the slab thickness, strength and reinforcement for the exterior ramp?
S02.01.04	1	Dowel baskets are noted at the "Contraction/Construction Joints". The PNA dowel baskets can not be used at Construction Joints. PNA diamond dowels should be noted to be use for this type of joint.
	2	Between grids XG, XF, Z1 and ZA there are multiple F3.0 footings at elevation 61.00 which does not allow for 12" of stone between top of footing and bottom of slab.

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	3	What are the slab thickness, strength and reinforcement for the stair tower?
	4	See comment 2, drawing S02.01.03.
	5	What are the slab thickness, strength and reinforcement for the exterior ramp?
	6	We would suggest indicating the contraction joints in the slab north of line C.4 .
	7	Is there a typical bollard detail?
S02.01.05	1	Drawing A02.02.05 appears to indicate an elevator pit between grid lines XH, XJ, Y1, and Y0.5. There is no pit indicated on this drawing.
	2	Slab in the "Check in Queue" is noted as 5" on plan, the slab detail (17/S12.01) indicates total slab thickness is 5 ¼" with the top ¼" ground down. Should cast elevation be indicated on plan along with the finished elevations?
	3	There do not appear to be any dimensions for the slab depressions at the rotary doors.
	4	The extent of the ramp between lines Y2 & Y1 north of line XM is not noted.
	5	What are the slab thickness, strength and reinforcement for the stair tower (3 locations)?
	6*	Elevator Pit 4&5: Verify no separator beam is required for rail support and/or shaft support at the pit level. This comment would also apply to elevators 6&7.
S02.01.07	1	The ramp and the dumpster pad are noted as 3000 psi concrete. Is this appropriate for exterior slabs?
	2	The extent of the loading dock ramp does not match the civil drawings.

Foundation Sections

S12.01	1	Detail 2, the detail with the PNA diamond dowels should be noted as a construction joint .
S12.11	1	Many of the details indicate WWF in the slabs.
S12.03	1*	Section 6: Verify no requirements to remove or reinforce backers.
	2*	Section 6: Suggest column sizes selected to eliminate web doublers.
	3*	Section 8, Alternate stiffener plate location: Verify flange continuity plate requirement will be met with this stiffener arrangement.
	4*	Section 8: Some field welded tube connections indicates one-sided weld, others two sided weld.
S12.04	1*	Joist reinforcement detail is not applicable- no joist construction.
S12.05	1*	Typ CMU details: Verify 1/2" gap at non-load bearing detail is coordinated with live load deflections.
	2*	Typ CMU details: Verify reinforcement requirements at non-load bearing walls (detail does not show vertical reinforcement).
S12.10	1*	Confirm all around weld is required in all cases; Provide weld roots or provide design loads for connection design.
S12.11	1*	Section 10: Elevator is a traction elevator; verify plunger reinforcement is applicable.

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S12.12	1	Section 9 & 10: a. Why are there two different details at the top of the stairs and ramp over the existing foundation wall? b. Could you use PNA dowel baskets for the intermediate joints in the ramp (Section 10)? c. Should there be drilled in dowel bars at the bottom of the stairs where it meets the existing slab, similar to ramp?
	2	Section 13: Slab shown is new not existing.
S12.13	1	Section 5: Frost depth noted as 4'-0", should be 4'-6" as per geotechnical report.
	2	Sections 6 & 7: Should additional information be provided to the contractor regarding the underpinning?
	3	Section 12: Should the slab be thickened down to the pier to support the architectural precast above.
	4	Section 1: Slab thickness shown as 8", noted as 6" in plan. There are no elevations shown for the dock leveler in plan.
S12.14	1*	Section 8: All-around column-to-base plate weld not possible.

Framing Plans

S02.03.04 (note carried on most framing plans)	1	Note 10: Specs indicate L/600 for deflection criteria, drawings indicated L/360.
S02.03.05	1	Section cut between XF and XD.7 near Y7.5 should reference drawing S12.21.
(See also other floors)	2*	Elevator separator beam, elevators 4 & 5: Ref A10.30, W8x24 separator beam flange width (6 1/2") is greater than width between shafts (5"). Verify that a tube section/vertical face is not required for rail attachment.
(See also other floors)	3*	Elevator separator beam, elevators 6 & 7: Ref A10.31, W8x31 separator beam flange width (8") is greater than width between shafts (4"). Verify that a tube section/vertical face is not required for rail attachment.
	4*	Part. Framing Plan at Elevators 6 & 7: Verify framing is design to support elevator piston, counterweight and rail reactions.
S02.03.03	1	Transition between deck type D1 and D2 is not clear.
S02.04.04	1	Sizes near XF and ZA not shown.
	2	Section cut along TY line near D' appear backwards.
S02.04.05	1	Section cut between Z4 and Z3 near top of plan: Section implies a moment connection by flange preparation. Plan implies shear connections only.
	2	Suggest adding column lines up/down the page for reference.

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	3	Lowest section mark on Y8 line: Section indicates vertical tube. No sizing/not apparent in plan.
	4	Lowest sections marks on Y7: One mark references 3/S12.30 and the other references 3/S12.31. Should they be the same?
S02.04.06	1	T/Floor 86'-2", T/Steel 85'-9" There is a 5" difference between these elevations, but a 6" thick slab is specified.
S02.04.05	1	Cantilever W12x50s in vicinity of Z3 and Z1.7 along the XJ line: Our calculations indicate deflections in excess of IBC Code requirements [2L/360 for LL, 2L/240 for TL per IBC table 1604.3].
Typical Framing Plan Sheet Notes	1	Puddle weld diameter/pattern/side laps not indicated.
S02.05.05	1	Verify no metal deck reinforcement required for openings in metal roof deck.
	2	W24x68's on the Z5, Z4 and Z3 lines: Our analysis indicates total load deflections are in excess of IBC Code requirements and are in excess of 4 inches.
	3*	At hydraulic elevators: Verify dropped hoist/safety beams are not required at top of shafts.
	4*	Verify framing direction at hydraulic elevators not required to go from rail-to-rail.
	5*	Reference Part Framing Plan (+102'-4"): Decking Type D2 note referenced on drawings notes.
	6*	Reference Part Framing Plan (+102'-4")/Drawing A10.32: T/Slab elevations not coordinated; Bottom W8 steel elevation is within overhead height indicated on A10.32 (15'-6" vs. 15'-5").
	7*	Verify machine room-less traction elevator support locations, machine reactions (dynamic & static) and deflection requirements (L/1667) have been included in design.
S02.05.06	1*	Deck type D7 at stair landing near Z2 line not indicated.
S02.RP.04	1	Drawing references Southern Yellow Pine decking, other sheet reference Douglass Fir.
	2*	Suggest providing minimum spacing between end joints/layout information for controlled random length decking.

Framing Sections

S12.20	1	Section 2: We recommend indicating vertical leg dim/expansion bolt embed on the pour stop/CMU support.
	2	Section 13: Verify no connection is required between CMU dowels and supporting beam.
	3	Section 2: Verify constructability of grouting the lower CMU. Verify system performance is acceptable with the lower CMU being built tight to the decking.
	4	Section 14: The weld shown should be a field weld, not clear what is being welded. Detail does not appear to be constructible with the plate in between the existing plank and beam.

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	5	Section 4: Indicate bearing to remain for the existing plank.
	6	All Sections: CMU reinforcing spacing varies between 16" and 24". Verify CMU spacing is coordinated.
	7	Section 5: Verify if channel bolts need to be slip critical or have standard holes to resist horiz. thrust.
	8*	Section 24: Suggest locating prestressed strands before installing anchors; Provide field weld for brace to beam; Suggest reviewing brace to connect to existing beam rather than new angle connection.
S12.21	1	Section 9: For beam side plates- Verify welds cannot be partial penetration and backing requirements.
	2	Section 6: Bottom flange weld: Suggest this weld be designed as down hand for constructability.
	3	Section 7: Verify single 3/4" through bolt sufficient for uplift at glulams.
S12.30	1	Section 11: Bottom flange weld: Suggest this weld be designed as down hand for constructability.
	2	Section 15: Kicker angle not specified.
	3	Section 12: Recommend specifying length on DBA, verify resolution of wind moment.
	4	Section 7: Verify no stiffener is required at hanger.
	5	Section 17: Specify welding requirements for stiffener, verify weld access for pour stop.
	6	Section 18: Verify no stiffener is required at beam bearing.
S12.31	1	Section 2&10: Verify connections required to address horizontal load transfer from kickers at single column support.
	2	Section 10: Section cut for 11/S12.31 does not appear correct.
	3	Section 4: Bumper is still required beyond entrance, indicate requirements for re-supporting bumper after field cutting.
S12.32	1	Section 12: Beam to hanger should be noted as a field weld.
	2	Section 9: Verify no connection is necessary between CFMF and the tube- Verify/indicate if CFMF engineer needs connection to tube if it is acceptable.
S12.40	1	Section 5: Verify roof deck requirements to lap onto and connect to beam.
	2*	Section 9: Suggest providing expansion gap dimensions.
S12.50	1*	Section 1: Suggest field weld be shop weld; indicate T flange plate width, verify full pen weld is required.
	2*	Section 1: Indicate nailer bolts spacing.
	3*	Section 12: Valley beam not shown.
	4*	Verify backing web stiffener not required where glulam seats connect to WF beams.
	5*	Advise if non-redundant, single bolt connection for glulam purlin to girder is acceptable .
	6*	Indicate if shear ring is required at both girder and purlin for purlin-to-girder connection; verify shear rings required in lieu of split rings.
	7*	Suggest dimensioning utility notch at connections.
	8*	Verify nailer species not required to match decking/glulams for aesthetics .

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	9*	Section 7: Verify shear rings or split rings are not required at purlin connection shown.
S12.51	1*	Section 3: Verify high strength bolt designation and thread requirements (A325/A490/N or X or SC).
	2*	Section 4,5,7: Dimension for bolt spacings/provide bolt grades.
	3*	Section 5&7: Verify tension not passed through connection or provide design guidance to glulam supplier..
	4*	Section 4: At pin connection tabs; provide tab welds to plates; pin diameter and specification; verify weld requirement in section A-A.

Specification Review

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

Paragraph	BSE Comment
1.4.C.1	Concrete note 13 on sheet S00.00 indicates that the addition of water on site is not allowed. This appears to contradict this paragraph.
1.4.F 1.5.E	Concrete note 21 on sheet S00.00 indicates that welding of reinforcement is not allowed in which case no submittal would be required.
1.5.H.1	Should Special Inspector be added to the list of attendees for the "Preinstallation Conference".
2.4.A & B	It appears in the drawings that PNA dowel baskets and diamond dowels are specified for this project. They do not appear in the specification. Are Epoxy-Coated bars going to be used on this project?
2.11.A.4	The repair material is noted to have strength of not less than 4100 psi, should this be 4000 psi?
2.12.C.4	Are corrosion-inhibiting admixtures to be used in any of the slabs on this project?
2.13.A.2	Air content does not match note 16 on S00.00 .
2.13	There does not appear to be a mix design for exterior slabs.
2.13.C & D	In item 1 the air content is noted to be 3% +/-1.5%, item 3 notes the maximum air content for troweled slabs to be 3%.
3.5.C.1	Welding of reinforcement is not allowed per note 21 on S00.003.
3.6.E	Is this note required with the PNA Dowel Baskets?
3.8.B & C	Concrete Note 21 indicates that no water addition is allowed on site.
3.10.D.2.a.	Are the flatness and levelness specific to any or all of the slabs.?
3.13.A.1	Need to chose one or six months for concrete curing before installation of sealants.

SECTION 03 45 00 PRECAST ARCHITECTURAL CONCRETE

Paragraph	BSE Comment
	No comments.

SECTION 04 22 00 CONCRETE UNIT MASONRY

Paragraph	BSE Comment
	No comments.

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

Paragraph	BSE Comment
1.3.D*	Protected zones not required for R=3/Not referenced in drawings.
1.3.E*	Verify Demand Critical welding requirements for R=3.
1.4A.1&2*	Provide design reactions or guidance for shear connections.
1.6.E.2	AISC 341 and AISC 341s1 are not required for design using R=3.

SECTION 05 31 00 STEEL DECKING

Paragraph	BSE Comment
2.2	It appears that this paragraph needs to be reviewed and variables chosen.
	If the flooring materials to be placed on the lightweight concrete decks are moisture sensitive ventilated decking should be considered.

SECTION 05 40 00 COLD-FORMED METAL FRAMING

Paragraph	BSE Comment
1.3.A.2.a	Notes on drawings indicate the deflection limitation is L/360 this paragraph indicates L/600.
1.3.A.4.a	Notes on drawings indicate the maximum upward and downward movement is 1", this paragraph indicates 3/4".
2.3.A.1 & B.1	Minimum base-metal thickness are not noted on the drawings.
3.4.B	Fastening of Stud to track "top and bottom" or just "bottom"?

SECTION 06 10 53 MISCELLANEOUS ROUGH CARPENTRY

Paragraph	BSE Comment
	No comments.

SECTION 06 15 00 WOOD DECKING

Paragraph	BSE Comment
3.2.B.1	Is the nailing adequate for the significant uplifts indicated on drawing S02.RP.06?
	Based on the ratings and building type indicated in the Architectural drawings it is our interpretation that the decking needs to be fire treated.
Multiple*	Decking specification references glue laminated wood decking and solid sawn wood decking; verify intent.
2.2.G*	Decking indicated to be pressure treated; verify requirement at interior/non-exposed locations.

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SECTION 06 18 00 GLUE LAMINATED CONSTRUCTION

Paragraph	BSE Comment
2.1.D & E*	Glulams indicated to be pressure treated; verify requirement at interior/non-exposed locations.
	Based on the ratings and building type indicated in the Architectural drawings it is our interpretation that the glu-lams need to be fire treated.



June 8, 2018

City of Biddeford
Attn: James A. Bennett, City Manager
205 Main Street, Suite 107
Biddeford, ME 04005

RFQ: ON-CALL PARKING STRUCTURE ADMINISTRATIVE REVIEW SERVICES

Dear Mr. Bennett,

As requested we have attached billing rates for your review.

Sincerely,

BECKER STRUCTURAL ENGINEERS, Inc.

A blue ink handwritten signature, appearing to read "Todd M. Neal", is written over a light blue horizontal line.

Todd M. Neal, P.E.
Vice President

RATE SCHEDULE

<u>Classification</u>	<u>Hourly Rate</u>
<i>Principal</i>	\$155.00
<i>Senior Associate</i>	\$140.00
<i>Associate</i>	\$135.00
<i>Senior Engineer</i>	\$125.00
<i>Project Engineer III</i>	\$115.00
<i>Project Engineer II</i>	\$105.00
<i>Project Engineer I</i>	\$95.00
<i>Staff Engineer</i>	\$90.00
<i>CAD/REVIT Senior Designer</i>	\$100.00
<i>CAD/REVIT Designer/Detailer II</i>	\$90.00
<i>CAD/REVIT Designer/Detailer I</i>	\$80.00
<i>Administration</i>	\$80.00
<u>Reimbursables</u>	<u>Charge</u>
<i>Mileage</i>	\$0.70/mile
<i>Blueprints / CAD Plots</i>	\$7.00/sheet (24X36)
<i>Photocopies</i>	\$0.20/sheet
<i>Scan/Finishing (E-mail)</i>	Cost plus 12%
<i>Communications Charge</i>	1.5% of amount invoiced
<i>Outside Consultants</i>	Cost plus 12%

Effective September 2017

Maine Standard Rates

2017 - 2018 Rate Schedule



Consultant Personnel		Hourly Rate
Labor Category		
I. Support Services		
- Administrative / Clerical		\$67
- Project Assistant		\$89
II. Professional Services		
- Technician		\$90
- GIS Analyst		\$102
- Designer / Engineer 1		\$104
- Survey/Mapping Specialist		\$105
- Regulatory Specialist 1		\$108
- Geologist 1		\$110
- Scientist		\$111
- Engineer 2		\$112
- Resident Engineer		\$115
- GIS Analyst 2		\$117
- Engineer 3		\$119
- Project Geologist		\$120
- Senior Designer		\$121
- Project Technical Specialist 1		\$133
- Project Engineer / Project Scientist		\$134
- GIS Manager		\$140
- Senior Project Scientist		\$142
- Project Technical Specialist 2		\$143
- Project Engineer 2		\$144
- Senior Geologist		\$170
- Project Manager		\$175
- Senior Structural Engineer		\$185
- Senior Project Manager		\$192
- Principal Scientist-Geologist		\$200
- Principal Engineer		\$210
This Rate Schedule is confidential and for customer internal use only. W&C reserves the right to adjust billing rates each January 1st.		

Expense Category

Travel ¹	.535/mile
Expenses	At Cost Plus 10%
Subcontracts (lab tests, drilling, etc.)	At Cost Plus 10%

1. Mileage rate will change as the federal allowable rate is modified.



Rate Schedule

Financial Review Services

\$200.00/Hr.

BIDDEFORD, MAINE

City of Biddeford Parking Garage

Basis of Design

This document summarizes the "Basis of Design" for the proposed 514 space Pearl/Lincoln parking structure for the City of Biddeford. The structure will be designed to accommodate efficient traffic flow while meeting all applicable codes.

Section 1 - Code Requirements and Design Loads

The design of the parking structure shall comply with Federal, State, City, Industry codes, standards and regulations, hereinafter referred to as "Code Requirements" in the design and construction of parking structures. When codes conflict, the most stringent code governs. This Section identifies the primary codes that are to be followed. The latest applicable version of each code that will be applicable. Any conflicts among codes are to be promptly brought to the attention of the appropriate building departments.

Subsequent Sections of the Design Criteria make reference to various applicable codes.

Minimum Design Live Loads

1. Parking areas; 40 psf or 3,000 lb. concentrated load acting on 20 sq. in. area.
2. Stair and elevator lobby 100 psf.
3. Storage areas 125 psf.
4. Mechanical rooms 125 psf:
5. Ground snow load $P_g=50$ psf
6. Roof level full live load plus snow load, plus snow drift per ASCE-10
7. Wind load per ASCE-10: for 3sec gust at El 45.0 Exposure B - 108 mph

Codes, Standards, and Regulations Applicable to the Parking Structure

The following identifies the primary codes, standards, regulations and their applicability to the design of the parking structure. Additional codes, standards, and regulations may apply.

CLASSIFICATION: 5-2 TITLE: Low-Hazard Storage Group

Building

- State of Maine Uniform Building Code adopting IBC 2015 (in 2018)
- American Concrete Institute Standards.
- Specifications for Structural Concrete in Buildings ACI 301.
- Building Code Requirements for Rein. Concrete ACI 318.
- Recommended Practice for Concrete Formwork ACI 347.
- American Institute of Steel Construction
- Code of Standard Practice for Steel Buildings and Bridges.

- Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
- Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts.
- Precast Concrete Institute. (MNL 116, MNL 117, MNL 120, MNL 22) PCI Design Notebook
- Post-Tensioning Institute
- American Society for Testing Material Standards.
- American Welding Society
- Structural Welding Code D1.80.
- Structural Steel Painting Council Standards.
- Good Painting Practice Steel Structures Painting Manual Vol. 1 Systems and Specifications Structures Painting Manual Vol. 2

Electrical

- State of Maine Electrical Code
- National Electrical Code
- National Fire Protection Association
- Illuminating Engineering Society (IES)

Fire Safety

- State of Maine Uniform State Building Code
- National Fire Codes and Standards, National Fire Protection Association
#72B Aux. Protective Signaling Systems.
#72C Remote Station Protective Signaling Systems.
#72D Proprietary Protective Signaling Systems.
#88A Standard for Parking Structures

Handicapped

- State of Maine and ADA.

Mechanical

- State of Maine State Building Code.

Plumbing

- State of Maine State Plumbing Code.

Signage

- Manual on Uniform Traffic Control Devices U.S. Department of Transportation.

Zoning

- Local Zoning Code as applicable.

Section 2 - Architectural

The parking structure shall be an open parking structure. The parking structure's foot print, height, and facade treatment will be similar to that depicted in preliminary plans.

1. The design is to be efficient. Building corners and other space which cannot be used for parking shall be used for required stairwells and storage space, etc., to the extent possible.
2. The design and material selection shall consider the need for ease of maintenance, economy, and durability. All necessary warranties should be secured as the approved structural system is pre-stressed precast concrete.
3. The parking structure shall be designed in such a manner that there shall be no discharge of storm waters off the exterior and interior edges of the elevated floors. Under normally expected rainfall conditions, every effort shall be made to slope each floor toward the interiors of the structures, and to provide positive drainage. Water shall drain away from elevators and stairwells.
4. UL fire metal doors with metal door frames shall be used throughout the buildings where required. Use rust resistant material shop primed and field painted.

Doors used in the parking facility will be metal, UL fire rating where required, with metal door frames and will use rust resistant material and be shop primed and field painted. Hardware shall be of a heavy-duty type (high-usage) three hinges on all doors. Doors to any storage rooms and equipment rooms accessible to the public shall be lockable and master-keyed to the facility locking system. Doors in stairwells shall be of aluminum storefront material where fire separation is not required and UL fire rated metal with vision panels where separation is required.

- a. Hardware shall be of a heavy-duty type (high-usage) three hinge on all doors.
- b. Doors to any storage rooms and equipment rooms accessible to the public shall be lockable and master-keyed to the General Parking locking system.
- c. Doors in stairwells (if any) shall have vision panels.

Section 3 - Landscaping/Streetscaping

1. If required, re-paving of existing streets in the general project area, and replacement of existing curbs and gutters shall be specified as necessary. Patching of existing streets, required as a result of utility connections for the project, shall be included in the project. Rerouting of utility lines and sewers will be included in the project. A survey showing site boundaries and utilities has been made part of this Design Package submission.
2. Plant material shall be suitable for the local climate, hardy and easily maintained. Landscaping around the structure shall be designed to blend, and generally match the adjoining areas of the site. They shall be approved by the Owner and comply with the following:

- a. Inspection Guide for Landscaping Planting. American Association of State Highway Officials
- b. American Society for Testing and Materials (ASTP).
- c. City Landscaping Ordinance (if applicable).

Section 4 - Parking Structure Layouts

1. Parking spaces shall be accessible for self-parking; i.e., no spaces shall be "stacked" or situated in such a manner to make it necessary to move another vehicle to utilize a parking space.
2. Grade floor-to-floor heights shall allow 8-2" minimum clearance for specially equipped vans per ADA requirements, where required. Signs and hanging bars shall indicate the minimum clearance.
3. Pedestrian access to the parking structure shall be provided at points along the perimeter which are convenient to pedestrian circulation. Pedestrian and vehicle conflicts at ingress/egress points shall be minimized.
4. Parking structure entrances shall provide vehicle reservoir space for cars entering/exiting the parking structures.
5. A layout that allows vehicles to travel in straight paths after passing the entrance or approaching the exit control point is preferable.
6. A sufficient number of entry and exit lanes shall be provided to accommodate the expected traffic flows, with an average waiting time during the peak hour of approximately 20 seconds or less upon exit and entry. Queuing areas shall be designed to accommodate average peak hour expected queues on the site, not spilling out into the street.
7. The exit area shall have minimal visual obstructions, and sight distance should be maximized as the driver exits the facility.
8. The layout shall provide, at the most reasonable location, at grade, an emergency vehicular exit to Stratford Road.
9. Parking geometrics, including parking stall size, driving aisle width and resultant dimensions, shall be comparable or better. Parking stalls shall be sized 9'-0" x 18'.
10. Long span construction shall be used. Interior columns in the typical parking bay are not acceptable. Grid dimension shall provide clear parking bays throughout each structure. Accessible spaces shall be provided per ADA requirements.
11. Parking bay floor slope gradients should not exceed +/- 6.5 percent for floors used for parking.

12. All entrance and exit aprons to exterior streets, or surface parking, shall be flush with pedestrian right-of-way.

Section 5 - Safety and Security

1. Active security devices such as CCTV, blue phones and audio alarms will be furnished and installed. Provision of conduit for these items shall be provided for locations identified by the Owner during design. It is anticipated that the conduit runs (in addition to any home runs) will include the following:
 - a. Risers at all elevator towers;
 - b. Risers at all stair towers;
 - c. Risers every 8,000 sq. ft;
 - d. Two runs to all entry and exit lanes from control closet.
 - e. Ten runs to various areas for video equipment.
 - f. Each elevator cab (provision made for self-contained security component).
2. Openings between parking structure levels in stairwells, elevator waiting areas, parking areas, etc. shall be designed to promote passive security and minimize hiding places.
3. The ground floors shall be designed to limit access to designated points on the parking structures periphery.
4. Paths of pedestrian and vehicle circulation shall be lighted per IPI and NPA recommendations.
5. Stairwells shall be visible from the exterior with sufficient glass enclosure to enhance passive security.
6. Elevators shall be visible from the exterior with sufficient glass enclosure to enhance passive security.
7. All stair and elevator lobbies shall be enclosed with curtain wall to provide weather protection.

Section 6 - Structural

1. The precast structure shall be designed conforming to PCI Design Handbook Edition 7 (MNL120) and applicable IBC, ASCE-7 and ACI 318 code requirements. The precast supplier shall be a member of the PCI Institute (shall be PCI certified to produce structural precast elements) and shall produce elements in sufficient quantities to ensure a proper and continuous construction schedule. PCI manuals 116, 135 and 127 shall also be followed. The design is to be prepared by a Professional Engineer employed by the precaster. The Engineer of Record shall review the design (calculations and drawings) for general conformance with applicable codes.

2. A clear span design shall be used to maximize parking efficiency, and allow future parking flexibility.
3. The garage structural system is to be a precast pre-stressed concrete superstructure with a cast-in-place foundation. Special precast finishes, such as brick inserts at spandrels and stair towers, shall be indicated on project documents. At low ends of double tee deck elements, washes shall be precast, following project criteria. Design precast elements for fire ratings that are required by applicable code(s).
4. Stiff elements such as stair/elevator towers, pedestrian bridge, walls, etc., should be structurally separated from the remainder of the parking structure, generally following PCI recommendations.
5. Construction sequencing shall be such that the elevator shafts shall be built concurrently with the balance of the structure.
6. Barrier walls, guardrails, barrier cables and railings in parking areas shall be designed to withstand a concentrated horizontal force of 6000 lbs. (service load – applied in 12” sq. area), or a uniform load of 1,200 lbs. per linear foot, applied at 18” or 27” above the deck at any point along the structure, whichever results in the greatest stress. All barrier walls need to be 33” high minimum, with 3’6” minimum height for handrail.
7. Stair and landing areas shall be of precast concrete construction with securely anchored safety nose treads.
8. Exposed concrete surfaces in stairs and elevators shall be plumb and level with architectural finishes, as applicable.
9. The structure shall be designed and constructed to be durable and minimize further maintenance problems.
 - a. The concrete mix for precast columns, double tees, spandrels and shear walls shall be normal weight minimum 5,000 psi 28-day strength proportioned to meet PCI/ACI requirements for areas exposed to freeze/thaw, and salt or water including limitations on water soluble chloride in the concrete and maximum water/cement (w/c) ratios.
 - b. The cast-in-place concrete foundation shall be a combination of spread and continuous wall footings supplemented by installation of ungrouted aggregate piers in the northeasterly portion of the building foot print. Concrete shall have a minimum 4000 psi 28 day strength, with a maximum w/c of 0.40 for exposed elements and 0.45 for below grade elements. Cast-in-place topping on precast elements shall be 5000 minimum with a w/c maximum of 0.38.
 - c. A superplasticizer may be used.
 - d. Aggregate conforming to ASTM Standard C-33 shall be used.
 - e. Freeze-thaw resistance shall be improved by the use of entrained air per ACI recommendations.
 - f. Shrinkage cracks shall be minimized by recommended practices for placing, finishing, and curing concrete.

- g. Embedded structural attachments and connections shall be hot dipped galvanized. Exposed connections (under caulk) shall be stainless steel.
 - h. The following durability enhancements to cast-in-place concrete topping are to be provided. Epoxy coating of reinforcement and a DCI concrete admixture (or approved equivalent) at a dosage rate of 3 gals/cu.yd. in addition to any admixture required to offset excess chlorides in the concrete aggregates. Provide fiber mesh for durability.
10. Reinforcing steel and tie wires support bars and chairs used in top 3" of slabs shall be epoxy coated. Column ties within 2" of the top surface of traffic bearing slabs shall be epoxy coated. Provide a minimum cover of 1-1/2" (ties and slab top steel) and 2" (beam and column main steel) except only 1" of cover shall be required on the undersides of slabs. Minimum cover of 3" shall be provided for concrete in contact with the earth.
11. Concrete slabs poured on grade shall be a minimum of 5" thick, placed over 12" of structural fill, and reinforced with welded wire fabric.
12. No materials containing intentionally added chloride ions shall be used in concrete.
13. Control joints in slabs on grade shall be arranged so that the long-side panel dimension does not exceed the short-side panel dimension by more than 75% ($A \leq 1.75B$). Panel area shall not exceed 600 sq.ft. with a maximum of 25 feet between control joints.
14. Control joints shall not be saw cut; joints shall be tooled and sealed. Construction and control joints shall be sealed with a high quality, flexible polyurethane sealant (IT-S-227E, Class A, Type 1 or 2 two component). A five year guarantee shall be provided.
15. Joints between precast deck elements and at connection pockets shall be filled with a two component polyurethane non-sag sealant.
16. Expansion joint shall be adequate in number, properly placed, watertight and easily maintained. The expansion joint seal system shall be a complete system of compatible materials designed by the manufacturer to produce a waterproof, traffic-bearing expansion joint seals as detailed on the drawings. The elastomeric joint shall be performed to a continuous length.

Section 7 - Mechanical

1. Piping shall be located and installed so that it does not reduce vertical minimum clearances. Sleeving through beams, when provided, shall be protected from rusting. Ferrous sleeves shall be hot-dipped galvanized. Sheet metal sleeves are not permitted.

2. Water shall be supplied at convenient locations on each floor, with adequate pressure for cleaning the facility using 100 feet of 3/4" hose. The water system shall be designed to prevent freezing without interrupting water to other portions of the parking structure. Piping is to be exposed, neatly and securely fastened to the surface of the structure, and located so it is not damaged by vehicles or subject to vandalism. Hose connections and valves shall not protrude in such a way as to present a safety hazard to pedestrians.
3. Sprinkler and fire alarm systems shall be provided as required by code. Sprinkler systems, if required, shall be air supervised dry systems.
4. Standpipe systems shall be dry stems. Hose connections and valves shall meet local fire department requirements and shall not protrude in such a way as to present a safety hazard to pedestrians.
5. Floor drains shall be of adequate size and located frequently enough to effectively capture run-off, floor drains in driving aisles should be avoided.
6. Heavy-duty cast-iron, vandal-resistant drains with strainers shall be used. Set drains below the finished floor elevations and finish slab down to the drains to insure the low points do not occur immediately adjacent to the drains.
7. Storm water drain lines, including leaders from the roof of elevator banks and stairwells, shall be protected from damage by vehicles. Exposed roof leader shall be fabricated of a non-rusting material.
8. Ice melting systems shall not be considered.
9. Thermostat control on all HVAC systems.
10. Tempered heat and HVAC installation required on pedestrian overhead bridge, at elevator machine room, in office (if included in layout), and water closet.

Section 8 - Electrical

1. Electrical service, adequate to meet the parking structure and pedestrian bridge requirements, shall be connected to the appropriate electric power company source by an underground service entrance.
2. Every effort should be made to utilize exposed conduit wherever possible. Only schedule rigid galvanized conduits shall be used. For rigid conduit, utilize threaded connectors only. Except where otherwise required by code they shall be run exposed and attached to the surface of the underside of slabs, or the surface of beams, columns, and walls, unless otherwise approved. Where exposed conduits encounter obstructions, the obstructions shall be sleeved to accept the conduit. Ferrous sleeves shall be hot-dipped/galvanized. Sheet metal sleeves are not permitted.

3. Central lighting control panels, secure from unauthorized use or tampering, shall be provided. Circuit outside lights separate from interior lights. No more than two floors may be controlled by a single control point.
4. Any switches, controls, or thermostats not in the central panel shall not be easily accessible to the public, or be protected from unauthorized use.
5. No aluminum wire shall be used.
6. Electrical outlets (20 amp - 120 volt) shall be provided at each stairwell and on each level inside each elevator lobby.
7. Car charging stations shall be provided on the grade level in an appropriate location as directed by the city.
8. The lighting system design shall address the following:
 - a. Lighting intensity shall consider the intensity of natural light as it relates to various parts of the parking structures.
 - b. Visibility shall be optimized with respect to the vertical and horizontal planes and uniformity of illumination.
 - c. Lighting appearance, color, and intensity shall be shielded by baffles to protect glare from adjacent buildings.
9. The lighting system shall be economical, efficient, and provide for minimum maintenance.
 - a. It shall be energy efficient.
 - b. Fixtures shall use tamperproof fasteners, be vandal resistant and be weather resistant wherever such fixtures are readily available.
 - c. Fixture locations shall be easily accessible for maintenance.
 - d. Fixtures shall be rated for a damp location.
10. Minimum illumination levels measured at the floor level and 30" above the floor level, shall be determined through photometric analysis and established based upon structural system method or operation and user groups to be served.
11. Minimum average and initial uniformity shall meet National Parking Association (NPA) recommendations for lighting of parking structures as well as the following:

Area	Sustained Intensity (EC)
Driving Aisles	10

Parking Areas	5
Roof	2 - 3
Lobby/Landing Areas of Stairs and Elevators - Entry/Exit Locations	20-40

The above average sustained illumination intensities shall be produced by a lighting system with an average/minimum uniformity ratio not exceeding 3/1. Point-by-point computer printouts are required to verify this performance. Proposed location of lighting shall be coordinated with structural system.

12. Lighting shall be controlled per owner requirements as determined by MEP consultant. Fixtures located to the interior of the structure on the parked levels and in all stair and elevator lobbies shall be on 24hours a day 7 days a week. Fixtures located to the exterior of the structure on the parked levels where adequate daylight exists shall be controlled either by photocells, timers or both, separately as determined by owner and MEP consultant.
13. Fixture Types: LED with pendant mounting similar to 1G Series by Cree.
 - a. Parking Areas – 120 - 227V White, 33 or 66 Watts, programmable multi-level luminaries and LED’s with plastic, aluminum or stainless steel housings, tamperproof fasteners, and vandal resistant ceiling mounts.
 - b. Stairwells and Lobby/Landing Areas - LED’s or 4’ florescent or 2 - T8 bulbs in plastic, aluminum or stainless steel housings, tamperproof fasteners, vandal resistant wall or ceiling mounted luminaries.
 - c. Roof - Pole mounted, anodized aluminum, 150 watt or 250 watt LED Fixture, medium cutoff, high impact lens, enclosed and gasketed, with integral ballast and adjustable knuckle shall be specified. Anodized hinged aluminum poles shall be provided. Poles where required location is on the perimeter are to hinge inward. Other poles must hinge so as not to meet obstructions.
 - d. Stair/Exit Signs - Self luminous, LED vandal resistant exit signs with emergency backup.
 - e. Traffic Control Signals – shall be provided at entry/exit lanes.
14. An emergency lighting system, in accordance with code requirements, shall be provided. Sealed maintenance-free lead-calcium batteries shall be used. There shall be no appreciable interruption of illumination during changeovers between power systems.
15. Circuits to serve elevator motors shall be sized in accordance with the needs of the specific elevator equipment.
16. Communication conduit from elevator machine room will be provided.
17. Provide P/V panels on roof.

Section 9 - Parking Control System

To be determined in compliance with system configurations and method of operations.

Section 10 - Elevators

1. Elevators shall be provided as shown on the plans.
2. Each elevator at the facility shall have a 3,500 lb. capacity with a speed of @ 350 fpm.

Section 11 - Paints and Coatings

1. Painting of any elements of the structure shall be compatible with the substrate.
2. Do not paint stainless steel, galvanized and non-ferrous metal surfaces.
3. Work performed shall be guaranteed in writing free of defects relating to workmanship or material deficiency for a minimum of eighteen (18) months from date of final acceptance.
4. Double line (heavy traffic paint) floor stripes shall be provided in color to be determined.
5. Apply vandal resistant coatings to all surfaces at grade and in all lobbies.

Section 12 - Signage

1. Signage for parking structures shall consist of a system of signs and graphics which shall provide garage users with essential directional information, safety/security, proper traffic flow and use of parking spaces, designed to present a coordinated appearance.
2. The following is a partial list of signs that shall be considered:

Exterior

- Entrance
- Clearance
- Garage Full - electrically operated

- Hours of Operation
- Parking Regulations and Rates
- Exit - Do Not Enter

Interior

- Park

- Handicapped Parking
 - Van Accessible Parking
 - Elevator
 - Stair
 - Exit
 - No Exit (for dead ends)
 - Parking Level Numbers
 - Stop
 - Do Not Enter
 - In Case of Fire (pictograph)
 - Elevator Car Number
 - Room Designations
 - Other direction signs as needed
3. Traffic control signs at driving lanes, if required, to and from the parking structures, and any associated exterior surface parking, shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, FHWA.
 4. The background color of similar sign types in the parking structures shall be uniform and not vary by level (except tier designations). Different sign types such as driver and pedestrian oriented signs may have different background color.
 5. Vehicular signs shall have reflective number, letters and symbols. Pedestrian signs may be painted. Backs of sign shall be painted.
 6. Parking level indicators are required and will be coordinated with elevator cab buttons.
 7. Signs shall be aluminum alloy, minimum sheet thickness .0125 inches, complying with strength and durability properties specified in ASTM B-209 for 5005-H15.

Section 13 - Miscellaneous

1. Provide a snow gate on the roof at an appropriate location.
2. Products without an initial warranty duration of eighteen (18) months shall not be used.
3. Study timing of traffic lights at the Pearl/Lincoln intersection and at the entry/exit location to provide a layout that permits an adequate exit flow.

City of Biddeford Parking Facility

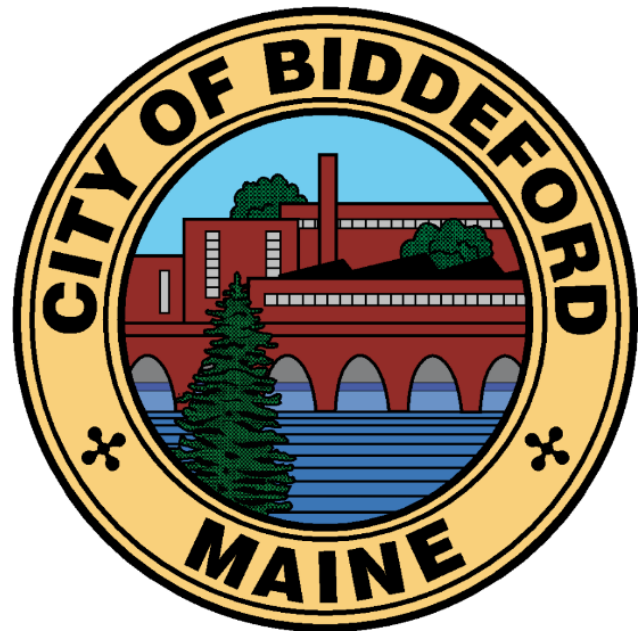
Biddeford, ME

Outline Project Specifications

May 31, 2018

Client:

City of Biddeford
205 Main Street
Biddeford, ME 04005



Engineer / Architect of Record

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Cost Estimating

PM+C
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Hingham, MA 02043

Geotechnical Engineer

Geotechnical Partnership
45 New Ocean St.-Suite A
Swampscott, MA 01907

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

- A. The work includes excavation and backfilling for building and structures, preparing subgrades for walks, pavements, turf and grasses, and plants, subbase course for walks and pavements, and excavating and backfilling for utility trenches as herein specified and as shown on drawings.

1.2 QUALITY ASSURANCE

- A. Pre-excavation Conference: Conduct conference at Project site.

1.3 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 6 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.2 ACCESSORIES

- A. Warning Tape: Comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.

3.2 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.

3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

3.6 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.7 UTILITY TRENCH BACKFILL

- A. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- B. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.8 SOIL FILL

- A. Place and compact fill material in layers to required elevations as follows:
 1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.

3.9 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

3.10 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations.

3.11 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades in layers of equal thickness as shown in cross-sections and elevations.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections as required by accepted standards and practices.

3.13 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 02300

SECTION 02370
SEDIMENTATION AND EROSION CONTROL MEASURES

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

- A. Work under this section includes the furnishing of all materials, labor and equipment to place and maintain the work of this section as shown on the drawings and specified herein, including, but not limited to the following:
1. Soil erosion and sediment control shall include implementation and maintenance of soil erosion and sediment controls devices and construction methods, as shown on the plans, which will reduce or prevent soil losses and associated damages from sedimentation during construction of this project. Work shall include, but not necessarily be limited to the following:
 - a. Install and maintain silt fence where shown on the plans.
 - b. Install and maintain construction entrance pad(s) at all access points.
 - c. Install and maintain inlet protection at the locations shown on the plans.
 - d. Install and maintain diversion swales and/or berms as required during construction.
 - e. Plant and maintain temporary seeding to control surface runoff by site conditions.
 - f. Construct and maintain stockpile areas as shown on the plans.
 - g. Install and maintain tree protection during construction.
 - h. Implement ongoing dust control.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: All materials and construction methods shall conform to Maine Department of Transportation, "Standard Specifications," November 2014 edition.
- B. Workmen: all workmen shall be thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Filter fabric fencing shall be a non-woven filter fabric having a weight of at least 2-1/2 ounces per square yard, a thickness of at least 17 mills, a co-efficient of not less than .0009 centimeters per second.

PART 3 - EXECUTION

- A. Filter fabric fencing shall be installed by the Contractor in locations shown on the plans, in accordance with the details shown on the plans.
- B. Contractor shall inspect erosion controls weekly and after storm events.
- C. Filter fabric fencing shall be installed by the Contractor in locations shown on the plans.
- D. Contractor shall inspect erosion controls weekly and after storm events. Inspection reports shall be prepared and kept on-site.

END OF SECTION 02730

SECTION 02510

WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves:

- a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

- 1) Standard: AWWA C500.
- 2) Minimum Pressure Rating: 200 psig (1380 kPa).
- 3) End Connections: Mechanical joint.
- 4) Interior Coating: Complying with AWWA C550.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping shall be the following:
 - 1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
- F. Underground Fire-Service-Main Piping shall be the following:
 - 1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used.

3.4 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. Comply with NFPA 24 for fire-service-main piping materials and installation.
- C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- D. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- E. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

3.6 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - 2. Fire-Service-Main Piping: According to NFPA 24.

3.7 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

3.8 CONNECTIONS

- A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.9 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
- C. Prepare reports of testing activities.

3.10 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 2 Section "Earthwork."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel.

END OF SECTION 02510

SECTION 02630

STORM DRAINAGE

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

1. Work includes all storm drainage improvements including installation of new pipe, installation of new catch basins, installation of yard drains, installation of area drains, rerouting of existing storm drainage pipe, and all associated fittings as shown on the drawings.

1.2 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: All materials and construction methods shall conform to Maine DOT – “Standard Specifications” November 2014.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

- A. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294M, Type S, with smooth waterway for coupling joints.

2.2 MANHOLES

- A. Standard Precast Concrete Manholes: Shall conform to Maine DOT – “Standard Specifications” Section 604.

2.3 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: Shall conform to Maine DOT – “Standard Specifications” Section 604.

2.4 YARD AND AREA DRAINS

- A. Yard and Area Drains: Shall conform to Maine DOT – “Standard Specifications” Section 604 and/or shall conform to details as shown on the plans.

2.5 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

- A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

3.3 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions

3.4 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.6 CHANNEL DRAINAGE SYSTEM INSTALLATION

- A. Install with top surfaces of components, except piping, flush with finished surface.

3.7 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
 - 1. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- B. Pipe couplings and expansion joints with pressure ratings at least equal to piping rating may be used unless otherwise indicated..

3.8 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

3.9 FIELD QUALITY CONTROL

- A. Conduct testing as required by applicable standards and acceptable practices during installation and once installation is complete.

END OF SECTION 02630

SECTION 02741 - ASPHALT PAVING

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

- A. The work includes cold milling of existing hot-mix asphalt pavement, hot-mix asphalt paving, hot-mix asphalt paving overlay, and pavement-marking paint.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Maine DOT Standards Specifications for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- C. Preinstallation Conference: Conduct conference at Project Site.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Aggregate (Coarse, Fine, and Filler Material): As defined in Maine DOT "Standard Specification" November 2014.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: As defined in Maine DOT "Standard Specification" November 2014.
- B. Tack Coat As defined in Maine DOT "Standard Specification" November 2014.

2.3 AUXILIARY MATERIALS

- A. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

2.4 MIXES

- A. Hot-Mix Asphalt: As defined in Maine DOT "Standard Specification" November 2014.

PART 3 - EXECUTION

3.3 EXAMINATION

- A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.4 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

3.5 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.

3.6 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

3.7 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

3.8 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

3.10 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated on drawings.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the accepted industry standards.

3.11 PAVEMENT MARKING

- A. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Replace and compact hot-mix asphalt where core tests were taken.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 02741

SECTION 02751

CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

- A. The work includes providing cast-in-place concrete as defined herein for driveways, roadways, and walks as shown on drawings.

1.2 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- D. Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project.

2.3 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

2.4 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II

2.5 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301.
- B. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Proof-roll prepared subbase surface below to identify soft pockets and areas of excess yielding.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.3 CONCRETE PLACEMENT

- A. Comply with ACI 301 requirements for measuring, mixing, transporting, placing, and consolidating concrete.

3.4 CONCRETE PROTECTION AND CURING

- A. Comply with ACI 308.

3.5 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117.

3.6 PAVEMENT MARKING

- A. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates.

3.7 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

SECTION 02920

TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.
 - a. Turfgrass (lawn) species

B. DESCRIPTION OF WORK

1. Provide all materials and equipment, and do all work required to complete the loaming, seed bed preparation, seeding and maintenance through establishment.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work experience includes installation of turfgrass (as well as conservation applications, such as native grasses and wildflower seeding).

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

B. Soil Analysis: Furnish soil analysis by the Maine Soil Testing Laboratory stating percentages of organic matter; gradation of sand, silt and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the topsoil. Recommendations and reporting shall include the following:

1. Report suitability of tested soil for turf and conservation cover, including wildflowers.
2. Recommendations:
 - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendment to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Reported presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
 - c. Evidence of invasive or noxious plant material, including root fragments and seeds

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

PART 2 - PRODUCTS

2.1 SEED

- A. All seed shall be certified as to mixture and shall conform to the following requirements:
 - 1. Percent germination >80%
 - 2. Pure live seed >85%
 - 3. Percent Purity >85%
 - 4. Weed Seed <1%
 - 5. Inert Matter <7%
 - 6. All seed shall be from the current year's crop unless recent tests by an approved testing agency demonstrate that older seed meets the above requirements.
- B. Seed Species: State-certified seed of grass species as follows:
 - 1. Turfgrass Mix: Proprietary, as noted, or similar approved, proportioned by weight as follows:

Botanical Name	Common Name	Percentage
Festuca rubra var. rubra (endophyte enhanced)	Creeping Red Fescue	15.00%
Lolium multiflorum	Perennial Ryegrass	15.00%
Poa pratensis 'KenBlue'	Kentucky Blue Grass	35.00%
Festuca rubra var. commutate 'Tiffany'	Chewings Fescue	15.00%

- C. Proprietary Mixes:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work are as follows.
 - a. Turfgrass Seed: Park Mix by Allen, Sterling & Lothrop, Falmouth, ME.; tel. 207-781-4142.
 - b. Turfgrass Seed: Park Mix, Approved Equal

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
- B. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- C. Aluminum Sulfate: Commercial grade, unadulterated.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.
- F. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (12.5-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

2.4 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 15 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: As recommended by the Maine Soil Testing Service based on the submitted soil samples for the project.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: As recommended by the Maine Soil Testing Service based on the submitted soil samples for the project.

2.5 PLANTING SOILS

- A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Amend soil as recommended by the Maine Soil Testing Service based upon the submitted soil samples for intended use.

2.6 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches (150 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 2. Spread planting soil to the specified minimum depth but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Turfgrass Mix Areas: Topsoil depth of 4 inches minimum.
- B. Unchanged Subgrades: If seeding in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 6 inches (150 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches (150 mm) of soil. Till soil to a homogeneous mixture of fine texture.
 - 3. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- C. Finish Grading: Grade seeding areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake,

remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

- D. Moisten prepared area before seeding if soil is dry. Water thoroughly and allow surface to dry before seeding. Do not create muddy soil.
- E. Before seeding, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees, shrubs or within defined planting beds. Limit extent of seed to outside edge of planting saucers.
- B. Sow seed at a total rate indicated on the plans and/or according to the application rate recommended by the manufacturer for the season of application.
 - 1. Turfgrass Seed
 - a. Application. Sow by hand or broadcast spreader in areas under an acre at a rate of 1 lb. per 200 square feet.
- C. Lightly rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.
- D. Roll surface with a hand-powered lawn roller to ensure even seed to soil contact
- E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.3 MAINTENANCE

- A. Turfgrass:
 - 1. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - a. Provide and maintain temporary piping, hoses and watering equipment as required to convey water from sources to planted areas.

- b. Schedule watering to prevent wilting, puddling, erosion and displacement of seed or mulch, Lay out temporary watering system to avoid pedestrian and newly planted areas.
 2. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height of 2-1/2 to 3 inches without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

3.4 SATISFACTORY COVERAGE

- A. All seeding installations shall meet the following criteria as determined by Landscape Architect:
 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
- B. Use specified materials to reestablish Seeded Turf that does not comply with requirements and continue maintenance until coverage is satisfactory.

END OF SECTION 329200

SECTION 02930

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plants.
 - 2. Planting soils.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils with stabilized organic soil amendments to produce topsoil or planting soil.
- E. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- F. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

- A. Product Data: From manufacturer for each type of manufactured soil amendment
- B. Soil Test Reports: For existing surface soils to be reused on site and imported topsoil
- C. Source List(s) of ordered plant materials to be installed, including supplier, size, genus, species and cultivars.
- D. Formal Requests for Substitutions. Requests for substitutions, which must be approved by the Landscape Architect and submitted in writing in conjunction with the Source List.
- E. Schedule for Planting Activities: Indicating anticipated planting dates for all areas.
- F. Load lists for all plant material delivered and off-loaded to the site. Load lists must be presented to the Landscape Architect at the time of delivery and plant inspection.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
- B. Soil Analysis: Furnish soil analysis by the Maine Soil Testing Laboratory stating percentages of organic matter; gradation of sand, silt and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the topsoil. Recommendations and reporting shall include the following.
 - 1. The soil-testing laboratory shall oversee soil sampling.
 - 2. Report suitability of tested soil for plant growth.
 - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
- C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- D. Pre-installation Conference: Conduct conference with landscape installer and Contractor at time of pre-construction conference.
- E. Owner's Inspection and Testing: Work will be subject to inspection at all times by the Landscape Architect. The Landscape Architect reserves the right to reject any and all materials or work not conforming to the plans and specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- B. Exercise care in handling plant materials to avoid damage or stress. Handle planting stock by root ball.
- C. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
- D. On-site storage of plant materials: Plants shall be placed in a location protected from direct sun and construction activities. All plant material shall be watered regularly. The Landscape Architect reserves the right to reject any stored plant material exhibiting signs of stress.

1.6 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods from Date of Substantial Completion or Planting Completion, whichever is later.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

1.7 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established.

1.8 FINAL INSPECTION AND ACCEPTANCE

- A. At the end of the warranty period, the Landscape Architect will, upon written notice of end of guarantee period, inspect the work for Final Acceptance. Request shall be received at least ten calendar days before the anticipated date for Final Inspection.
- B. Upon completion and re-inspection of full repairs or replacements necessary in the judgment of the Landscape Architect. At that time, the Landscape Architect will recommend to the Owner that Final Acceptance of the Work of this Section be given.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- C. Herbaceous Plant Material: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery, and remove all active blooms prior to planting.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
- B. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- C. Aluminum Sulfate: Commercial grade, unadulterated.
- D. Perlite: Horticultural perlite, soil amendment grade.

- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (13-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
- B. Manure: Well-rotted, un-leached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen (N), Phosphorus (P) and Potassium (K) in amounts recommended by the Maine Soil Testing Service based on the submitted soil samples.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen (N), Phosphorus (P) and Potassium (K) in amounts recommended by the Maine Soil Testing Service based on the submitted soil samples.
- C. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 - 1. Size: 5-gram tablets.
 - 2. Nutrient Composition: As recommended by the Maine Soil Testing Service based on the submitted soil samples.

2.5 PLANTING SOILS

- A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 5 percent organic material content. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with the soil amendments in the quantities recommended for ornamental plantings by the Maine Soil Testing Service based on the submitted soil samples.

2.6 MULCHES

- A. Organic Mulch: Ground or shredded well-composted and screened pine bark.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

PART 3 - EXECUTION

3.1 LAYOUT

- A. Layout individual tree and shrub locations and planting beds, or areas for multiple or mass plantings. Stake locations, outline plant bed areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make subsequent adjustments as required
- B. Protect adjacent areas and site features from damage caused by planting operations. All damage caused by the Contractor or his work shall be the responsibility of the Contractor to repair or rectify at no additional cost to the Owner.

3.2 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 12 inches (300 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Thoroughly blend planting soil before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 2. Spread planting soil to a depth of 12 inches (300 mm) but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - 3. Do not add soil amendments to individual planting pits. Reuse native soils, and where necessary, supplement pit material by mixing with prepared imported soils.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away

from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately two times as wide as ball diameter.
2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

- B. Subsoil and topsoil removed from excavations may be used as planting soil provided it meets the specification requirements for Planting Soils.

3.4 TREE AND SHRUBS PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set stock plumb and in center of planting pit or trench with root flare 1 to 2 inches above adjacent finish grades.

1. Use planting soil for backfill.
2. Balled and Burlapped: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
4. Fabric Bag-Grown Stock: Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
5. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
6. Continue backfilling process. Water again after placing and tamping final layer of soil.

- D. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.5 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut

tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

3.6 HERBACEOUS PLANT PLANTING

- A. Set out and space herbaceous plants as indicated in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.7 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch (75-mm) average thickness, with 24-inch (600-mm) radius around trunks or stems. Do not place mulch within 3 inches (75 mm) of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches (75 mm) of trunks or stems.

3.8 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and through warranty period. Treat, repair, or replace damaged plantings.

END OF SECTION 329300

SECTION 02945

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 DEFINITIONS

- A. Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.0 times the diameter of the drip line unless otherwise indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.

- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
- B. Topsoil: Stockpiled topsoil from location shown on Drawings.
- C. Organic Mulch: Ground, sifted, composted pine bark free from deleterious materials.
- D. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Architect.
 - 1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch (50-mm) opening, 0.148-inch- (3.76-mm-) diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- (60-mm-) OD line posts, and 2-7/8-inch- (73-mm-) OD corner and pull posts; with 1-5/8-inch- (42-mm-) OD top rails and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - 2. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch (50-by-100-mm) rails, with 4-by-4-inch (100-by-100-mm) preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
 - 3. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch (50-by-100-mm) horizontal rails, with 4-by-4-inch (100-by-100-mm) preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart, and lower rail set halfway between top rail and ground.
 - 4. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet (2.4 m) apart. High-visibility orange color, nonfading.
 - 5. Height of Fencing: 4 feet (1.2 m) minimum.
 - 6. Gates: Swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones.
- E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree Protection Zones: Provide tree protection of the Critical Root Zone (CRZ).
 - 1. The CRZ shall be defined as the area for each tree which contains the estimated minimal amount of both structural and feeder roots that must be protected to minimize tree damage and retain structural stability.
 - 2. The CRZ for each tree is calculated based on the Tree Species Tolerance to construction impacts and age class, as outlined in the International Society of Arboriculture's *Best Management Practices: Managing Trees During Construction* (K. Fite, T. Smiley, 2008). Although CRZs will differ by species and tree age, zones range from ½ foot per one inch DBH (diameter at breast height) to 1½ foot per one inch DBH. If the species tolerance is unknown, then the 1½ foot per one inch DBH standard is assumed.
 - 3. To the extent possible, the Contractor shall limit encroachment of the CRZ during construction activities.

3.2 CONSTRUCTION ACTIVITIES

- A. Extreme care must be exercised in removing curbing, sidewalk or pavement in the CRZ, lifting rather than dragging paving pieces. Tools and equipment for this activity shall be approved by the Engineer prior to the start of excavation.
- B. Any excavation for utility or infrastructure installation within a CRZ shall be done by hand or pneumatic excavation, or micro tunneling. Trenching shall not occur within the CRZ unless absolutely necessary and without prior approval of the Engineer.
- C. Where such excavation does occur for the removal of existing features or the installation of new work, the excavated area shall be backfilled immediately. Exposed roots shall be covered with burlap or other approved material, and kept constantly moist. Burlap shall be checked a minimum of two (2) times a day, once in the morning and once in the afternoon in order to maintain appropriate levels of moisture, until backfill is complete. If directed, soaker hoses shall be installed to facilitate properly moist conditions of excavated areas.
- D. Adjustments in grades shall meet the following considerations:

1. Soil Removal. Any removal of soil within the CRZ shall be performed under the supervision of a Consulting Arborist. Soil removal within the CRZ shall be as described herein.
2. Soil Addition. Soil addition of up to three (3) inches additional depth *may* be permitted with the written approval of the Engineer.

3.3 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Do not allow exposed roots to dry out before placing permanent backfill.

3.4 ROOT PRUNING

- A. No roots over one (2) inch diameter should be shaved or cut without the approval of the Engineer. If small roots must be cut this should be done with a sharp implement to leave a clean finish. Use of heavy equipment such as a backhoe to cut roots is prohibited.

3.5 CROWN PRUNING

- A. If clearance pruning is proposed, it shall not take place without the written permission of the Engineer, and shall only be performed with professional equipment as per the City's standards and specifications for such work.
- B. No trees shall be pruned or removed without the written permission of the Engineer. Tree work is to be performed by an arborist holding certification from the International Society of Arboriculture (ISA). The City Arborist is to receive notification 48 hours before any tree work is to begin:

3.6 REGRADING

- A. Adjustments in grades shall meet the following considerations:
 1. Soil Removal. Any removal of soil within the CRZ shall be performed under the supervision of a Consulting Arborist. Soil removal within the CRZ shall be as described herein.
 2. Soil Addition. Soil addition of up to three (3) inches additional depth *may* be permitted with the written approval of the Engineer.

B. FIELD QUALITY CONTROL

- C. Inspections: All construction activities in the CRZ of trees to remain shall be coordinated with and approved by the Engineer.

3.7 GENERAL REQUIREMENTS

A. In addition to the requirements above:

1. All contact between equipment and overhead tree limbs should be avoided. Bending or breakage of limbs is prohibited.
2. Stockpiling of materials. Under no circumstances should equipment and materials be stockpiled within the CRZs
3. Disposal of wastewater and other debris. No contaminants or wastewater from construction activities should be disposed of within or around protected areas.
4. Parking. No vehicle shall be parked within or driven onto CRZs
5. Exhaust fumes and excessive heat should always be directed away from trees to prevent scorching.
6. Trees within and directly adjacent to the construction area shall be encircled with wooden tree guards. Tree guards shall remain in place through construction and shall be removed upon project completion.

3.8 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

1. Perform the root cutting, branch pruning, and damage repair of trees and shrubs in accordance with standard acceptable practice.
2. Treat damaged trunks, limbs, and roots according to standard acceptable practice and as directed by the Engineer.
3. Perform repairs within 24 hours.
4. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Engineer.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02945

DIVISION 3 – CONCRETE

033000 CONCRETE GENERAL

1. The structure shall be designed and constructed to be durable and minimize maintenance problems.
 - a. The concrete mix for retaining walls, footing and foundation walls, and slab on grade shall be normal weight 4,000 psi 28-day strength proportioned to meet ACI requirements for areas exposed to freeze / thaw and salt or water including limitations on water soluble chloride in the concrete and maximum water/cement ratios.
 - b. A superplasticizer may be used.
 - c. Aggregate conforming to ASTM Standard C-33 shall be used.
 - d. A water/cement ratio of 0.40 or less shall be used
 - e. Freezes-thaw resistance shall be improved by the use of entrained air (minimum 6% \pm 1%) per ACI recommendations (for above grade concrete).
 - f. Shrinkage cracks shall be minimized by recommended practices for placing, finishing, and curing concrete.
2. Slabs poured on grade shall be a minimum of 6" thick, placed over 12" base of structural fill, and reinforced with welded wire fabric.
3. No materials containing intentionally added chloride ions shall be used in any concrete.
4. Control joints in slabs on grade shall be arranged so that the long-side panel dimension does not exceed the short-side panel dimension by more the 75% ($A \leq 1.75B$). Panel area shall not exceed 600 s.f: with a maximum of 25 feet between control joints.
5. Construction and control joints shall be sealed with a high quality, flexible polyurethane sealant (IT-S-227E. Class A. Type 1 or 2 - two component). A five year guarantee shall be provided.

034100 STRUCTURAL PRECAST CONCRETE

1. Work in this section shall include the following:
 - a. Long span precast double tees.
 - b. Structural framing units including light walls, columns, beams and girders.
 - c. Exterior wall panels with architectural finish including thin brick veneer and pigmented concrete.
 - d. Stairs and plank units.
2. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated.
 - a. ACI 301 "Specifications for Structural Concrete for Buildings.
 - b. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - c. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
 - d. Prestressed Concrete Institute MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products".
3. Fabricator Qualifications: Firms which have five years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.

- a. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.
4. Design by Fabricator: Design precast units and connections to support superimposed live and dead loads as indicated on drawings and as required for compliance with local Building Code requirements.
 - a. Provide complete design analysis for the entire structure for all loads as required by code (dead, live, earthquake, wind, thermal stresses, etc.) Calculations shall be prepared and stamped by a Registered Engineer, licensed in State where project is located.
5. Fire-Resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire-resistance classification, provide units tested and listed by U.L. in "Fire-Resistance Directory", with each unit bearing U.L. label and marking, or in accordance with PCI Manual, MNL – 124, "Design for Fire Resistance of Precast Prestressed Concrete".
6. Submittals:
 - a. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.
 - b. Mix Designs: Submit written reports of proposed concrete mix as specified in Part 2 of this section.
 - c. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection. Shop drawings shall be stamped and signed by a Professional Engineer licensed to practice in the State where the project is located.
 - ♦ Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS Standard symbols. Details inserts, connections, and joints, including accessories and construction at openings in precast units.
 - ♦ Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.
 - ♦ Include erection procedure for precast units and sequence of erection.
7. Calculations: Provide stamped and signed design calculations prepared by a registered Professional Engineer licensed to practice in the State where the project is located. Provide complete design analysis for the entire structure, precast units, and connections for all loads as required by code (dead, live, earthquake, wind, thermal stresses, etc.)
8. Samples:
 - a. Submit three sets of samples approximately 12 inches x 12 inches x 3 inches to illustrate the quality, color, and texture of the surface finish for the Architectural Finish precast units; exterior wall panels.
 - b. Full Size Panel: Upon approval of small sample panels, and before fabrication of any other architectural precast concrete work commences, construct one full height panel approximately 8 feet long, and deliver it to the site at a location designated by the Architect. If this panel is approved by the Architect, it shall remain on site and be used as a standard of quality for architectural precast concrete work required for this project.

Fabrication of the architectural precast work shall not commence until on site full size panel has been approved by the Architect.

9. Provide forms and where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.
 - a. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.
10. The structure shall be designed and constructed to be durable and minimize maintenance problems.
 - a. The concrete mix for precast units shall be proportioned to meet ACI requirements for areas exposed to freeze / thaw and salt or water including limitations on water soluble chloride in the concrete and maximum water/cement ratios.
11. Connection Materials: All exposed steel plates, steel shapes, anchor bolts, threaded fasteners and tee flange connectors shall be stainless steel per ASTM A666, Type 304, Grade A36.
12. Concrete Mix: Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.
 - a. Produce standard weight concrete consisting of specified Portland cement, aggregates, admixtures, and water to produce the following minimum properties:
 - ♦ Compressive strength; 5000-psi minimum at 28 days. Release strength for prestressed units: 3500 psi.
 - ♦ Cure compression test cylinders using same methods as used for precast concrete work.

DIVISION 4 - MASONRY

042000 UNIT MASONRY

1. Concrete masonry units:
 - a. Standard units at Storage and Utility Rooms: ASTM C90, Type N, hollow load bearing units with nominal face dimension 16 inches long x 8" high.

DIVISION 5 - METALS

055000 METAL FABRICATIONS

1. Pipe bollards, 6-inch diameter concrete filled galvanized steel pipe.
2. Miscellaneous steel lintels.
3. Steel pipe handrails.
4. Miscellaneous angles.
5. Miscellaneous framing and supports.
6. Elevator divider beams and hoistway beams.
7. Elevator pit ladders.

DIVISION 6 - WOOD AND PLASTIC

061000 ROUGH CARPENTRY

1. Wood nailers and blocking
2. Rough hardware
3. Preservative treated wood for roof blocking

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

075300 SINGLE PLY MEMBRANE ROOFING

1. At canopy over vehicle entrance/exit lanes..
2. Loose laid and ballasted 60 mil reinforced EPDM membrane
3. Flashing at parapets, roof curbs, and roof penetrations
4. Insulation; either extruded polystyrene or polyisobutylene
5. Warranty: 10 years

076000 FLASHING AND SHEET METAL

1. Miscellaneous flashing and sheet metal.

076100 PREFORMED METAL ROOFING AND FRAMING

1. At Stair/Elevator Towers: Preformed roofing system is to include all accessories and trim, gutter and leader systems.
 - a. Hot-dip zinc coated steel sheet, ASTM A446, Grade A except where higher strength required for performance, G90 zinc coating, surface treated for maximum coating performance.
 - b. Fluoropolymer Coating: Full strength 70% "Kynar 500" coating baked on for 15 minutes at 450 degrees F (232 degrees C), in a dry film thickness of 1.0 mil, 30% reflective gloss (ASTM D 523), over min. 0.2 mil baked on modified epoxy primer.
2. Framing: Provide a complete metal framing and support system with deflection limited to L/360 under the full load prescribed by Building Code.

079200 JOINT SEALANTS

1. Elastomeric type: Multi-part non-sag urethane sealant for exterior and interior horizontal and vertical traffic and non-traffic locations
2. Latex type: One part non-sag, mildew resistant acrylic emulsion sealant, paintable, recommended for exposed interior and protected exterior vertical locations where joint movement is less than plus or minus 5 percent
3. Locations:
 - a. Saw cut and construction joints in exposed slab-on-grade
 - b. Masonry control joints
 - c. Perimeter joints around door frames
 - d. Joints between dissimilar materials

DIVISION 8 - DOORS AND WINDOWS

081110 STANDARD STEEL DOORS AND FRAMES

1. Welded steel door frames, galvanized, 3 foot x 7 foot and 6 foot x 7 foot.
2. Hollow metal doors, 18 gauge, galvanized, glazed openings, 3 foot x 7 foot.
3. Doors and frames shall be prime painted and ready for site applied painted finish.

084100 ALUMINUM ENTRANCES AND STOREFRONTS

1. Aluminum entrance doors at stairs, Medium Stile, 1/4 inch clear tempered glass.
2. Finish: PPG Duranar, two coat system, standard color

087100 FINISH HARDWARE

1. Hinges, three per door on all metal doors and rowton hinges at ground floor lobby doors
2. Cylindrical locksets
3. Removable Lock cylinders and keys
4. Manual bolts
5. Key system as approved by Owner
6. Exit devices
7. Closers – LCN or Sargent “Heavy Duty Commercial”
8. Miscellaneous door control devices.
9. Astragals on pairs of doors
10. Thresholds - Aluminum
11. Weather-stripping
12. Stops

088000 GLASS AND GLAZING

1. Curtain wall and Storefront at stairs: 1/4 inch clear glass, tempered where required by code.
2. Entrance doors: 1/4 inch clear tempered glass
3. Fire rated glass: 1/4 inch wire glass

089200 GLAZED ALUMINUM CURTAIN WALLS

1. Curtain wall framing at exterior faces of stair and elevator shafts.
2. Finish: PPG Duranar, two coat system, standard color or clear anodized finish.

DIVISION 9 – FINISHES

099000 PAINTING

1. Paint: Low sheen (eggshell) acrylic latex typical on concrete and drywall. A high performance special paint coating shall be used on all metals and certain areas where Owner requires a more durable paint finish. Substrates to be painted include, but are not limited to:
 - a. Exposed interior masonry
 - b. Exposed miscellaneous metals
 - c. Stairs handrails
 - d. Hollow metal doors and frames
 - e. Piping

DIVISION 10 - SPECIALTIES

104000 IDENTIFYING DEVICES

1. Signage for parking structures shall consist of a system of signs and graphics which shall provide garage users with essential directional information, safety/security, proper traffic flow and use of parking spaces, and a coordinated appearance.
2. Interior signage: To be defined in Design Development.
3. Exterior signage: To be defined in Design Development

105220 FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

1. Fire extinguishers, multi-purpose dry chemical type, 10 lb.
2. Fire extinguisher cabinets, prime painted steel cabinets with vertical duo glass opening

DIVISION 11 - EQUIPMENT

111500 PARKING EQUIPMENT

1. Parking equipment will be provided as part of this project. Conduit shall be provided under the entry/exit slabs for parking equipment. System will contain all necessary equipment (software and hardware) for a functional system including but not limited to:
 - a. Barrier gates
 - b. Detector loops
 - c. Pay-on-foot machines
 - d. Entry stations
 - e. Exit stations
 - f. Control software

DIVISION 14 - CONVEYING SYSTEMS

142200 TRACTION ELEVATORS

1. The extent of elevator work is shown on drawings and in schedule, and is hereby defined to include, but not by ways of limitation, the driving machine, car enclosures, hoistway entrances, guide rails, signals, controls, electrical wiring, plungers, buffers and devices for operating, dispatching, safety, security, leveling and alarm. Except for battery emergency power as required by Code, electrical service to the elevator system is not included as elevator work, and construction of the basic elevator hoistway, pits and machinery rooms complete with access, services and utilities is not included as elevator work.
 - a. The extent of work includes furnishing and installing three traction passenger elevators.
 - b. Power Supply: Refer to Division 16 Sections & Electrical Drawings for current characteristics of power supplied for elevator machinery and for lighting and service outlets, including fused disconnect switches or circuit breakers for power supply line disconnect.
2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - a. Thyssen Krupp Corporation
 - b. KONE, Inc.
 - c. Otis Elevator Co.
 - d. Schindler Elevator Corp.
3. Parking Garage Elevators:
 - a. Capacity and Speed: 3,500 pounds, 350 feet per minute.
 - b. Travel Distance (Approx.): 46 feet.
 - c. Landings Served: 5
 - d. Operation: Microprocessor controller Multiple Car System
 - e. Machine: Overhead machine room-less.
 - f. Power Supply: See electrical.
 - g. Car Enclosure:
 - ♦ Clear Car Inside: 6'-8" wide x 5'-5" Deep.
 - ♦ Doors: Single speed, side opening 3 feet-6 inches wide x 7 feet-0 inches high.
 - ♦ Ceiling Height: 7 feet, 4 inches, min.
 - h. Hoistway Entrances:
 - ♦ Doors: 3 feet-6 inches wide x 7 feet-0 inches high.
 - ♦ Operation: High speed electric power with nudging and time saving features.
 - ♦ Hoistway Access: Key access at all floors.
4. Special Features:
 - a. Emergency lighting in cars.
 - b. Emergency car ventilation system.
 - c. Provisions for telephone.
 - d. Handicap accessibility per code.
5. Auxiliary Operations:

- a. Inspection operation from top of car.
 - b. Fireman's service switch.
 - c. Infrared detector device.
6. Performance Requirements:
 - a. Speed - \pm 10% of contract speed under any loading condition.
 7. Side Walls: Side Walls: Minimum 18 gauge rigidized stainless steel with a No. 302 Sheffield pattern, satin finish similar to Rigid-Tex metal pattern No. 5WL. Provide two removable panels with edges finished in same material as face. Provide ½ inch reveals between panels with black painted recess.
 8. Back Wall: Laminated safety glass in stainless steel frame.
 9. Provide stainless steel handrail on back wall 1/4 inch x 4 inches high, 32 inches above floor.
 10. Provide applied resilient base black vinyl or rubber, FS SS-W-40A-66, 1/8 inch x 4 inch, with set-on cove base.
 11. Floor Covering: Rubber tile equal to Jason/Pirelli, Low Profile Stud, Series 100. Color to be selected by Architect.
 12. Luminous Ceiling and Lighting: Manufacturer's standard luminous ceiling system, with white, virgin acrylic diffuser panels of either solid pattern or open egg-crate (as selected by Architect), and with single-tube fluorescent fixtures as required to provide initial output at floor of 15 foot-candles with diffuser panels in place.

DIVISION 21 – FIRE SUPPRESSION

211200 FIRE PROTECTION

1. Provide dry fire standpipe system with fire connections located to comply with local authorities.
2. Piping shall be located and installed so that it does not reduce vertical minimum clearances.
3. Hose connections and valves shall not protrude in such a way as to present a safety hazard to pedestrians.

DIVISION 22 – PLUMBING

220000 PLUMBING

1. The plumbing system will consist mainly of storm piping. The storm piping system will consist of heavy-duty floor or area drains on each level. Piping will be cast iron. Piping shall be located and installed so that it does not reduce vertical minimum clearances.
2. Piping is to be exposed, neatly and securely fastened to the surface of the structure, and located so it is not damaged by vehicles or subject to vandalism. Hose connections and valves shall not protrude in such a way as to present a safety hazard to pedestrians.
3. Hose bibs, two per level will be installed on 1” copper piping in the garage at convenient locations for domestic water. The hose bib system will be provided with a draining system to allow for winterization of piping. Water pressure to a hose bib shall be not less than 60 PSI. Each hose bib shall have a keyed valve that is not accessible to the general public.
4. Floor drains shall be of adequate size and located frequently enough to effectively capture runoff, floor drains in driving aisles should be avoided. Floor drains shall be located as required to provide a 2% slope. Trench drains are required at entry/exit lanes (slab on grade).
5. Heavy-duty cast-iron, vandal-resistant drains with strainers shall be used. Set drains below the finished floor elevations and finish slab down to the drains to insure the low points do not occur immediately adjacent to the drains.
6. Storm water drain lines, including leaders from the roof of elevator banks and stairwells, shall be protected from damage by vehicles. Exposed roof leader shall be fabricated of a non-rusting material.

DIVISION 23 – HVAC

230000 HVAC

1. There will be no heating provided for in the garage parking area.
2. Electric unit heaters will be provided for in elevator control room, utility and electrical rooms.
3. Cooling will be provided in the elevator control room.
4. Thermostatic controls shall be installed on all equipment.

DIVISION 26 ELECTRICAL

260000 ELECTRICAL WORK

1. Electrical service, adequate to meet the parking structure requirements, shall be connected the appropriate electric power company source by an underground service entrance.
2. Every effort should be made to utilize exposed conduit wherever possible. Except where otherwise required by code they shall be run exposed and attached to the surface of the underside of slabs, or the surface of beams, columns, and walls, unless otherwise approved. Where exposed conduits encounter obstructions, the obstructions shall be sleeved to accept the conduit. Ferrous sleeves shall be hot-dipped galvanized.
3. Central lighting control panels, secure from unauthorized use or tampering, shall be provided. Circuit outside lights separate from interior lights. Interior lights over the parking area shall consist of a combination of inner and outer rows of lights. No more than two floors may be controlled by a single control point in the office.
4. Any switches, controls, or thermostats not in the central panel shall not be easily accessible to the public, or be protected from unauthorized use.
5. No aluminum wire shall be used.
6. Electrical outlets (20 amp - 120 volt) shall be provided at each stairwell and on each level inside each elevator lobby.
7. The lighting system. design shall address the following:
 - a. Lighting intensity shall consider the intensity of natural light as it relates to various parts of the parking structures.
 - b. Visibility shall be optimized with respect to the vertical and horizontal planes and uniformity of illumination.
 - c. Lighting appearance, color, and intensity shall be shielded by baffles to protect glare from adjacent buildings.
 - d. It shall be energy efficient.
 - e. Fixtures shall use tamperproof fasteners, be vandal resistant and be weather resistant wherever such fixtures are readily available.
 - f. Fixture locations shall be easily accessible for maintenance.
 - g. Fixtures shall be rated for a damp location.
8. Minimum illumination levels measured at the floor level and 30" above the floor level, shall be determined through photometric analysis and established based upon structural system method or operation and user groups to be served.
9. Minimum average initial illumination levels and uniformity shall meet National Parking Association (NPA) recommendations for lighting of parking structures as well as the following:

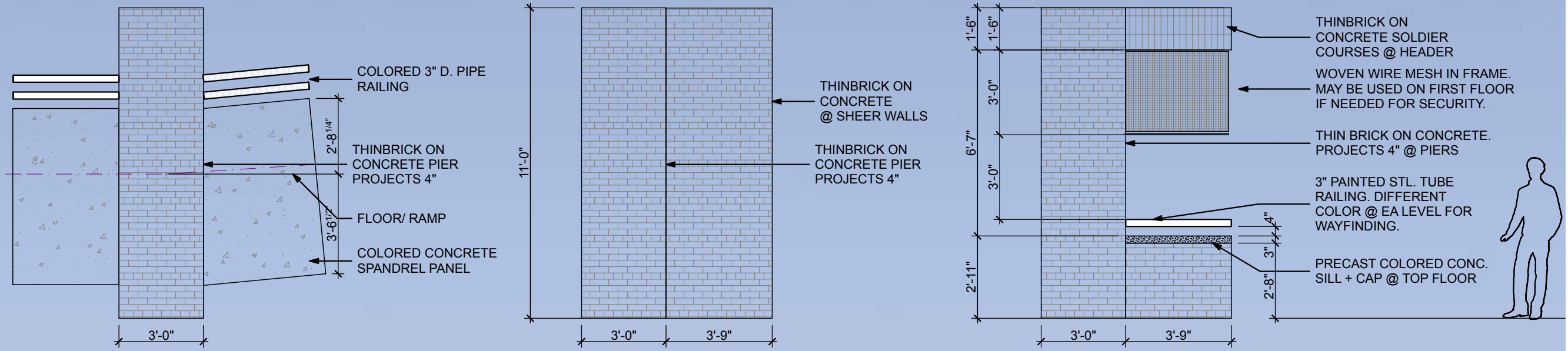
Area	Intensity (EC)
Driving Aisles	10
Parking Areas	5
Roof	2
Lobby/Landing Areas of Stairs and Elevators/Entrance-Exit Lanes	20-40

The above average initial illumination intensities shall be produced by a lighting system with an average/minimum uniformity ratio not exceeding 3/1. Point-by-point computer printouts are required to verify this performance. Proposed location of lighting shall be coordinated with structural system.

10. Lighting shall be controlled by a combination of manual on-off switches to be located in the office. 7 day electronic time switches shall be provided with reserve power, and photo controls.
11. Fixture Types:
 - a. Parking Areas - 100 W LED depending on a lighting analysis, plastic, aluminum or stainless steel housings, metal halide, tamperproof fasteners, vandal resistant ceiling mounted luminaries.
 - b. Stairwells and Lobby/Landing Areas - Fluorescent or metal halide, vandal resistant wall packs.
 - c. Roof- Pole mounted, anodized aluminum, 150 or 250 watt LED luminaire, medium cutoff, high impact lens, enclosed and gasketed, with integral ballast and adjustable knuckle shall be specified. Square anodized hinged aluminum poles shall be provided. . Poles must hinge so as not to meet obstruction.
 - d. Stair/Exit Signs - Self luminous, fluorescent vandal resistant exit signs are to be used.
 - e. Traffic Control Signals - Each vehicle entrance and exit lane shall be controlled by a red or green traffic signal.
12. An emergency lighting system, in accordance with code requirements, shall be provided. Sealed maintenance-free lead-calcium batteries shall be used. There shall be no appreciable interruption of illumination during changeovers between power systems.

261000 POWER

1. Power will be distributed from the electrical room throughout the garage. Convenience outlets will be located throughout the garage. The main power in the garage will be 480 volt, 3 phase. 120-volt power for miscellaneous equipment and outlets will be provided through the use of transformers.
2. Battery back-up exit and emergency lighting will be provided in the facility per code requirements.
3. General site lighting along entrance drive and sidewalk shall be provided.



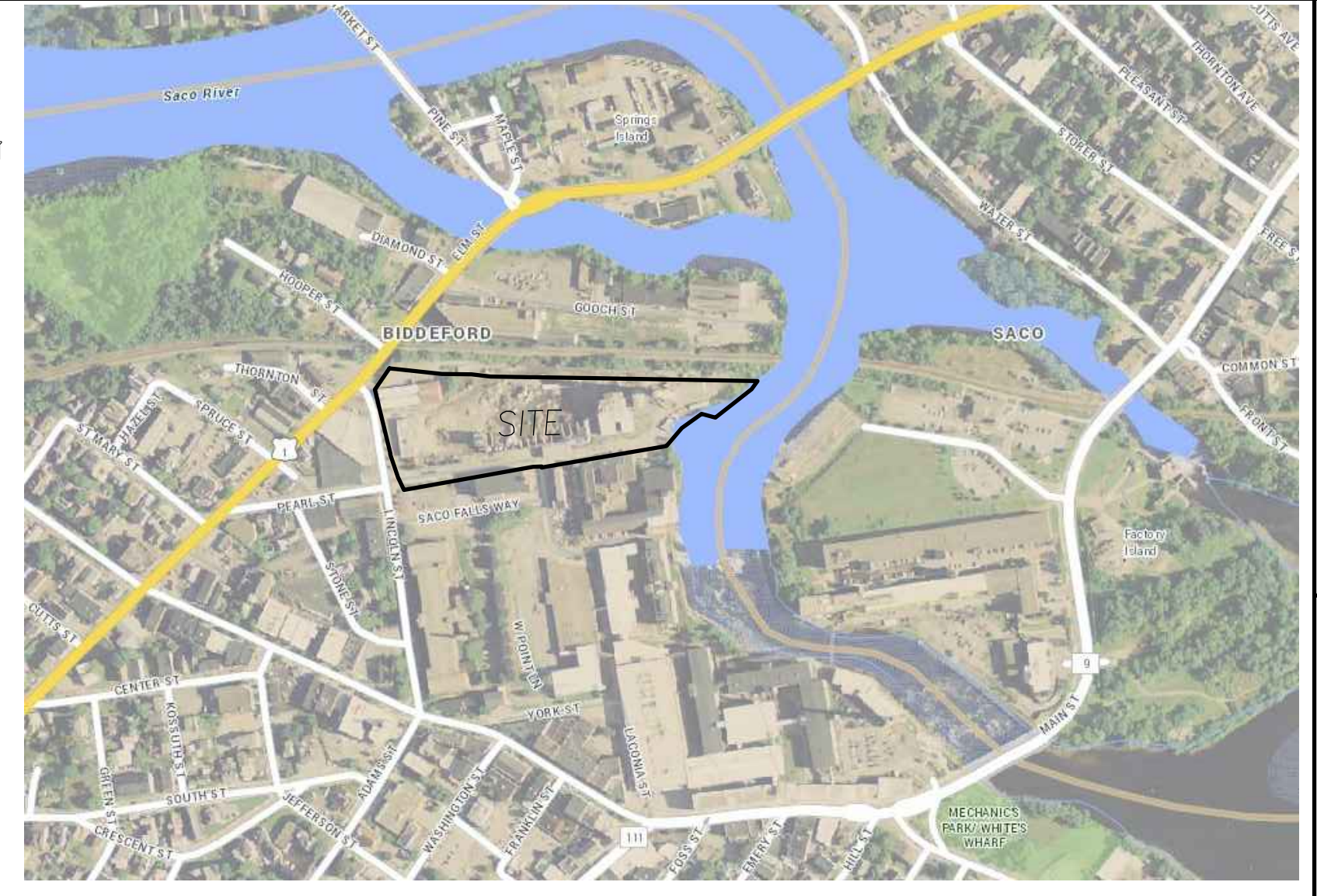
Biddeford Parking Garage

CONCEPTUAL DESIGN

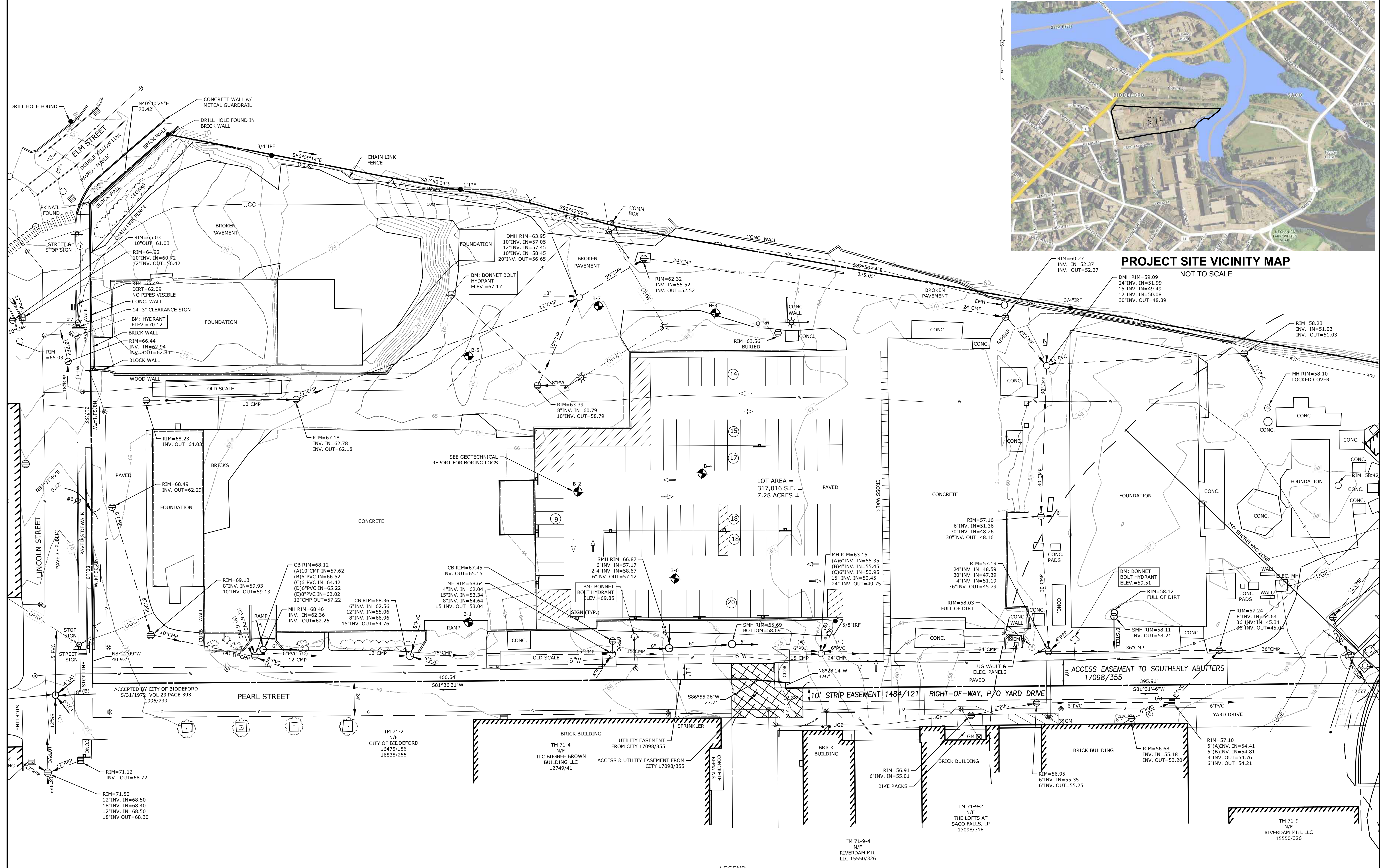
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WHIPPLE |
 CALLENDER
 ARCHITECTS

DESMAN
 Design Management



PROJECT SITE VICINITY MAP
NOT TO SCALE

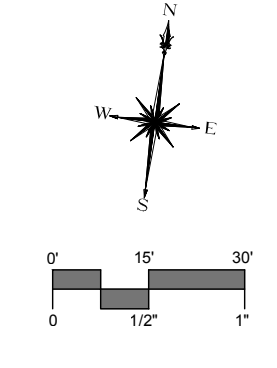


LEGEND

	STREET LINE		WOOD FENCE		CATCH BASIN
	PROPERTY LINE		CHAIN LINK FENCE		FLARED END SECTION
	EASEMENT		OVERHEAD WIRES		GATE POST
	STONEWALL		SANITARY LINE		POST
	WATERCOURSE		GAS LINE		UTILITY POLE
	TREELINE		DRAINAGE MANHOLE		GUY WIRE
	WIRE FENCE		SANITARY MANHOLE		HYDRANT
			MANHOLE		

NOTES:

- TOPOGRAPHIC INFORMATION IS TAKEN FROM MAP PREPARED BY: OWEN HASKELL, INC. ENTITLED: "EXISTING CONDITIONS SURVEY ON PEARL STREET, BIDDEFORD, MAINE", DRAWN AT A SCALE OF 1"=40', DATED APRIL 19, 2018.
- NORTH ARROW, BEARINGS AND COORDINATES ARE BASED UPON THE MAINE STATE PLANE COORDINATE SYSTEM, WEST ZONE (NAD 83).
- INFORMATION SHOWN BEYOND THE LIMITS OF THIS PLAN ARE BASED UPON AVAILABLE MAPPING AND SHOULD BE CONSIDERED APPROXIMATE.
- ELEVATIONS, CONTOURS, AND BENCHMARK ARE BASED UPON NAVD 88 DATUM.



ACCEPTED BY CITY OF BIDDEFORD
5/31/1972 VOL 23 PAGE 393
1996/739

TM 71-2
N/F
CITY OF BIDDEFORD
16475/186
16838/255

BRICK BUILDING
TM 71-4
N/F
TLC BUGBEE BROWN
BUILDING LLC
12749/41

UTILITY EASEMENT
FROM CITY 17098/355

ACCESS & UTILITY EASEMENT FROM
CITY 17098/355

BRICK BUILDING
TM 71-9-2
N/F
THE LOFTS AT
SACO FALLS, LP
17098/318

BRICK BUILDING
TM 71-9-4
N/F
RIVERDAM MILL
LLC 15550/326

BRICK BUILDING
TM 71-9
N/F
RIVERDAM MILL LLC
15550/326

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN DEVELOPMENT

NOT FOR CONSTRUCTION

ISSUE

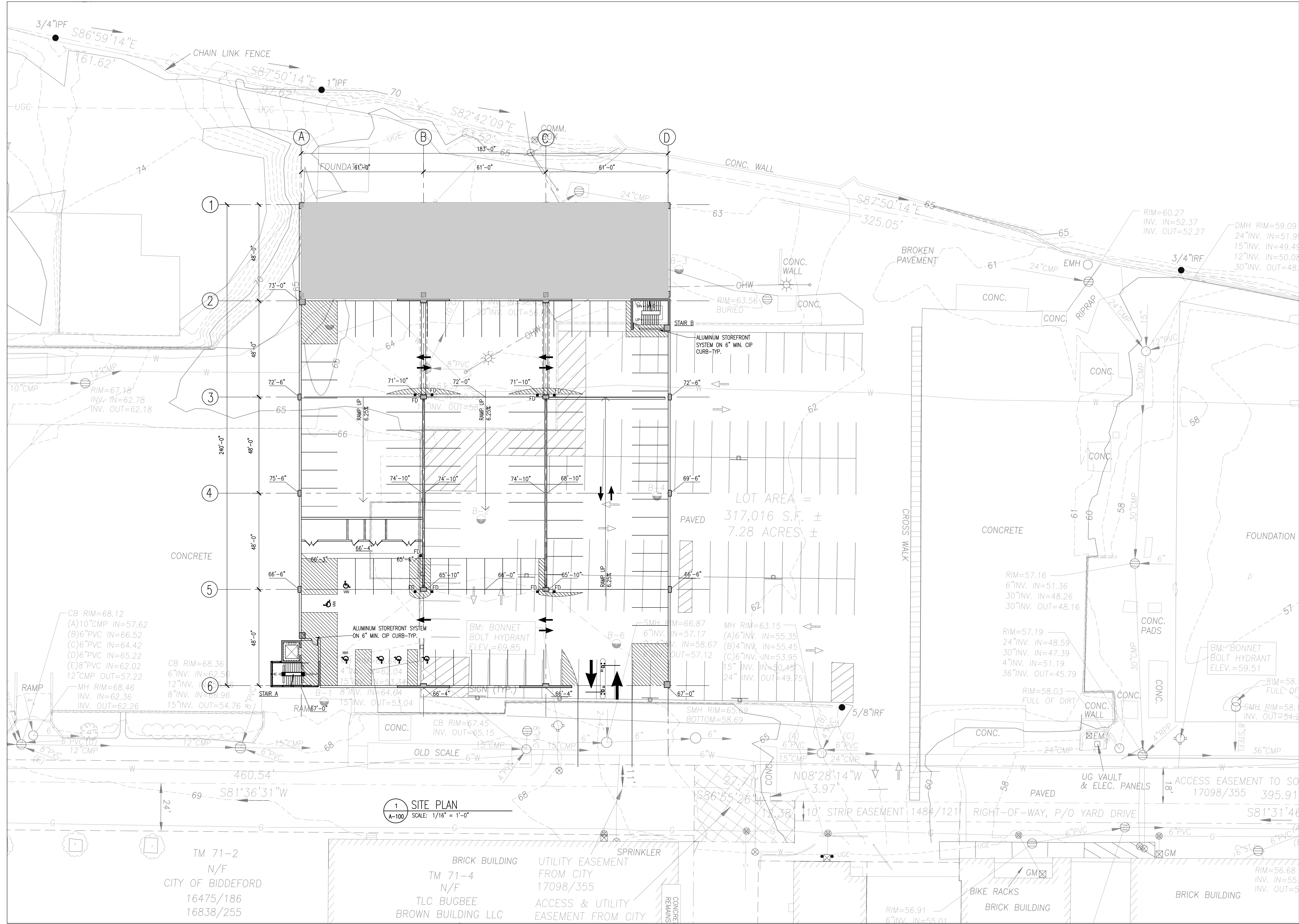
NO. DESCRIPTION DATE

DRAWING TITLE:
Site Plan

DRAWING NO:
A-100

SCALE: As indicated
DATE: 05/31/2018

PROJECT NO: 40-17109.00-1
DES. NG DRWN. WF CHK'D. WF



1 SITE PLAN
SCALE: 1/16" = 1'-0"

LOT AREA =
317,016 S.F. ±
7.28 ACRES ±

TM 71-2
N/F
CITY OF BIDDEFORD
16475/186
16838/255

BRICK BUILDING
TM 71-4
N/F
TLC BUGBEE
BROWN BUILDING LLC

UTILITY EASEMENT
FROM CITY
17098/355
ACCESS & UTILITY
EASEMENT FROM CITY

BIKE RACKS
BRICK BUILDING

BRICK BUILDING

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN DEVELOPMENT

NOT FOR CONSTRUCTION

ISSUE

NO. DESCRIPTION DATE

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DRAWING TITLE:

Grade Level
Striping Plan

DRAWING NO.:

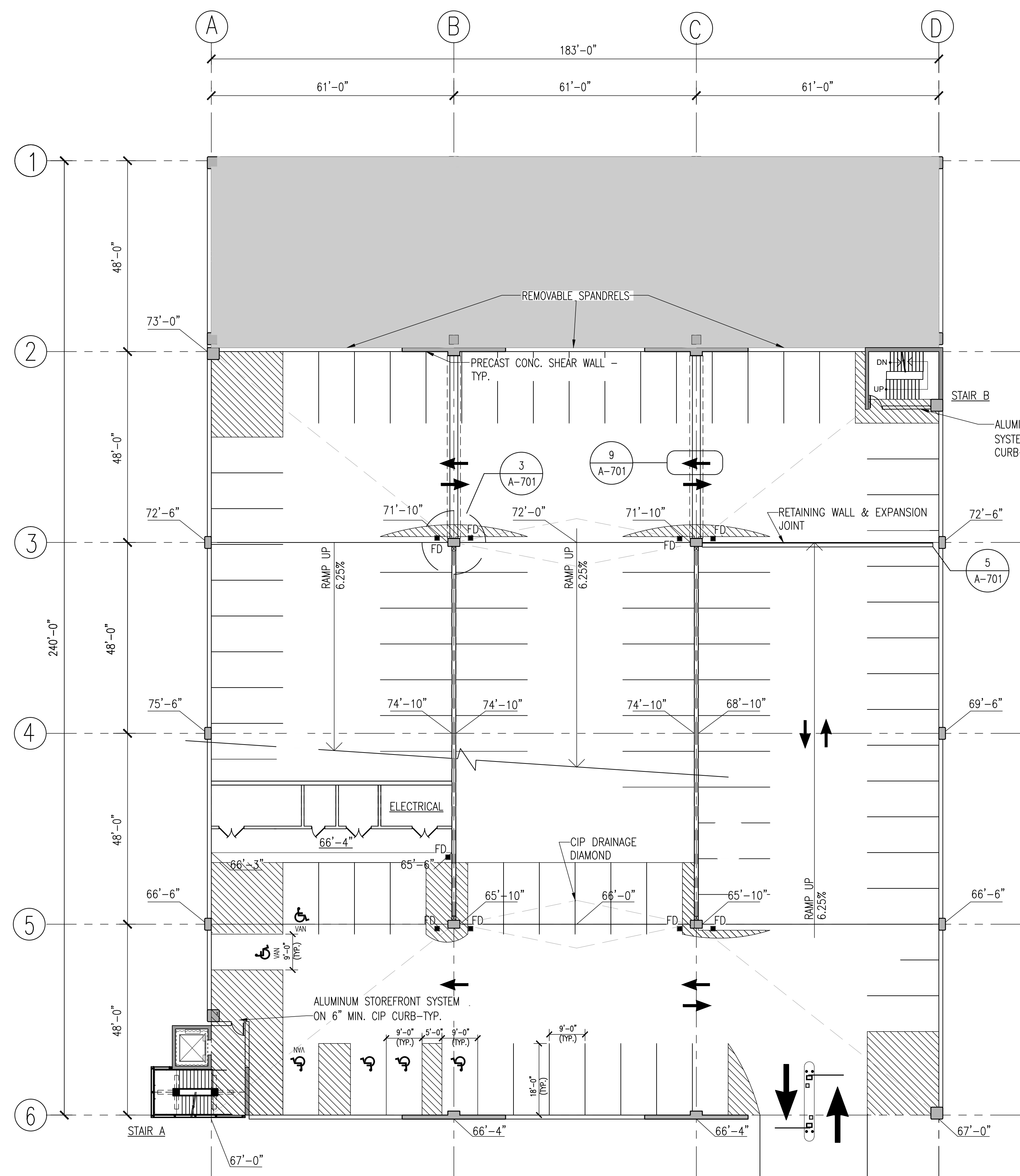
A-101

SCALE: As indicated

DATE: 05/31/2018

PROJECT NO: 40-17109.00-1

DES. DRWN. CHK'D.
NG WF WF



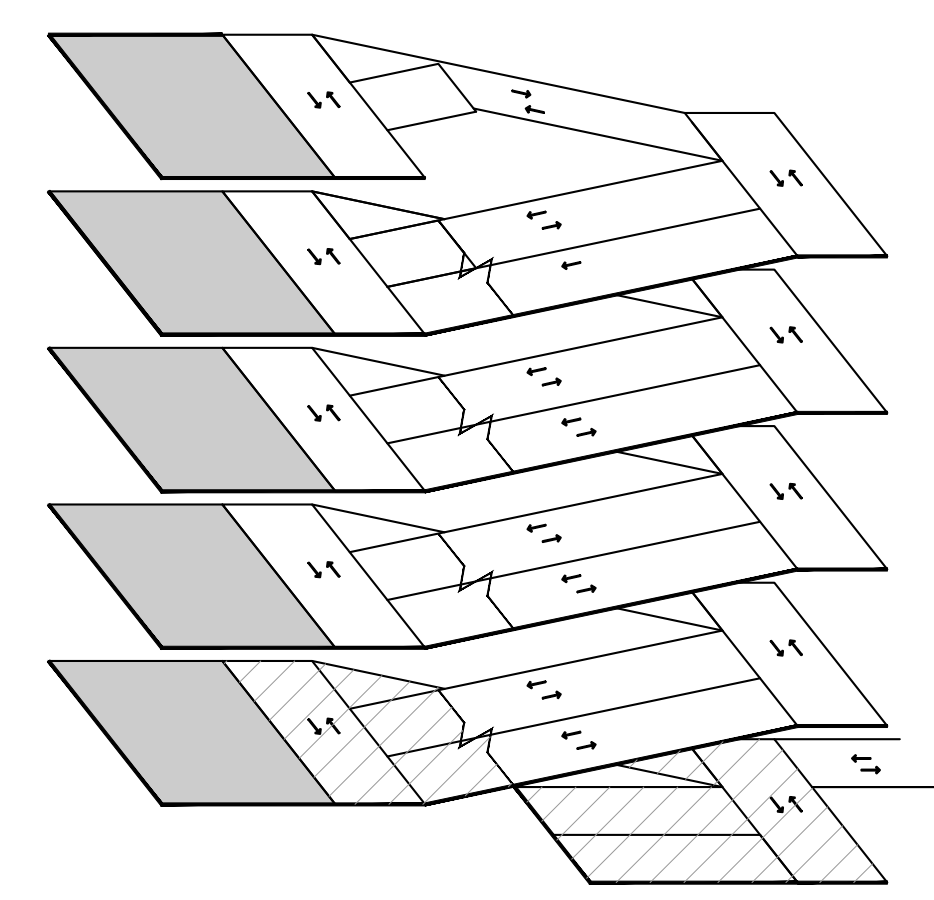
- GENERAL NOTES:**
- ELEVATIONS SHOWN THUS XX.XX' ARE TOP OF SLAB ELEVATIONS EXCLUSIVE OF CANTS, CURBS, FLOW LINES, ETC.
 - ELEVATIONS SHOWN THUS ±XX.XX' ARE TOP OF CURBS, WASHES, ETC.
 - ELEVATIONS NOT SHOWN ARE STRAIGHT LINE INTERPRETATIONS BETWEEN ELEVATIONS INDICATED.
 - MINIMUM FLOOR TO FLOOR HEIGHT=11'-0" TYPICAL, 12'-0" AT GRADE LEVEL
 - ELEVATIONS SHOWN RELATIVE OWEN HASKELL SURVEY DATED 4-19-18

■ PHASE 2 FUTURE EXPANSION

1 GRADE LEVEL PLAN
A-101 SCALE: 1/16" = 1'-0"

Option 2B Parking Summary		Phase 1	
	Standard Stall	Area SF	Efficiency
Floor Level	9'-0"x18'-0"		
Grade Level	94	33628	358
Typical (x3)	109	35482	326
Roof	91	29256	321
Total	512	169330	331

- ROOF LEVEL
112.0'
- 4TH LEVEL
101.0'
- 3RD LEVEL
90.0'
- 2ND LEVEL
79.0'
- GRADE LEVEL
67.0'



■ = Phase 2 Future Expansion

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN DEVELOPMENT

NOT FOR CONSTRUCTION

ISSUE

NO. DESCRIPTION DATE

DRAWING TITLE:
Typical Level Plan

DRAWING NO:

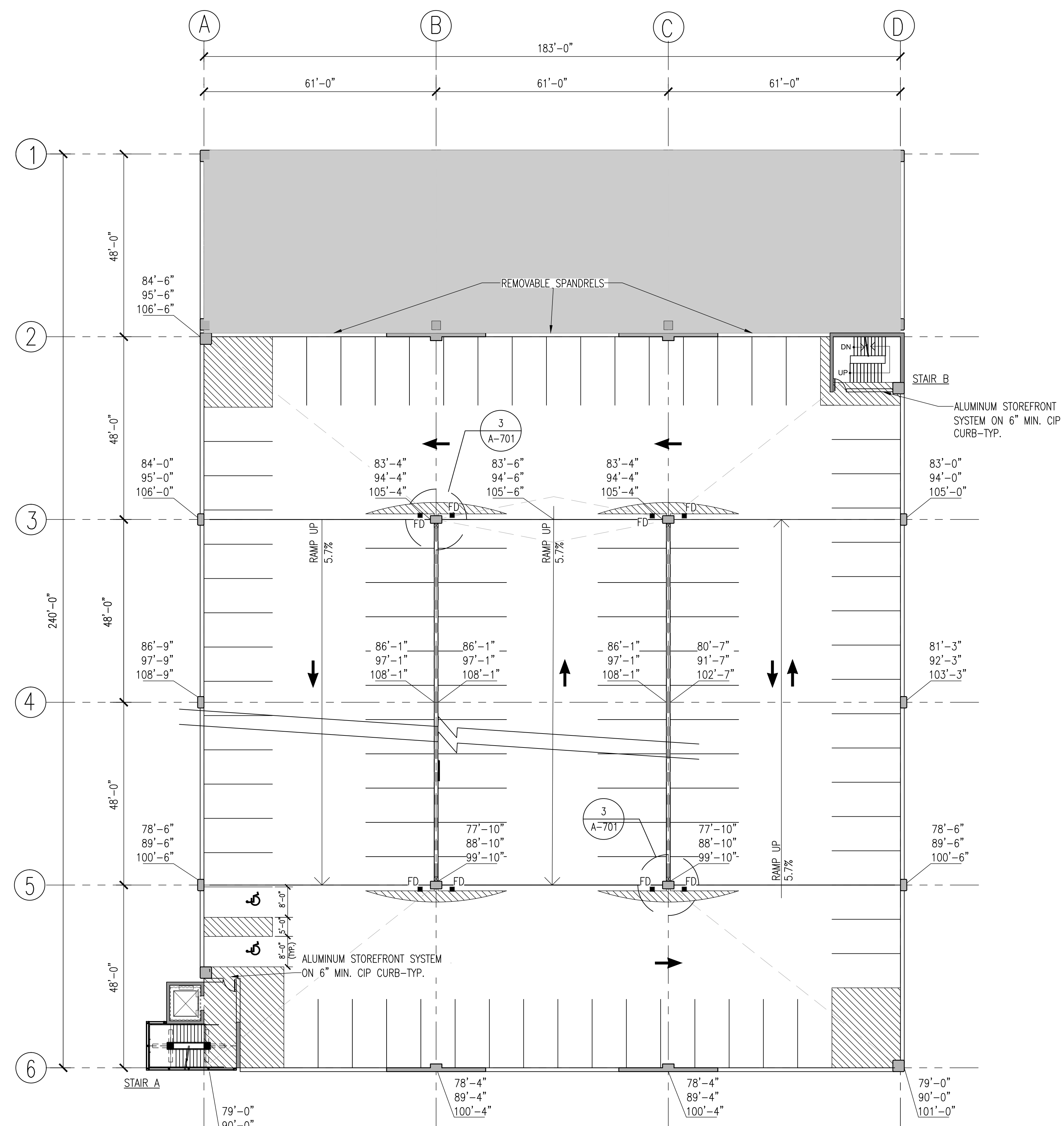
A-102

SCALE: As indicated

DATE: 05/31/2018

PROJECT NO: 40-17109.00-1

DES. NG DRWN. WF CHKD. WF



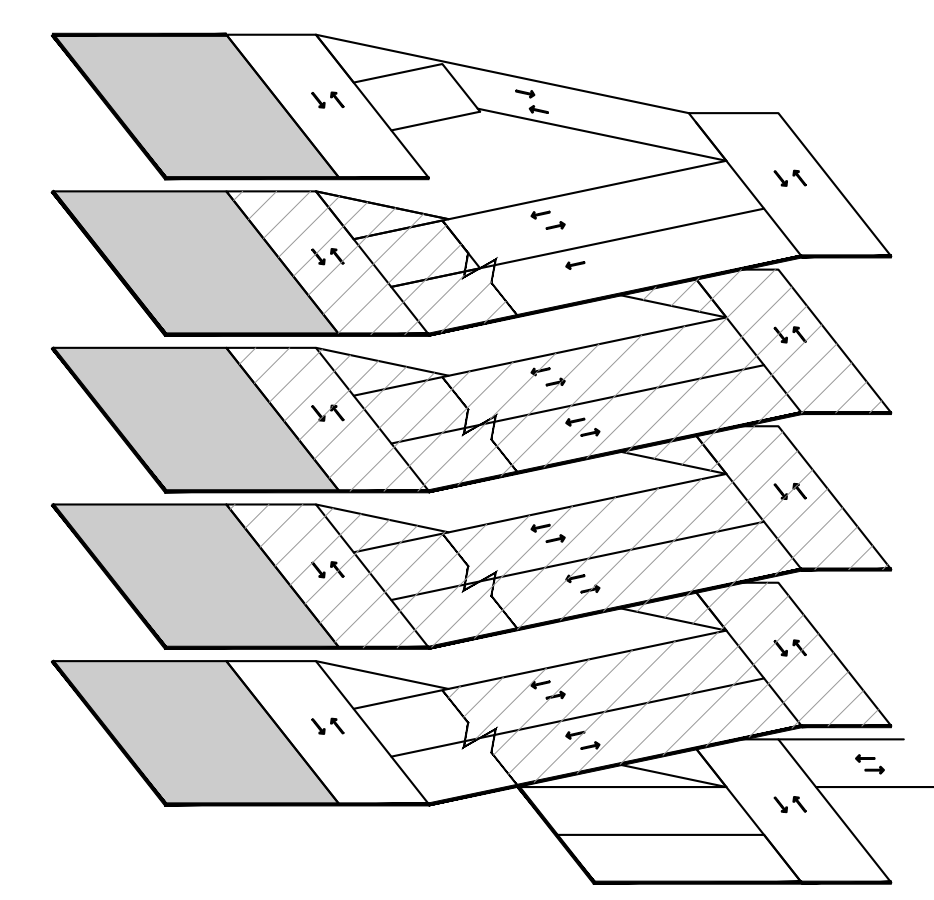
- GENERAL NOTES:**
- ELEVATIONS SHOWN THUS **XX.XX'** ARE TOP OF SLAB ELEVATIONS EXCLUSIVE OF CANTS, CURBS, FLOW LINES, ETC.
 - ELEVATIONS SHOWN THUS **XX.XX'** ARE TOP OF CURBS, WASHES, ETC.
 - ELEVATIONS NOT SHOWN ARE STRAIGHT LINE INTERPRETATIONS BETWEEN ELEVATIONS INDICATED.
 - MINIMUM FLOOR TO FLOOR HEIGHT=11'-0" TYPICAL, 12'-0" AT GRADE LEVEL
 - ELEVATIONS SHOWN RELATIVE OWEN HASKELL SURVEY DATED 4-19-18

■ PHASE 2 FUTURE EXPANSION

1 TYPICAL LEVEL PLAN
A-102 SCALE: 1/16" = 1'-0"

Option 2B Parking Summary		Phase 1	
Floor Level	Standard Stall	Area SF	Efficiency
Grade Level	94	33628	358
Typical (x3)	109	35482	326
Roof	91	29256	321
Total	512	169330	331

- ROOF LEVEL
112.0'
- 4TH LEVEL
101.0'
- 3RD LEVEL
90.0'
- 2ND LEVEL
79.0'
- GRADE LEVEL
67.0'



■ = Phase 2 Future Expansion

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN
DEVELOPMENT

NOT FOR
CONSTRUCTION

ISSUE

NO. DESCRIPTION DATE

DRAWING TITLE:
**Roof Level
Striping Plan**

DRAWING NO.:

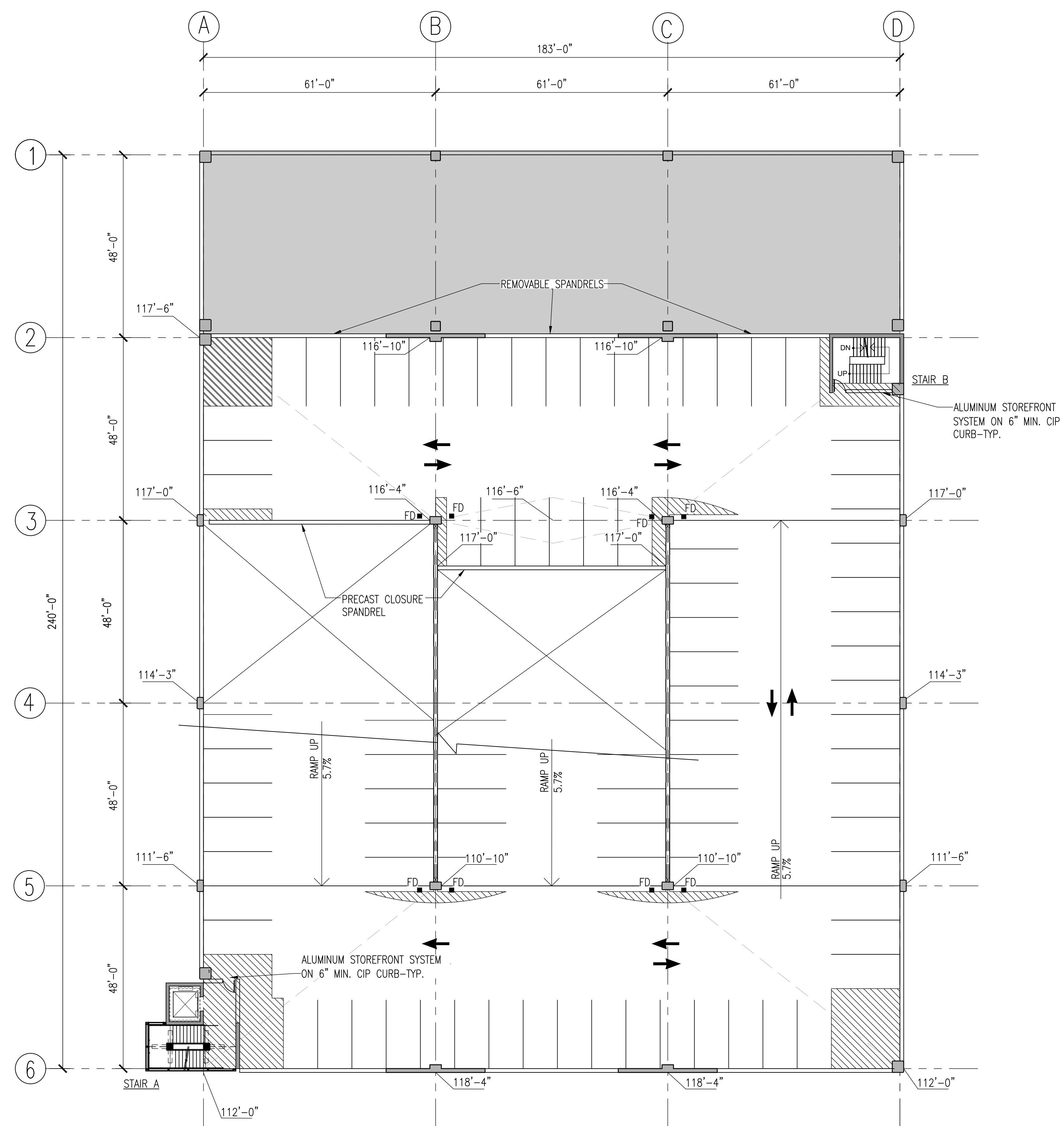
A-103

SCALE: As indicated

DATE: 05/31/2018

PROJECT NO: 40-17109.00-1

DES. DRWN. CHK'D.
NG WF WF



- GENERAL NOTES:**
- ELEVATIONS SHOWN THUS XX.XX' ARE TOP OF SLAB ELEVATIONS EXCLUSIVE OF CANTS, CURBS, FLOW LINES, ETC.
 - ELEVATIONS SHOWN THUS [XX.XX] ARE TOP OF CURBS, WASHES, ETC.
 - ELEVATIONS NOT SHOWN ARE STRAIGHT LINE INTERPRETATIONS BETWEEN ELEVATIONS INDICATED.
 - MINIMUM FLOOR TO FLOOR HEIGHT=11'-0" TYPICAL, 12'-0" AT GRADE LEVEL
 - ELEVATIONS SHOWN RELATIVE OWEN HASKELL SURVEY DATED 4-19-18

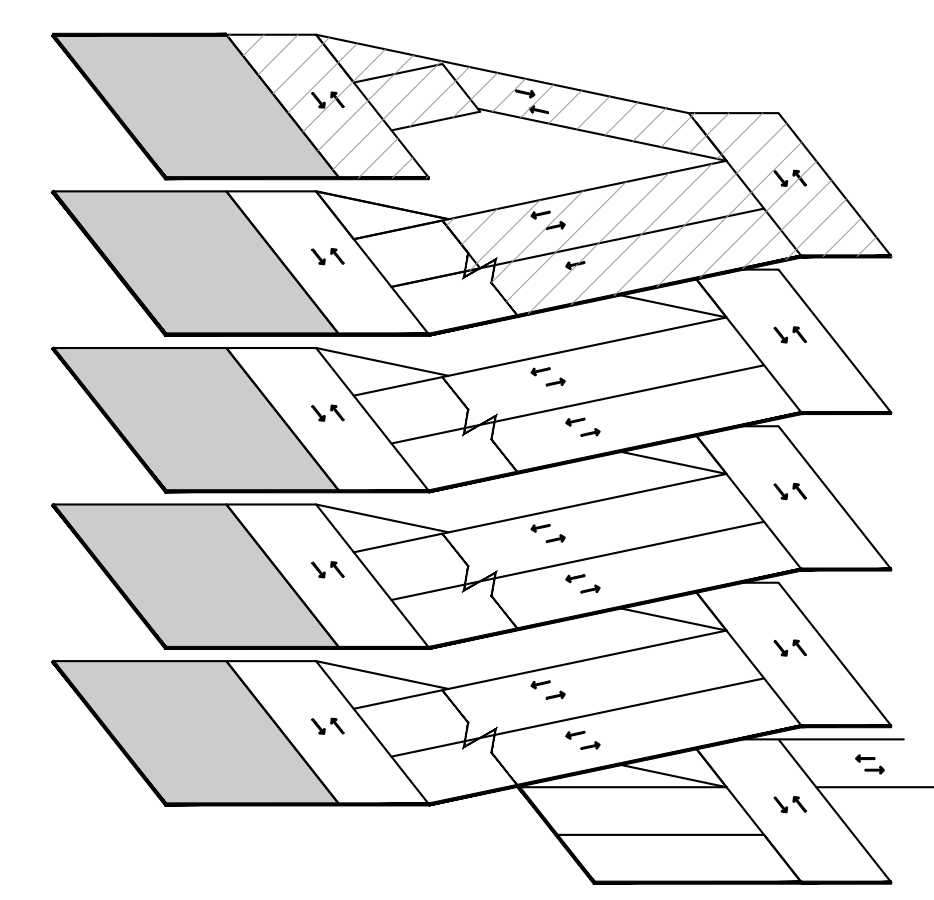
■ PHASE 2 FUTURE EXPANSION

1 ROOF LEVEL PLAN
A-103 SCALE: 1/16" = 1'-0"

Option 2B Parking Summary

Floor Level	Phase 1		
	Standard Stall	Area SF	Efficiency
Grade Level	94	33628	358
Typical (x3)	109	35482	326
Roof	91	29256	321
Total	512	169330	331

- ROOF LEVEL
112.0'
- 4TH LEVEL
101.0'
- 3RD LEVEL
90.0'
- 2ND LEVEL
79.0'
- GRADE LEVEL
67.0'



■ = Phase 2 Future Expansion

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN DEVELOPMENT

NOT FOR CONSTRUCTION

ISSUE

NO. DESCRIPTION DATE

DRAWING TITLE:
Grade Level Striping Plan - Phase 2

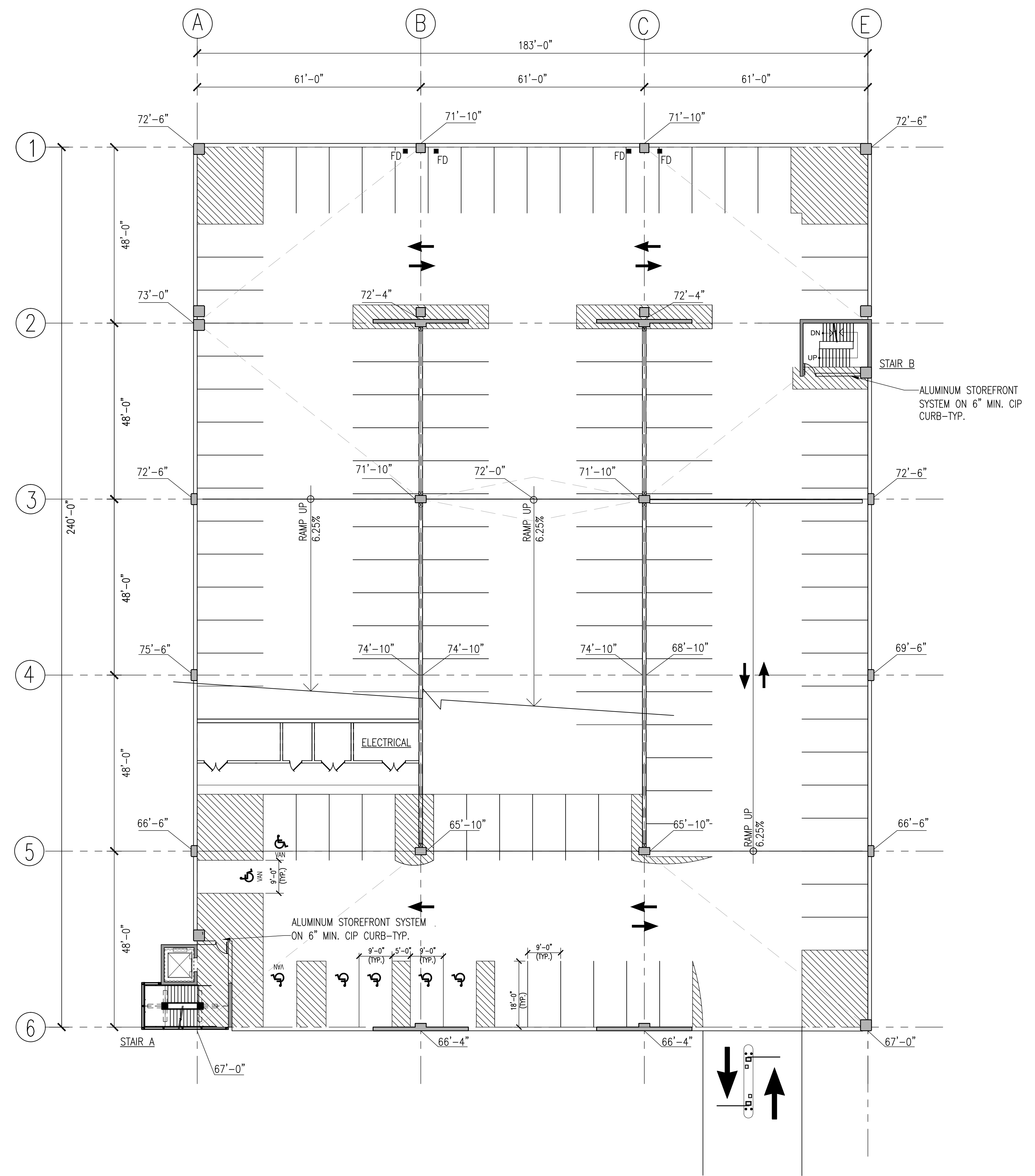
DRAWING NO:
A-104

SCALE: As indicated

DATE: 05/31/2018

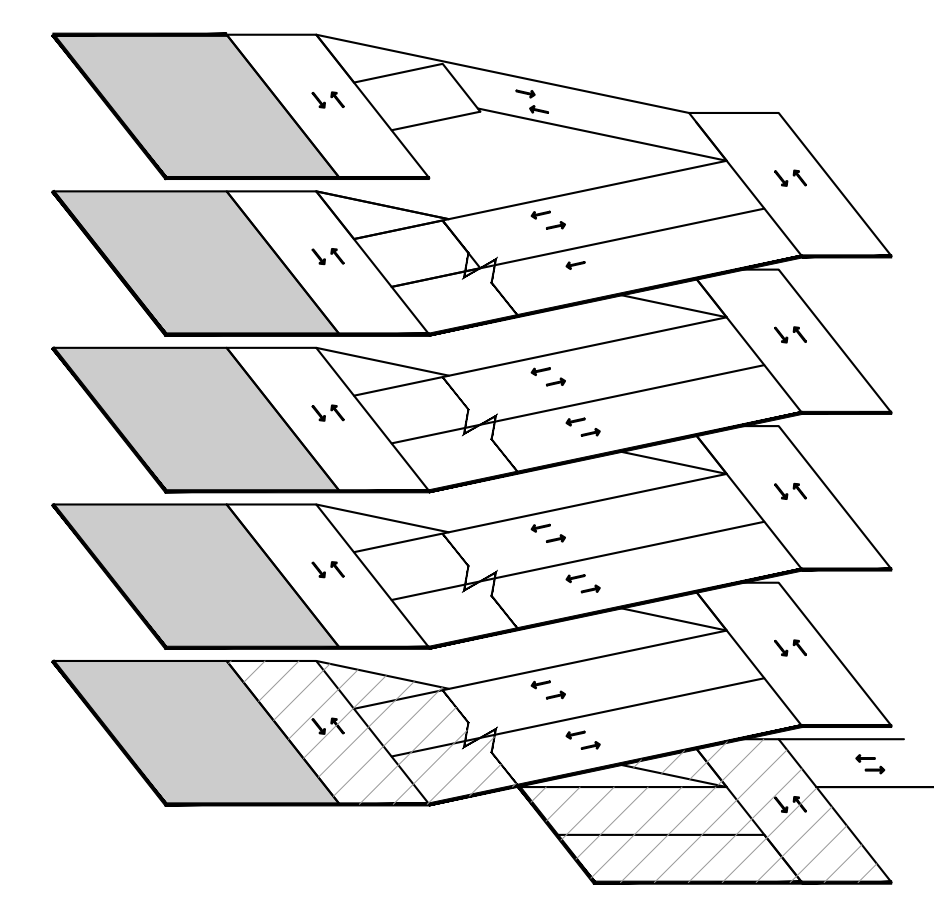
PROJECT NO: 40-17109.00-1

DES. DRWN. CHK'D.
NG WF WF



Option 2B Parking Summary		Phase 2	
Floor Level	Standard Stall	Area SF	Efficiency
Grade Level	9'-0"x18'-0"	122	42412
Typical (x3)		138	44267
Roof		105	38040
Total		641	213253

- ROOF LEVEL
112.0'
- 4TH LEVEL
101.0'
- 3RD LEVEL
90.0'
- 2ND LEVEL
79.0'
- GRADE LEVEL
67.0'



■ = Phase 2 Future Expansion

1 GRADE LEVEL PLAN PHASE 2
A-104 SCALE: 1/16" = 1'-0"

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN DEVELOPMENT

NOT FOR CONSTRUCTION

ISSUE

NO. DESCRIPTION DATE

DRAWING TITLE:
Typical Framing Plan

DRAWING NO:

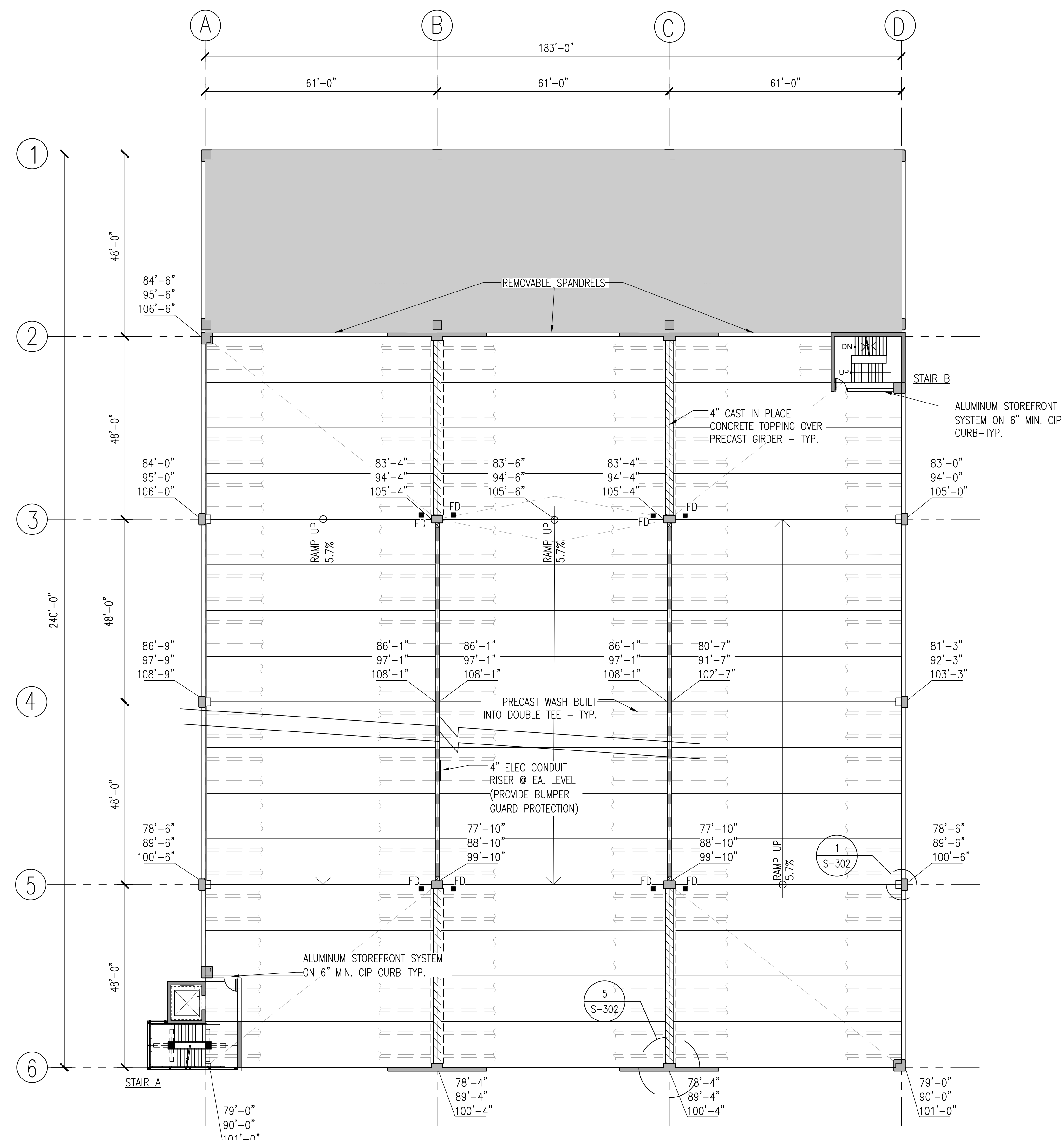
S-202

SCALE: As indicated

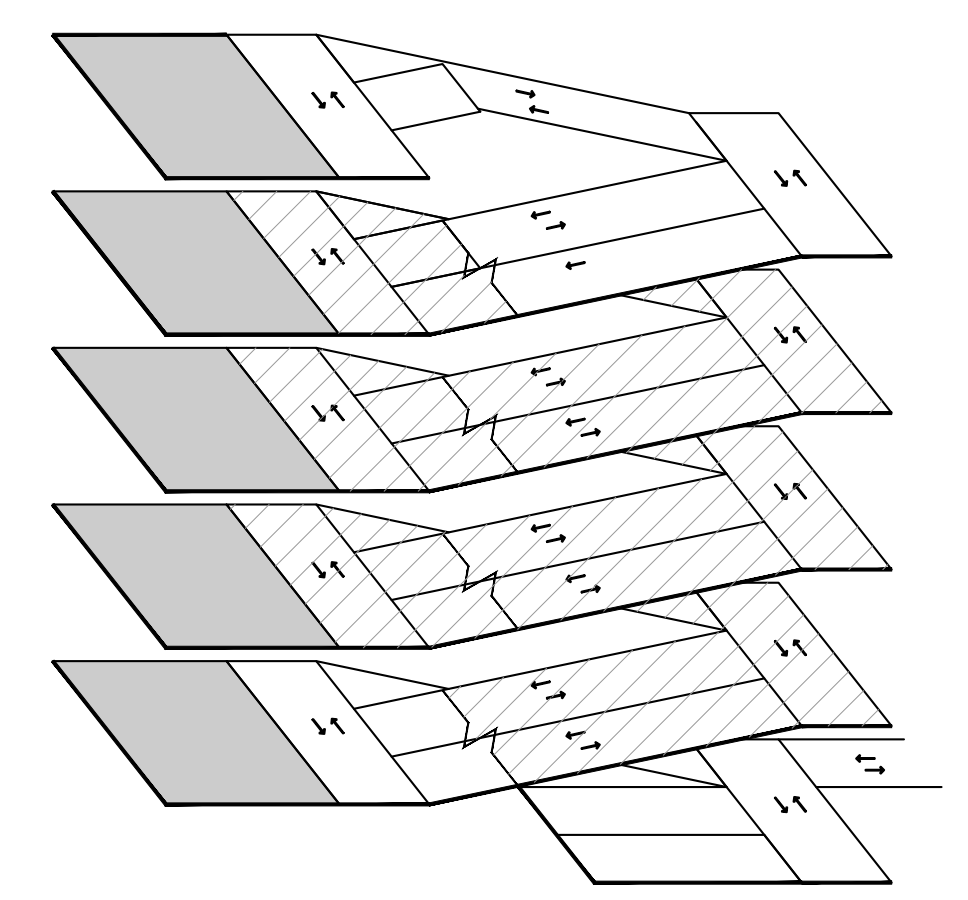
DATE: 05/31/2018

PROJECT NO: 40-17109.00-1

DES. NG	DRWN. WF	CHK'D. WF
---------	----------	-----------



ROOF LEVEL	112.0'
4TH LEVEL	101.0'
3RD LEVEL	90.0'
2ND LEVEL	79.0'
GRADE LEVEL	67.0'



■ = Phase 2 Future Expansion

- GENERAL NOTES:**
- ELEVATIONS SHOWN THUS XX.XX' ARE TOP OF SLAB ELEVATIONS EXCLUSIVE OF CANTS, CURBS, FLOW LINES, ETC.
 - ELEVATIONS SHOWN THUS XX.XX' ARE TOP OF CURBS, WASHES, ETC.
 - ELEVATIONS NOT SHOWN ARE STRAIGHT LINE INTERPRETATIONS BETWEEN ELEVATIONS INDICATED.
 - MINIMUM FLOOR TO FLOOR HEIGHT=11'-0" TYPICAL, 12'-0" AT GRADE LEVEL
 - ELEVATIONS SHOWN RELATIVE OWEN HASKELL SURVEY DATED 4-19-18

■ PHASE 2 FUTURE EXPANSION

1
TYPICAL LEVEL FRAMING PLAN
S-202 SCALE: 1/16" = 1'-0"

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN
DEVELOPMENT

NOT FOR
CONSTRUCTION

ISSUE

NO. DESCRIPTION DATE

DRAWING TITLE:
Roof Level
Framing Plan

DRAWING NO:

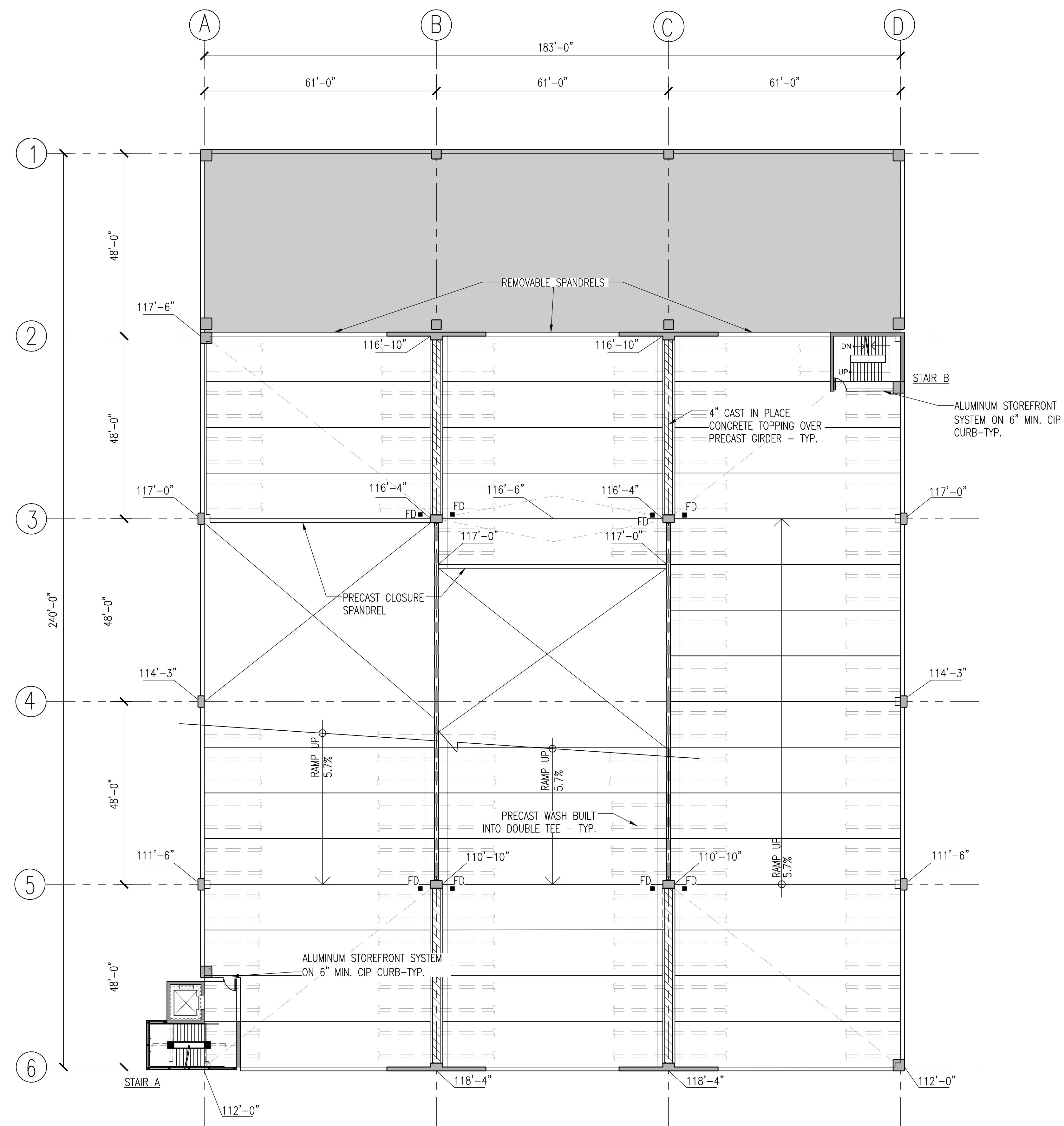
S-203

SCALE: As indicated

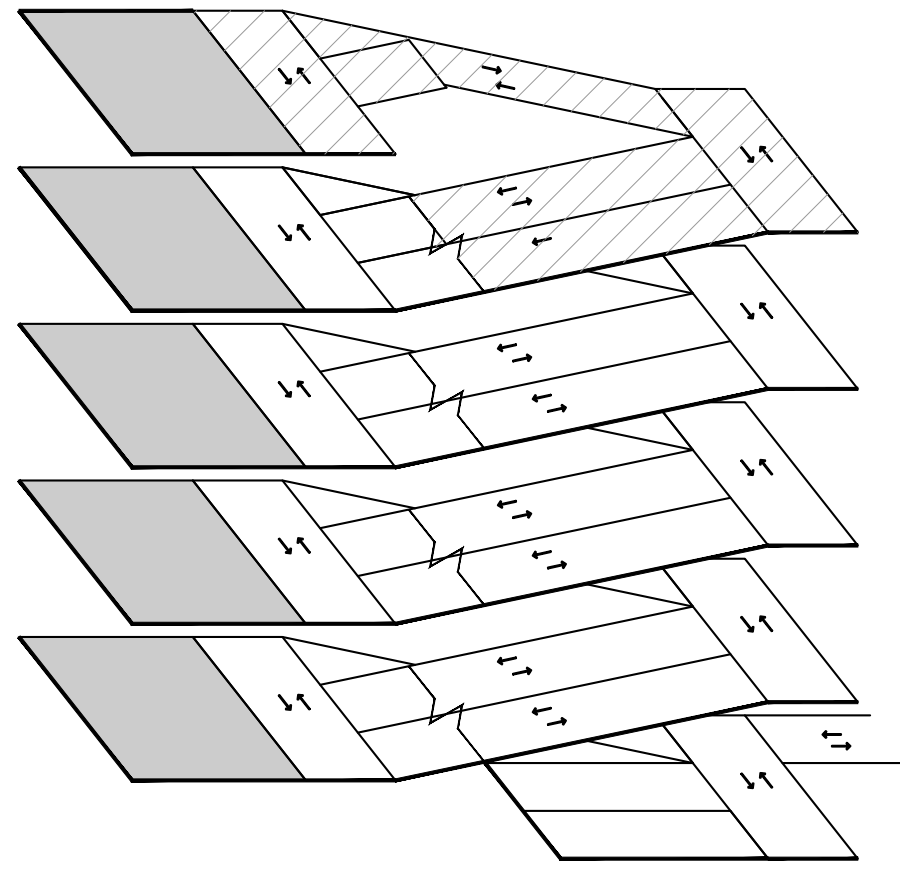
DATE: 05/31/2018

PROJECT NO: 40-17109.00-1

DES. DRWN. CHK'D.
NG WF WF



ROOF LEVEL	112.0'
4TH LEVEL	101.0'
3RD LEVEL	90.0'
2ND LEVEL	79.0'
GRADE LEVEL	67.0'



■ = Phase 2 Future Expansion

- GENERAL NOTES:**
- ELEVATIONS SHOWN THUS XX.XX' ARE TOP OF SLAB ELEVATIONS EXCLUSIVE OF CANTS, CURBS, FLOW LINES, ETC.
 - ELEVATIONS SHOWN THUS XX.XX' ARE TOP OF CURBS, WASHES, ETC.
 - ELEVATIONS NOT SHOWN ARE STRAIGHT LINE INTERPRETATIONS BETWEEN ELEVATIONS INDICATED.
 - MINIMUM FLOOR TO FLOOR HEIGHT=11'-0" TYPICAL, 12'-0" AT GRADE LEVEL
 - ELEVATIONS SHOWN RELATIVE OWEN HASKELL SURVEY DATED 4-19-18

■ PHASE 2 FUTURE EXPANSION

1 ROOF LEVEL FRAMING PLAN
S-203 SCALE: 1/16" = 1'-0"

**BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME**

CONCEPT PLAN
DEVELOPMENT

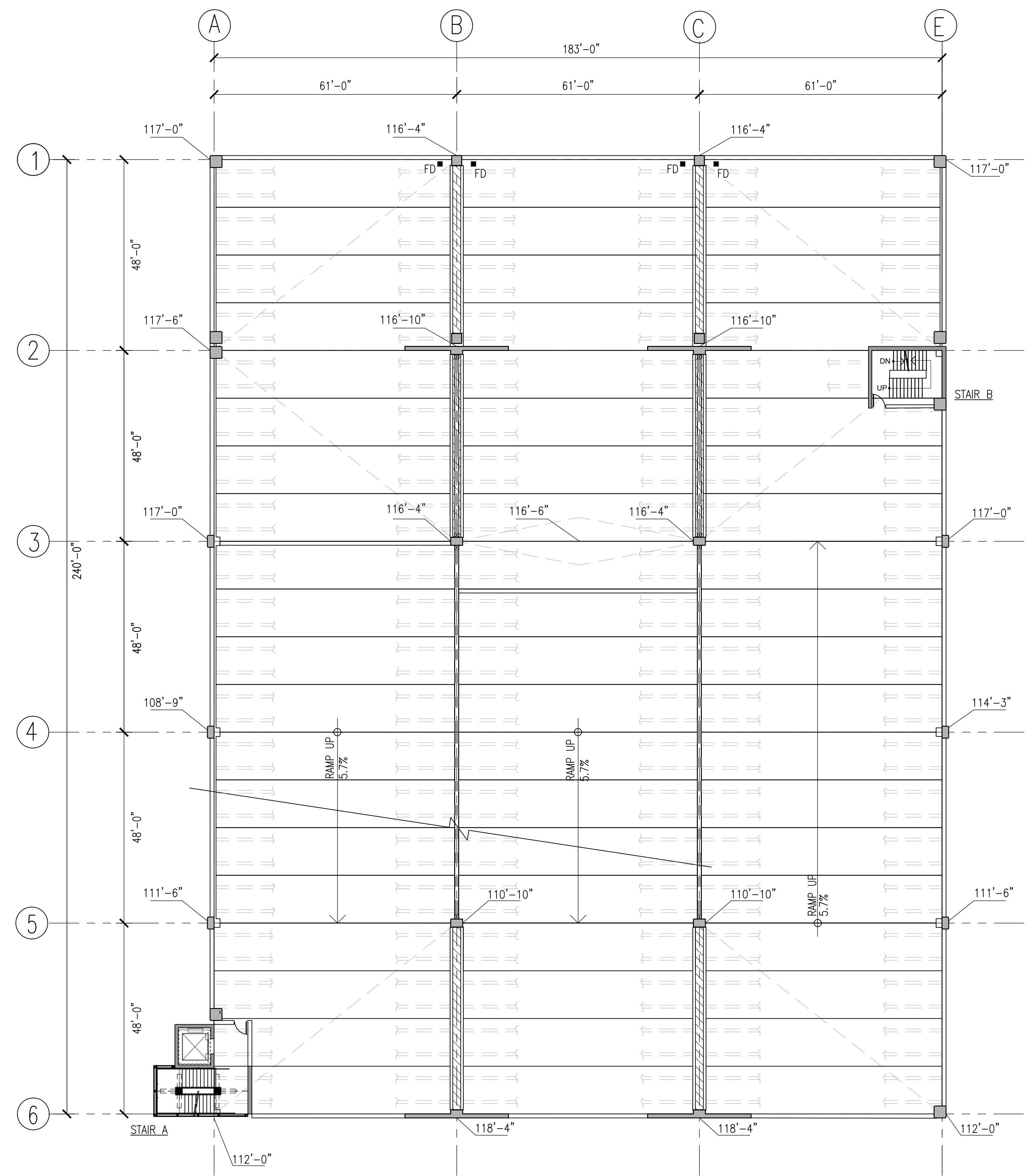
NOT FOR
CONSTRUCTION

NO.	DESCRIPTION	DATE

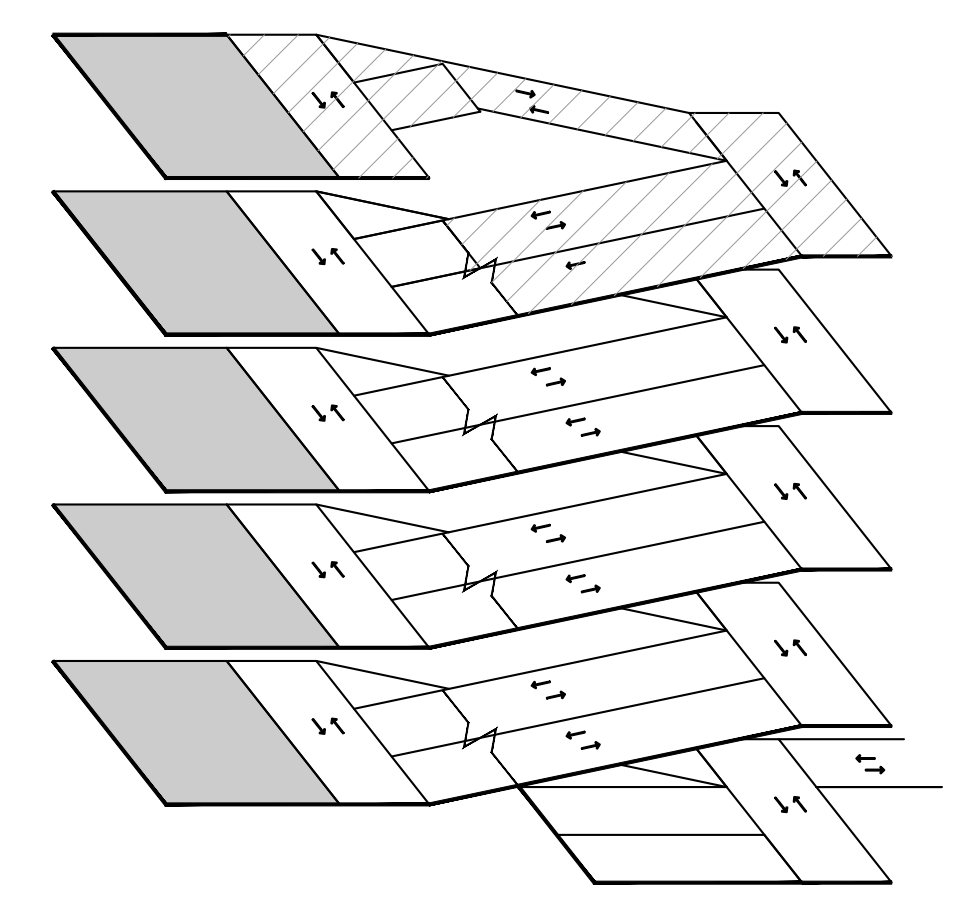
DRAWING TITLE:
**Roof Level
Framing Plan -
Phase 2**

DRAWING NO:
S-206

SCALE: As indicated		
DATE: 05/31/2018		
PROJECT NO: 40-17109.00-1		
DES. NG	DRWN. WF	CHK'D. WF

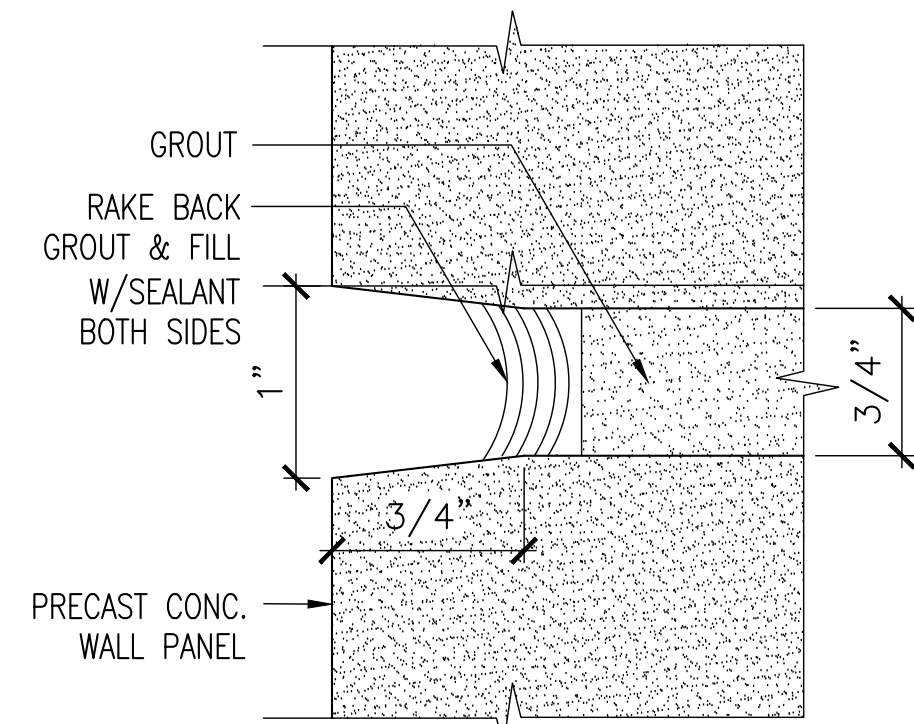


ROOF LEVEL	112.0'
4TH LEVEL	101.0'
3RD LEVEL	90.0'
2ND LEVEL	79.0'
GRADE LEVEL	67.0'

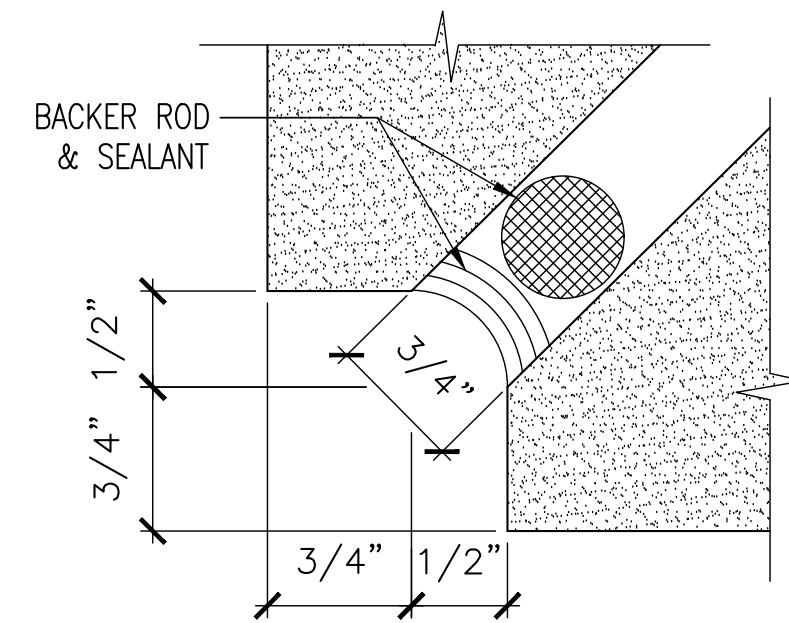


■ = Phase 2 Future Expansion

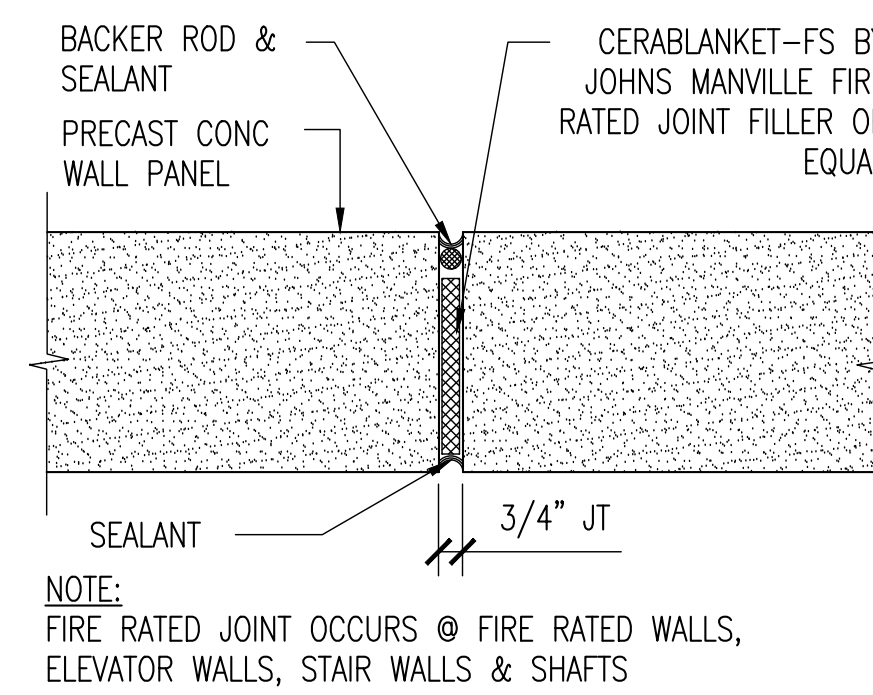
1 ROOF LEVEL PLAN PHASE 2
S-206 SCALE: 1/16" = 1'-0"



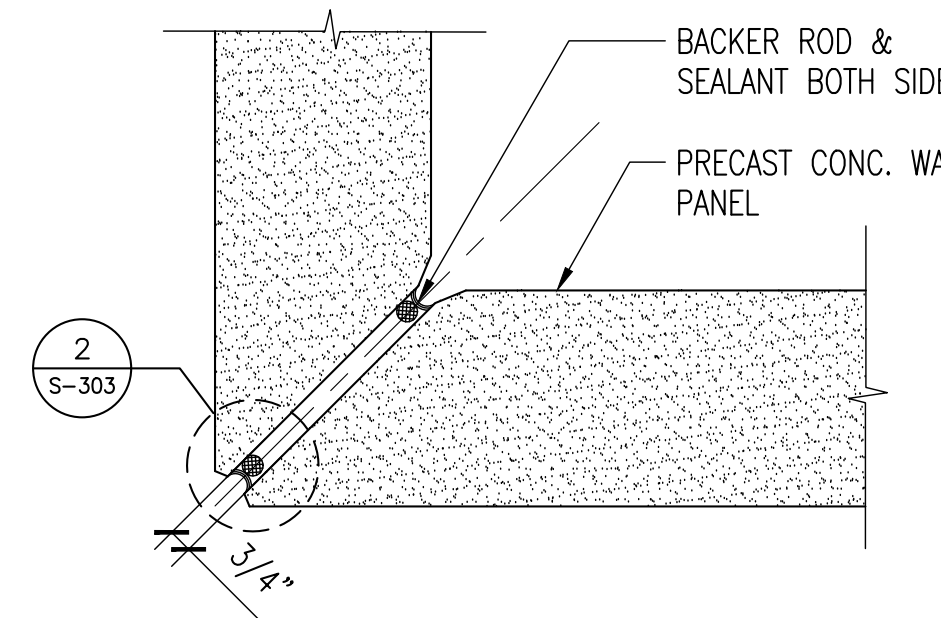
1 DETAIL @ GROUTED JOINTS
S-303 SCALE: FULL



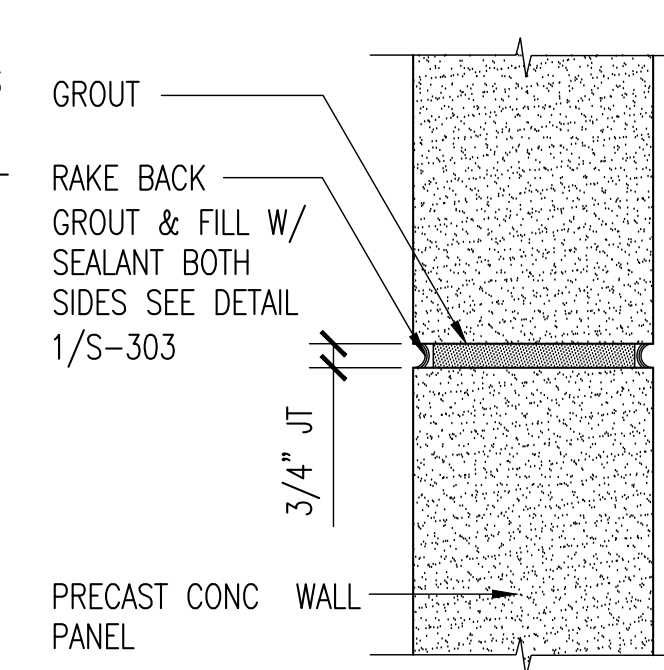
2 MITERED PRECAST JOINT DETAIL
S-303 SCALE: 1" = 1'-0"



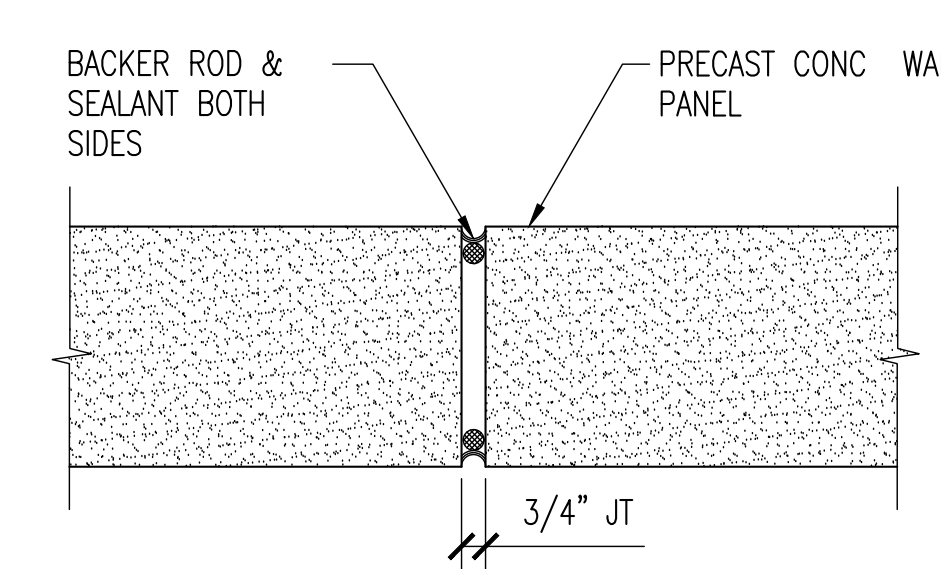
3 FIRE RATED JOINT
S-303 SCALE: 1-1/2" = 1'-0"



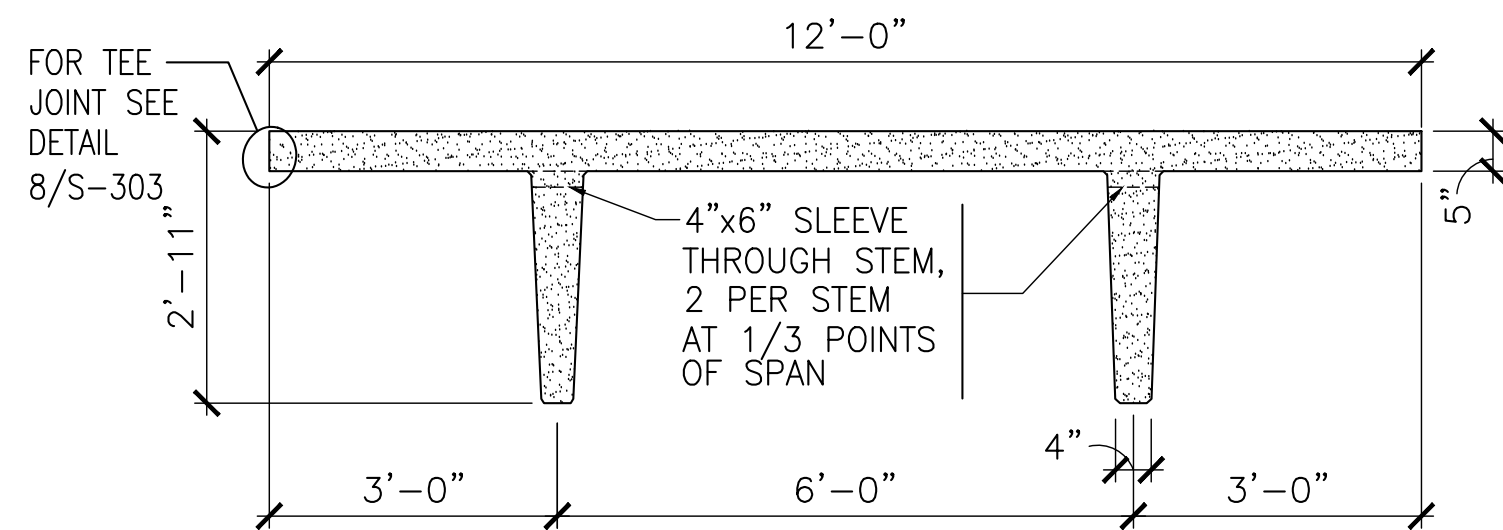
4 MITERED PRECAST JOINT
S-303 SCALE: 1-1/2" = 1'-0"



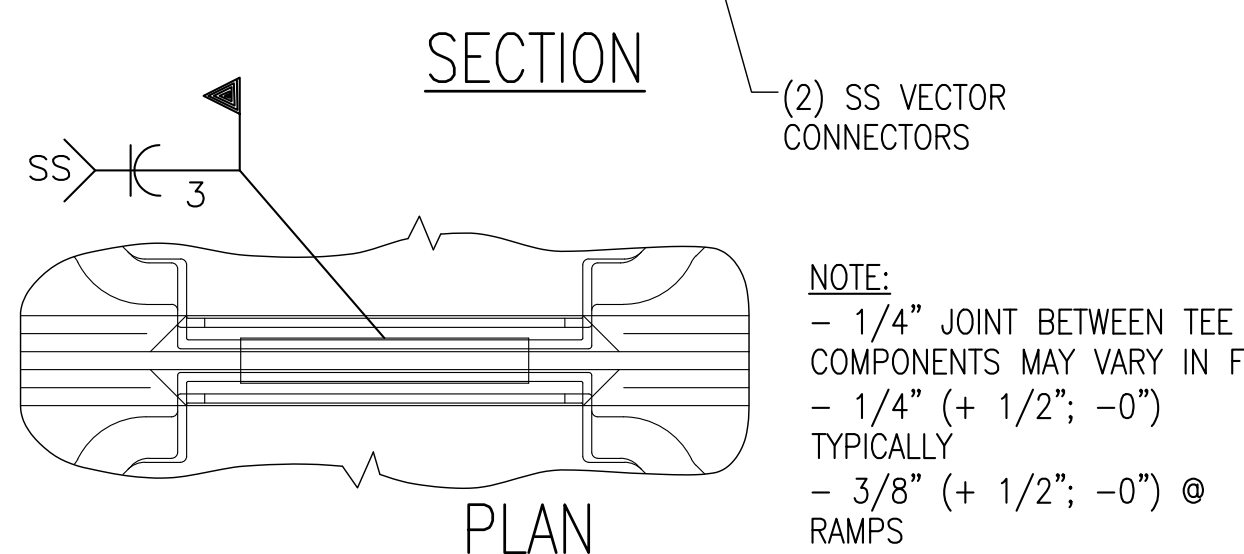
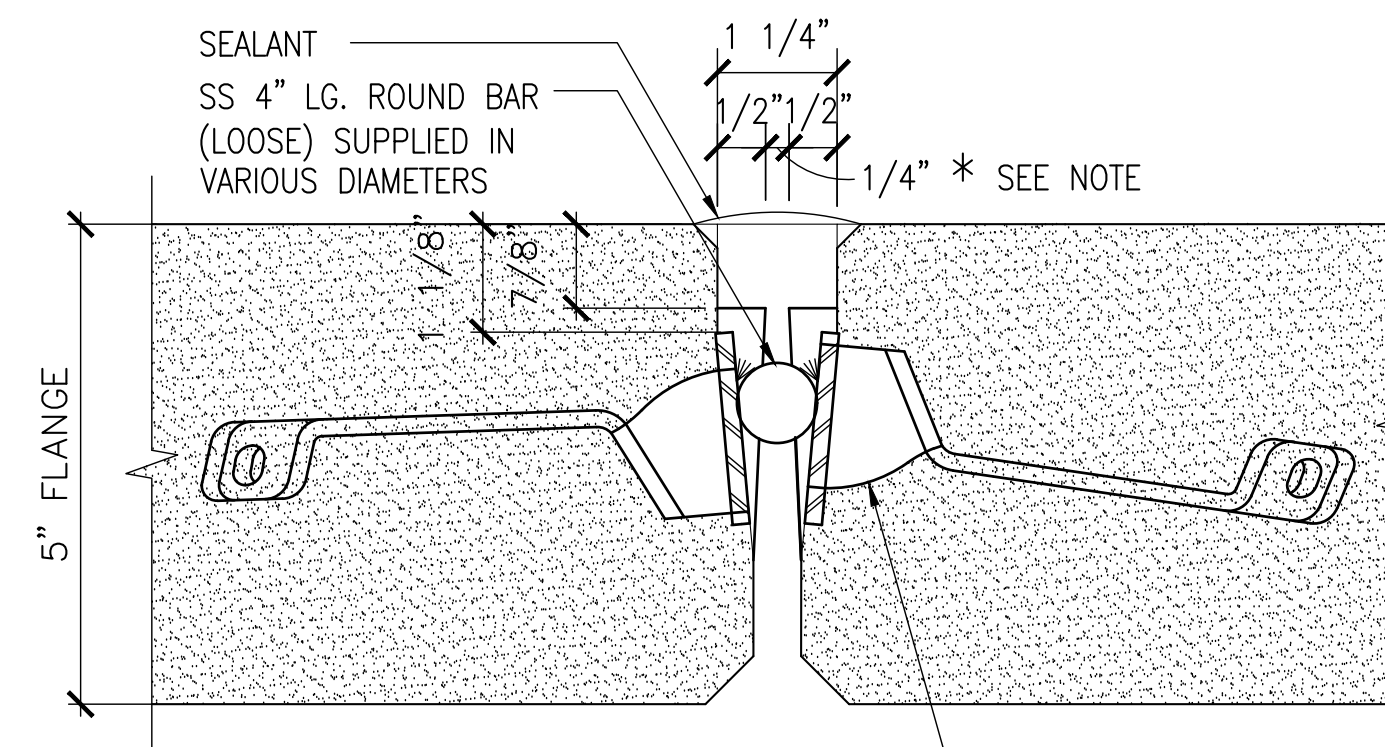
5 HORIZ. PRECAST JOINT
S-303 SCALE: 1-1/2" = 1'-0"



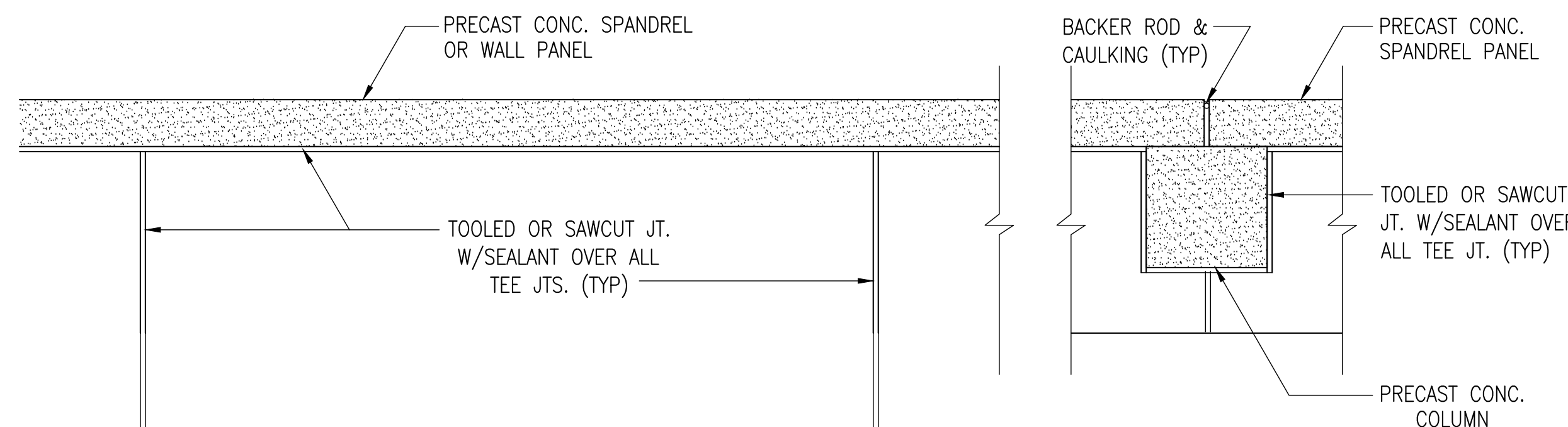
6 VERTICAL PRECAST JOINT
S-303 SCALE: 1-1/2" = 1'-0"



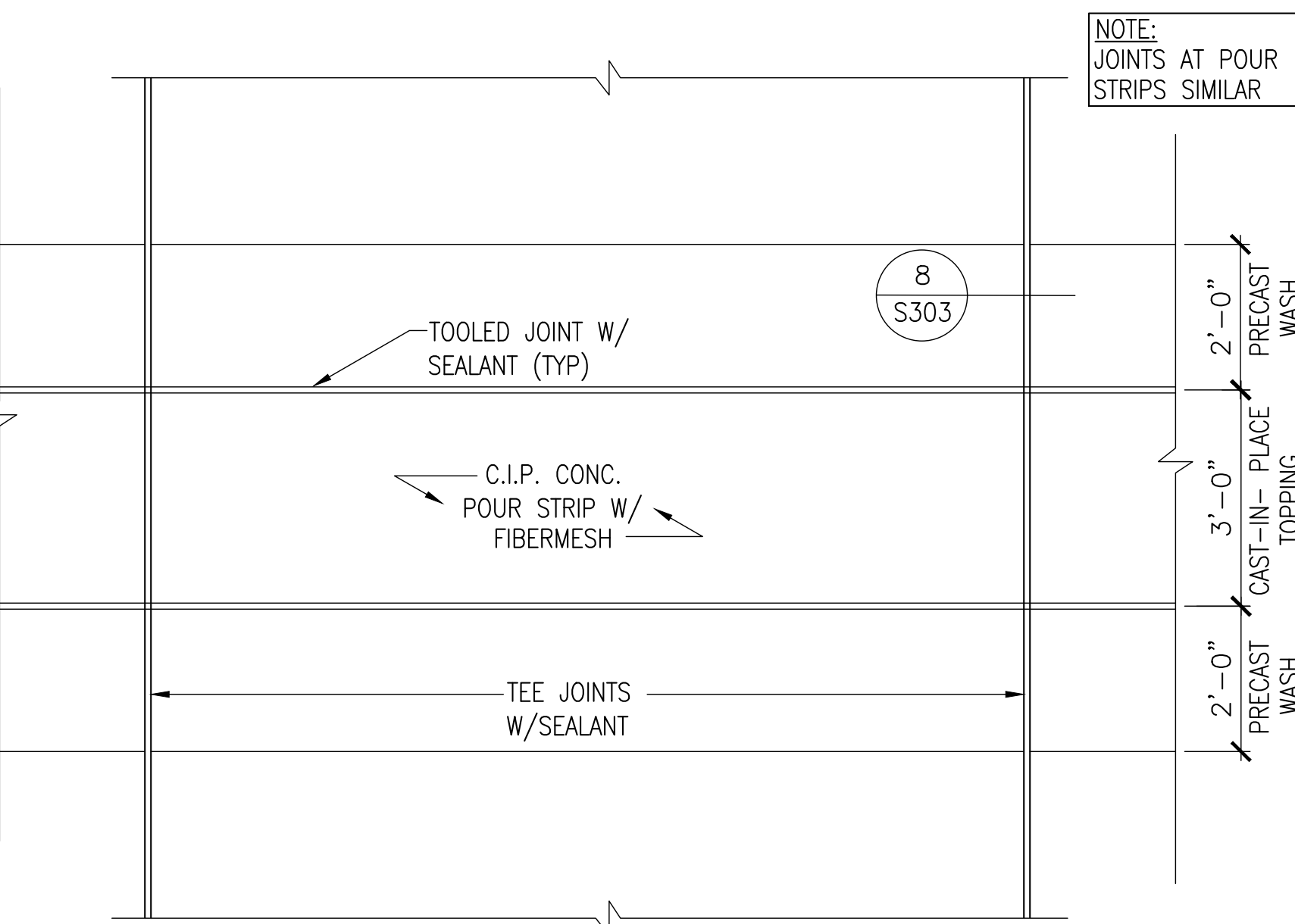
7 TYP. PRECAST CONC. DOUBLE-TEE
S-303 SCALE: 1/2" = 1'-0"



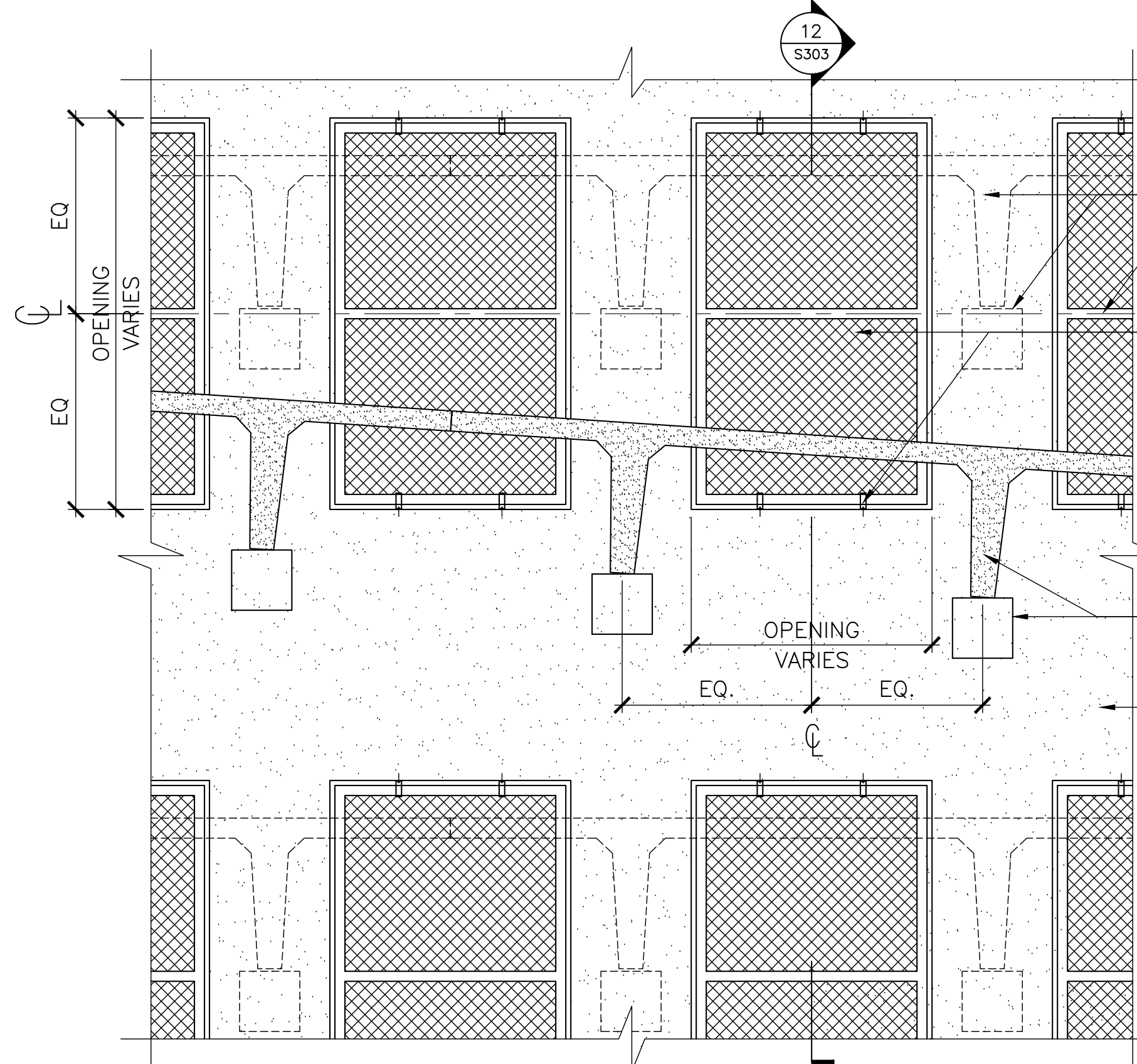
8 TYP. TEE TO TEE DETAIL
S-303 SCALE: 6" = 1'-0" (SPACING NOT TO EXCEED 5'-0")



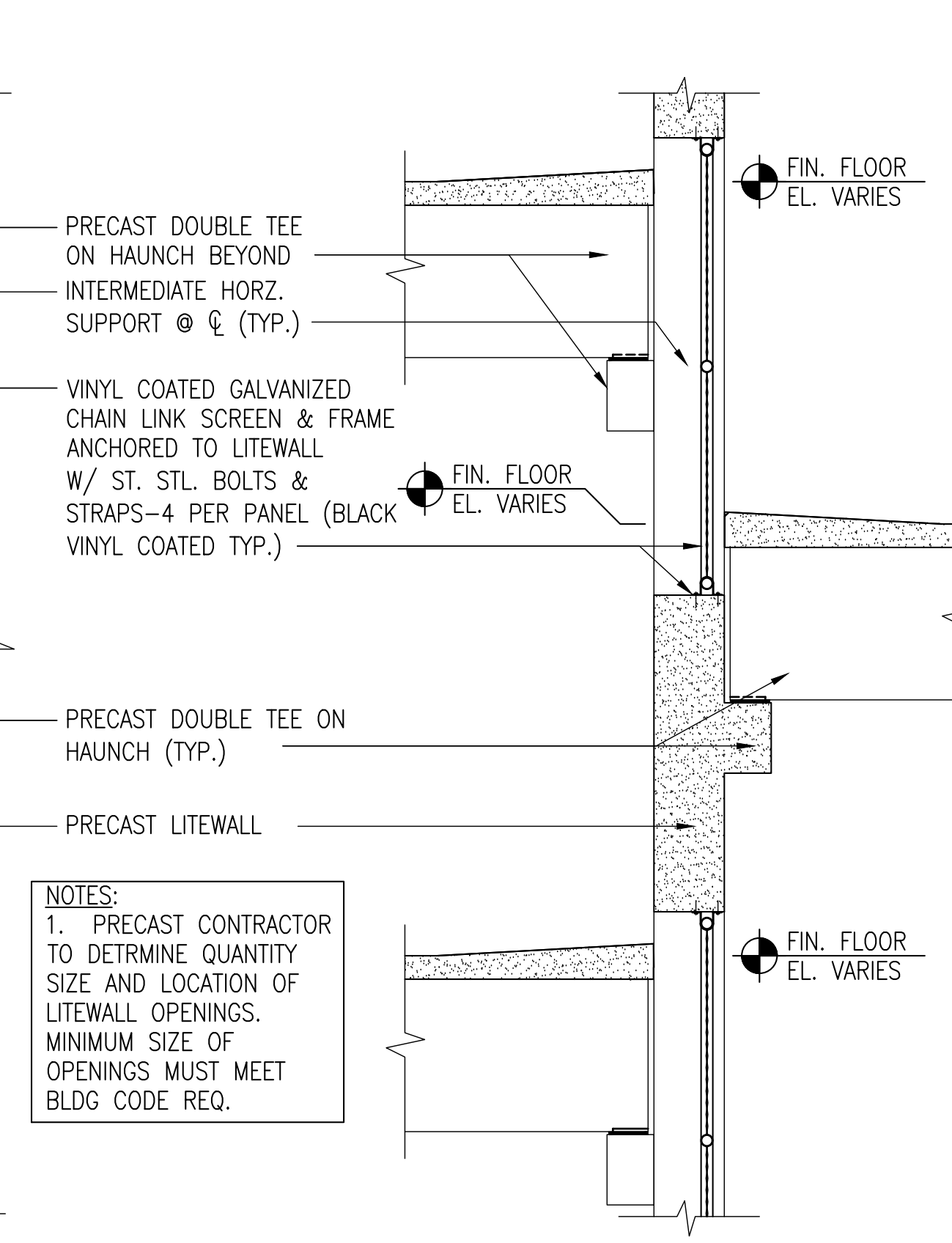
9 PLAN OF JOINTS @ SPANDREL/WALL PANEL/COLUMN
S-303 SCALE: 1/2" = 1'-0"



10 PLAN OF JOINTS OVER 'T' GIRDER
S-303 SCALE: 1/2" = 1'-0"



11 ELEVATION- P.C. LITE WALL OPENINGS
S303 SCALE: 1/2" = 1'-0"



12 SECTION- P.C. LITE WALL OPENINGS
S303 SCALE: 1/2" = 1'-0"

NOTES:

1. DETAILS DEPICTED ARE TYPICAL PRECAST DETAILS MEANT TO DEFINE THE PRECAST ELEMENTS FOR THE STRUCTURE. ALL CONNECTIONS, PLATE SIZES, BOLT SIZES, WELDING, ANCHORING, REINFORCEMENT, ETC. ARE THE RESPONSIBILITY OF THE PRECAST MANUFACTURER AND ARE TO BE INCLUDED IN THE FINAL DESIGN CALCULATIONS.
2. PRECAST CONTRACTOR TO DETERMINE SIZE OF DIAPHRAGM STEEL BASED ON STRUCTURAL ANALYSIS OF THE FRAME.
3. GENERAL CONTRACTOR TO PROVIDE EPOXY COATED DIAPHRAGM STEEL IN CONCRETE POUR STRIPS. FOR PRICING PURPOSES ASSUME (3) #6 BARS CONTINUOUS, IN ALL POUR STRIPS

BIDDEFORD PARKING GARAGE
MERC SITE
BIDDEFORD, ME

CONCEPT PLAN DEVELOPMENT

NOT FOR CONSTRUCTION

ISSUE

NO. DESCRIPTION DATE

DRAWING TITLE:

Typical Precast Details

DRAWING NO:

S-303

SCALE: As indicated

DATE: 05/31/2018

PROJECT NO: 40-17109.00-1

DES. NG DRWN. WF CHKD. WF

Geotechnical Partnership, Inc.



Since 1987

Geotechnical Engineering Services for New England

Lisa R. Casselli, PE Principal - A WBE Firm

**Subsurface Exploration
Foundation Specialty Systems**

**Laboratory Soil Testing
Ground Improvement**

**Geothermal Testing
Earthwork Testing**

13 April 2018
File No. 1727

Desman Design Management
55 Capital Blvd., 4th Floor
Rocky Hill, CT 06067

Attention: Norman Goldman – Senior Associate Vice President
William Fair – Project Designer

Subject: **Geotechnical Data Summary Report**
Proposed Parking Garage
Pearl Street
Biddeford, Maine

Dear Sirs:

This geotechnical data summary report outlines our site background data review, including subsurface explorations, field soil, groundwater and bedrock testing.

It also summarizes our engineering data summaries, analyses and calculations for the proposed new parking garage proposed to be erected opposite 22 Pearl Street in Biddeford, Maine (Figure 1A)

Our geotechnical engineering data summary, analyses and recommendations follow.



45 New Ocean Street – Suite A
Swampscott, MA 01907
Tel. 781/646-6982

805 Main Street
Sanford, ME 04073
Tel. 207/459-7800

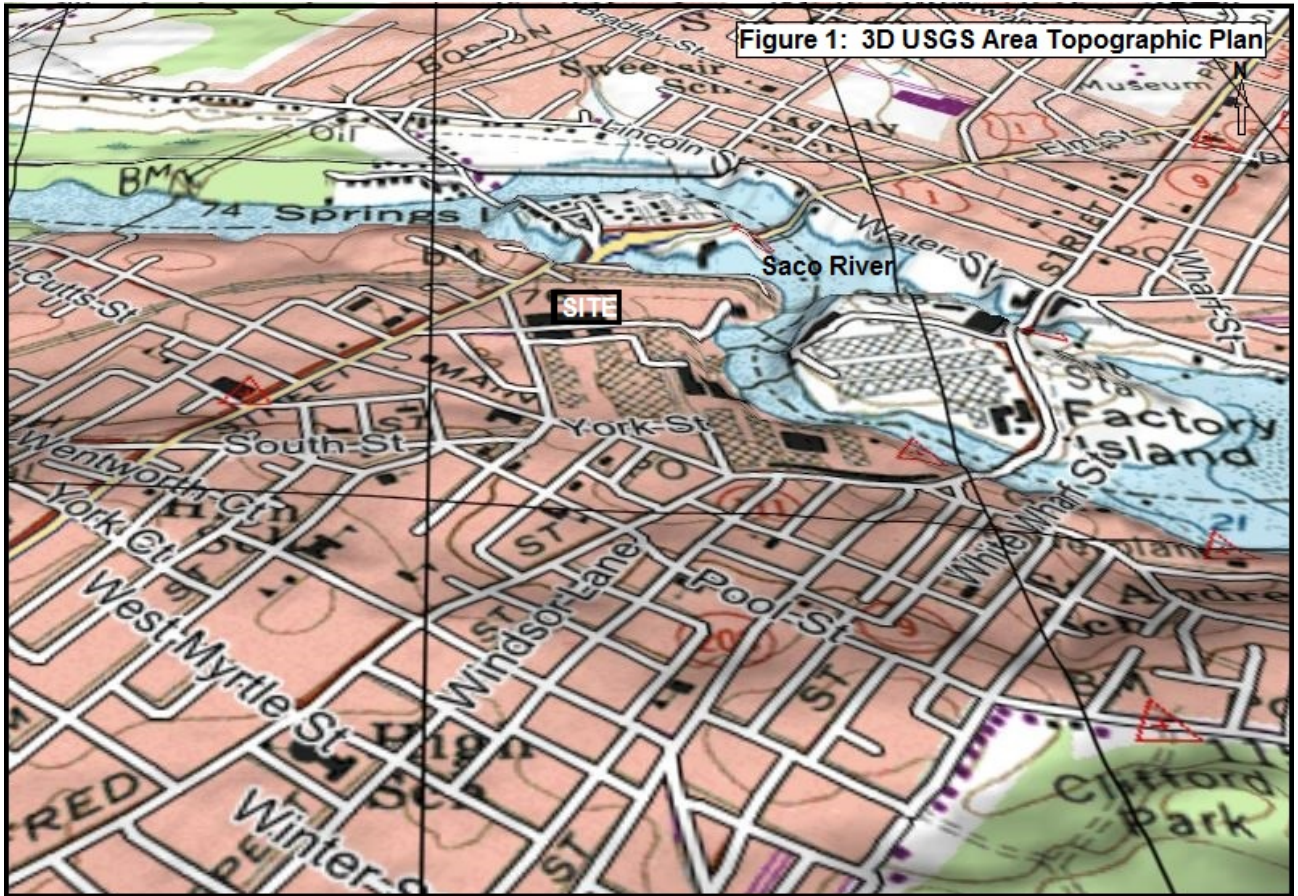


Figure 1: 3D USGS Area Topographic Plan

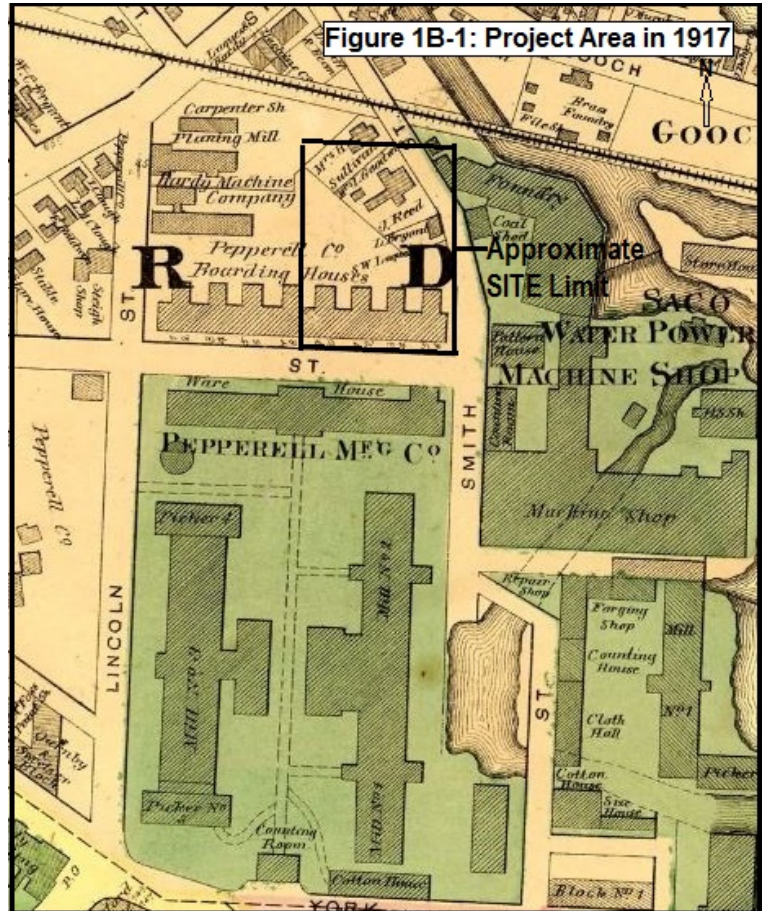
I. Proposed Construction:

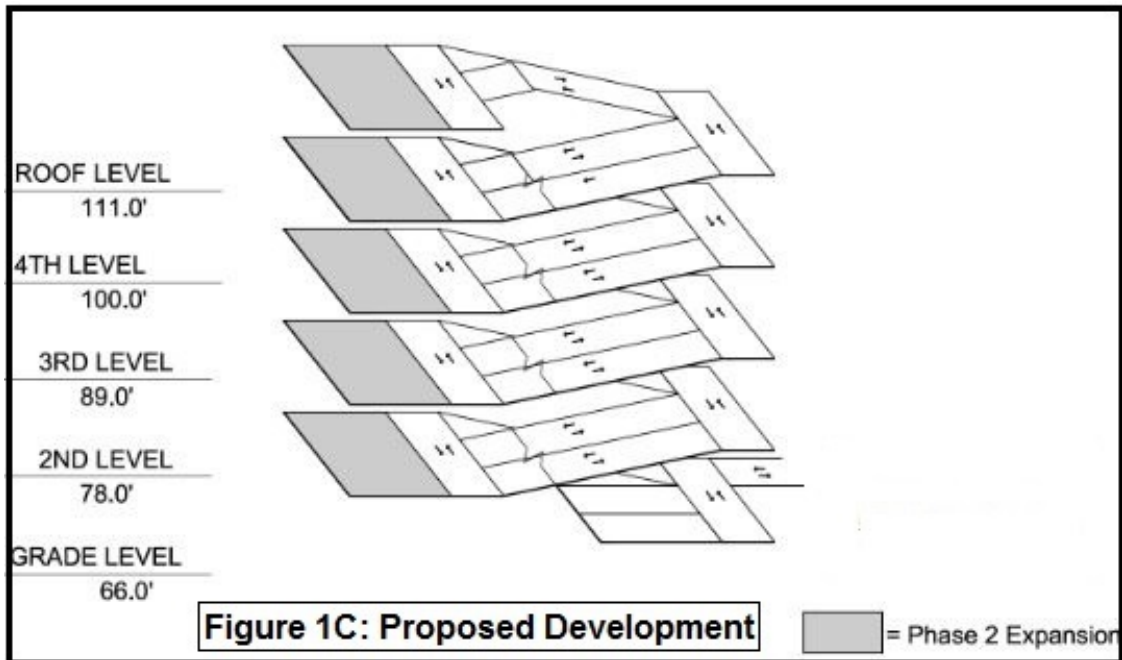
Existing Conditions:

- Plan reference:
 - No existing site survey plan was available to us at the time of this review.
 - No existing site utility plan was available to us at the time of this review.

- Direction, Datum, Elevation and Coordinates:
 - Direction:
 - Plan north: *Figure 1A*
 - Called north for this review: in the general direction of the rail line (dashed line, *Figure 1A*).
 - Datum and Elevation:
 - Vertical elevation datum:
 - Spot elevations were provided us at site test boring locations by Owen Haskell, the site surveyor.
 - Site vertical datum is NAV88 per Owen Haskell.
 - Site Coordinates:
 - Latitude: 41.6317° N
 - Longitude: -71.0076° W

- **Existing Site Conditions:**
 - No attempt has been made to undertake a history of this site. Historic review is included in research for Phase I environmental site assessments.
 - A 1917 historic property map (Figure 1B-1) showed the site area to have been developed with:
 - Smith Street (northeast)
 - Three buildings all or partially on-site fronting on Smith Street (north); and
 - Pepperell Co. boarding houses (south),
 - The site was later part of a larger parcel (Figure 1B-2) used as the Maine Energy Recovery Co. (MERC) trash to energy site in-service from 1987 to 2012 that was then razed.
 - MERC foundations and floor slabs appear to remain.
 - Portions of the former MERC building intersecting the subject site include the Processing Building (west), the Tipping Building (east) and an overhead conveyor (north).
 - Existing site elevations range from about:
 - Low = El. 62.3 ft. (NAV88) (existing parking lot area)
 - High = El. 66.4 ft. (NAV88) (southwest)
 - No bedrock outcrops are visible on-site. The immediate site area ground surface beyond the existing parking lot is relatively level to slightly sloping.
 - Possibly active underground site structures and utilities:
 - Water lines (blue paint, flags) (north, south)
 - A storm sewer line (north)
 - A fire line (north)





Anticipated New Construction:

- Plan Reference:
 - *Parking Garage Isometric Sketch Plan*; prepared by Desman Design Management (see *Figure 1C*).
- Building Structural Information:
 - Building Levels: (*Figure 1C*)
 - Three (3) above-grade (supported) levels
 - No below-grade levels; although the lowest level reportedly may be more deeply embedded than shown on *Figure 1C*, *Figure 4A* and *Figure 4B*.
 - Elevator(s) and stairways: assumed passenger elevator(s) and stairway(s) in design
 - Foundation footings:
 - Load bearing footings (assumed):
 - Column footing: 1700 K applied total load (maximum, assumed)
 - Shear wall bearing: TBD
 - Bottom of footing (BOF):
 - Column footings: assumed at 7 feet below exterior grade.
 - Bearing walls and pilasters: assumed at 7 ft. embedment depth (*Figure 4A*, *Figure 4B*)
 - Frost wall footings: TBD; see frost recommendation report section.
 - Assumed lowest level floor (*Figure 1C*) configuration:
 - Consist of conventional concrete slabs-on-grade or bituminous concrete pavement
 - Lowest level assumed to vary in elevation
 - 5%+/- concrete ramp to upper levels
 - Ramp retaining wall and shear wall; and
 - Ramp engineered fill in-fill
 - Elevator Pits: elevator pits' base elevations are assumed at 4 ft. below adjacent lowest level slab finish floor.

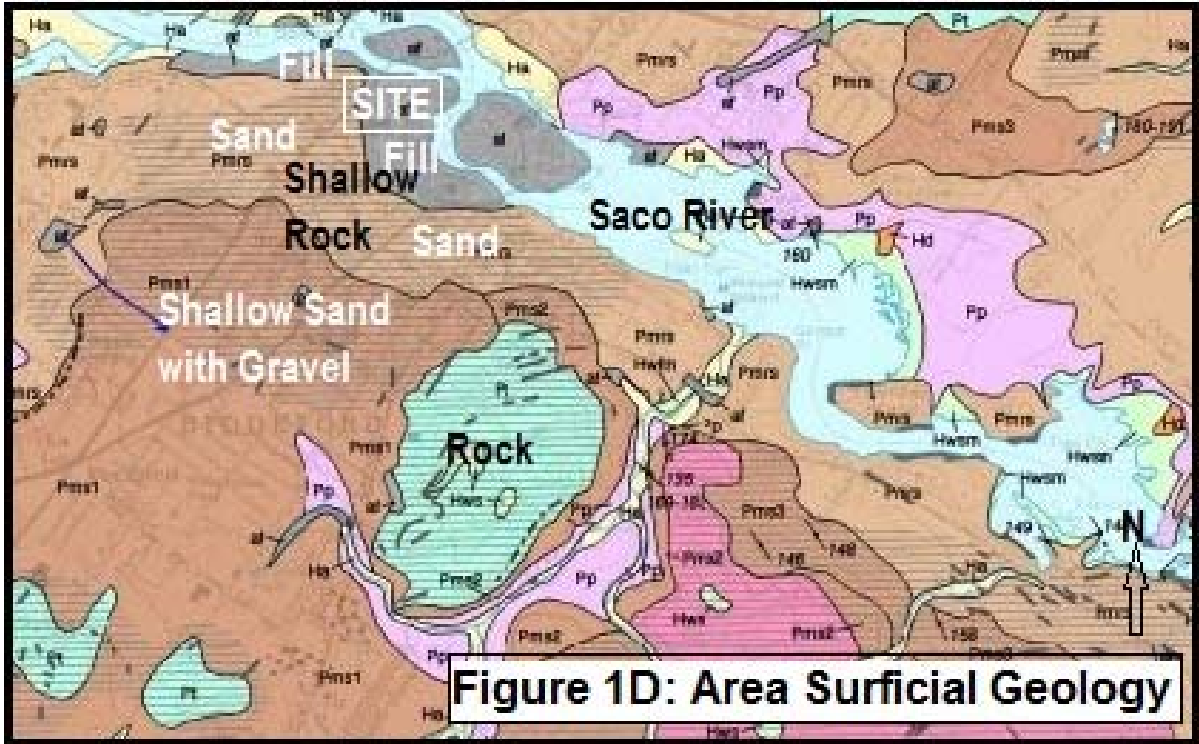


Figure 1D: Area Surficial Geology

II. Subsurface Conditions:

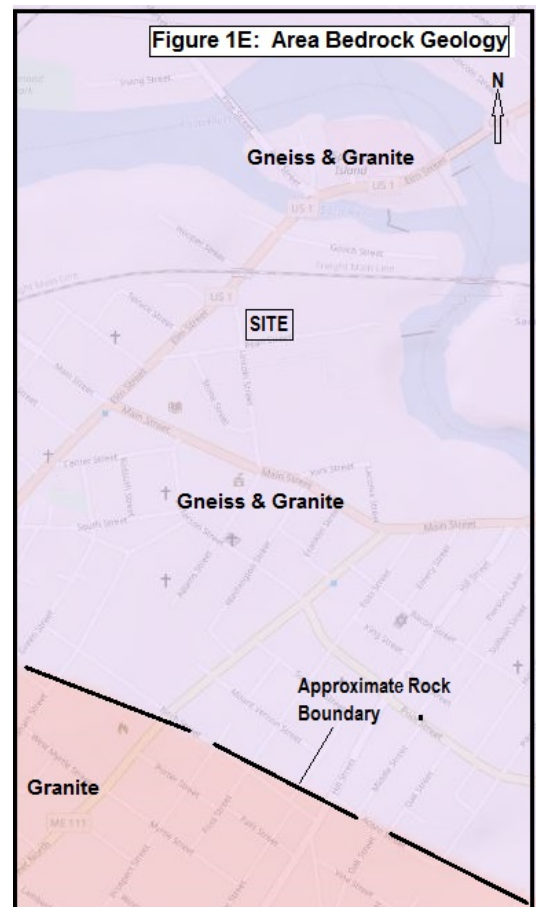
Topographic Data:

- Elevation Range:
 - The immediate site area is relatively level to slightly sloping (*Figure 1: 3D USGS Area Topographic Plan*).
 - The vertical scale in *Figure 1* has been purposely exaggerated by a factor of 4X to better reveal site and area topographic variation.
- Area Surficial Geology:
 - Area surficial geology is the result of a complex interaction of glacial advance and retreat and intrusive marine action.
 - *Figure 1D* and *Figure 1* show the general project area is situated upon a surficial fill deposit
 - Adjacent soil formation mapping indicate marine near-shore and glacial soil deposits are likely found below the fill. These can include:
 - Marine deposited sand (marine regressive) and silty clay (marine sediment); as well as
 - Glacially deposited marine reworked glacial till and undisturbed glacial till.
 - Horizontal lines shown in the site area on *Figure 1D* indicate likely shallow depth to bedrock.
 - According to area surficial geologic mapping utilizing the site's latitude and longitude, the property was predicted to be located upon the following native materials to be found below surficial existing fill (*Figure 1, Figure 1D*)::
 - Discontinuous marine regressive sand with included marine sediment and marine reworked glacial till
 - Thin, discontinuous, undisturbed glacial till over
 - Bedrock.

- Near Site Area Water Bodies:
 - Saco River: 620 ft. north and 650 ft. east
 - No other significant project area water bodies (ponds, lakes, rivers, streams) are mapped on *Figure 1* within 1 mile of the subject site.
 - Unmapped wetlands can be found in area river lowlands buried below placed fill.

- Anticipated Site Substrata: based upon the collected geologic and topographic data, the following subsoils were considered to be potentially encountered on-site:
 - Man-placed fill.
 - Organics (peat, organic silt)
 - Marine Regressive (sand)
 - Marine Sediment (silty clay)
 - Reworked glacial till
 - Thinly bedded undisturbed till

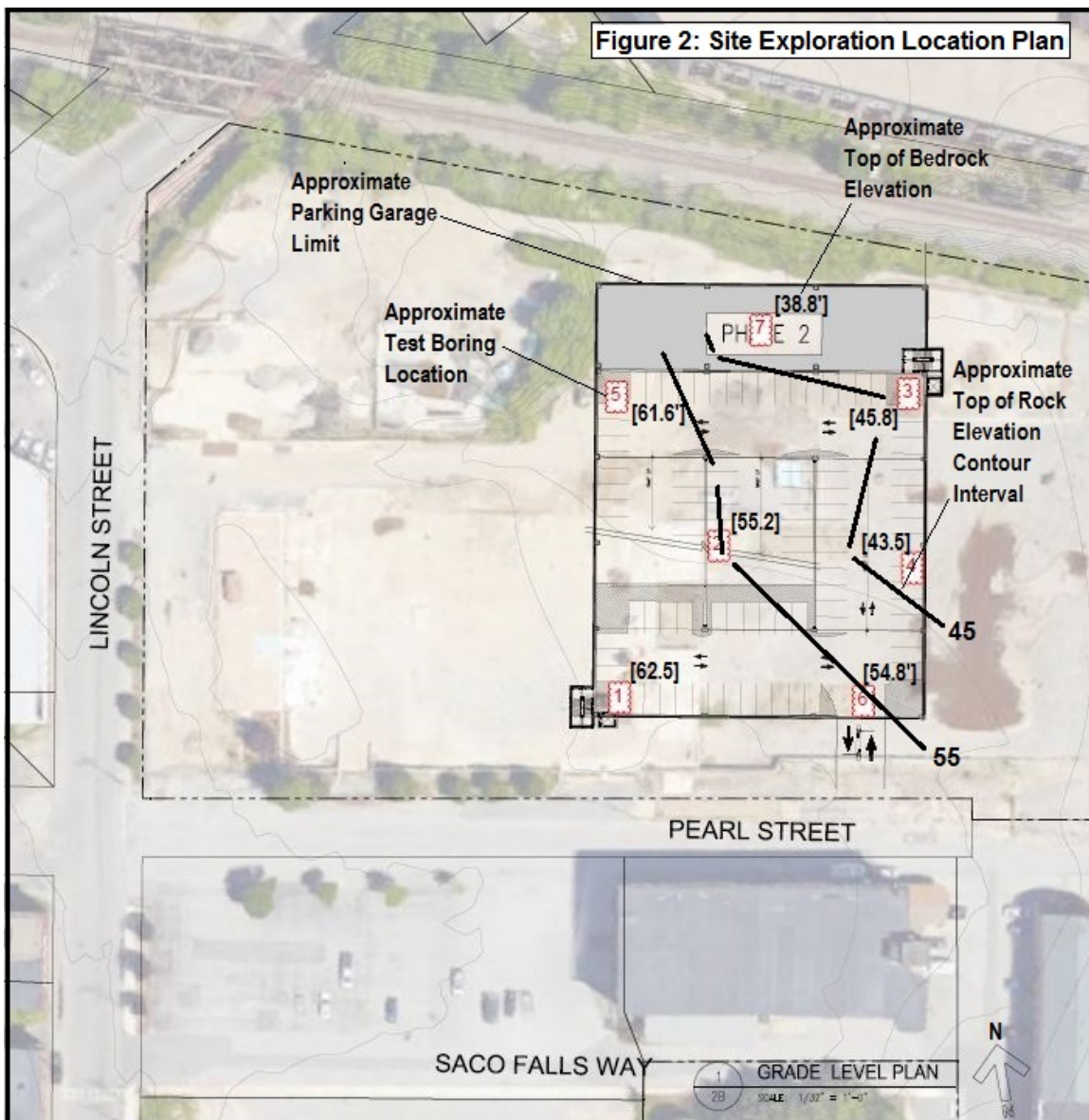
- Area Bedrock Geology: [US Department of the Interior; US Geological Survey mapping; see *Figure 1E*]
 - Common area bedrock: granite
 - A crystalline igneous rock.
 - Granitic rock with alkali feldspar and quartz
 - A hard, sound medium grained rock
 - Alternate common area bedrock: gneiss
 - Banded metamorphic rock; bands typically 1 mm to 1 cm thick); defined by texture and arrangement of mineral grains
 - Layers are mineralogically unlike; coarse grained
 - Can originate from igneous rock (granite): recrystallization due to intense regional metamorphism
 - Dominated by quartz and feldspar
 - Gray, well layered biotite-plagioclase-quartz gneiss
 - Other bedrock data:
 - Test borings drilled 200 ft. to 400 ft. south across Pearl Street ranged in depth to bedrock from 5 ft. to 15 ft. depth.
 - Rock cored was said to be phyllite.
 - Phyllite characteristics:
 - Fine grained, strongly schistose foliated metamorphic rock often with mica and quartz
 - Intermediate type between schists and slates
 - Can have a glittery sheen (due to mica); may contain visible garnet and pyrite crystals
 - Typically light coloration, although sometimes darker shades including black
 - Derived from fine grained sedimentary rock by mechanical deformation and recrystallization
 - Depth to bedrock:
 - Estimate GIS depth to bedrock: < 16 ft.+/-
 - Surficial mapping indicated depth to bedrock was likely relatively shallow (*Figure 1D*).



Previous Test Borings

- On-Site Borings:
 - None of record were found for the subject site.
 - No remnant groundwater wells were found which would have indicated prior subsurface site review.
- Off-site across Pearl Street:
 - The following general soil strata were seen in borings drilled in 2009 in a parking area nearby across Pearl Street. [Note that concrete encountered in most 2009 borings caused abandonment of the drill holes without attempting to drill through and explore the underlying subsurface soils and bedrock.]

*Man-placed fill and construction debris; buried structural remnants (concrete)
Silt, sand and gravel (glacial till?)*



Test Borings Undertaken for this Study

- **Dig Safe:**
 - Test boring locations were laid out on-site by us.
 - General Dig Safe site underground utility clearance: was provided by us.
 - The Dig Safe ticket number for this project: 2018-140-0408.
 - Utilities contacted: Maine Gas, Central Maine Power, Unitil, Sprint-Nextel, Consolidated Communications, AT&T, Firstlight, Champagne Energy
 - Water lines were found marked on-site with blue paint and pin flags.
 - Fire and storm sewer lines were noted by us during drilling.
 - The as-drilled test boring surface elevations were surveyed by Owen Haskell.

- **Test borings:**
 - Drilling by Soil Exploration Corp of Leominster, Massachusetts: seven (7) structural test boring (designated B1 through B7) were drilled on-site during 12 and 13 April 2018. Two days were required due to the difficulty of drilling through found remnant structures.
 - Refer to *Figure 2: Site Exploration Location Plan* for as-drilled test boring locations.
 - A truck mounted drill-rig (*Photo 1*) equipped with an auto-hammer, drilled and sampled soils in the borings below grade.
 - Pre-drilling with a concrete core drill was required at parking lot borings (*Photo 2*).
 - Borings were sampled on a semi-continuous basis: 4 ft. of soil samples retrieved per each 5 ft. depth interval drilled.
 - Auger borings were advanced to up to 25.3 ft. depth
 - All borings were terminated within demonstrably sampled bedrock.

- **Digital Boring Logs:**
 - Recovered test boring soil samples were digitally logged by the geotechnical engineer in accordance with *ASTM D-5434-97: Standard Guide for Logging of Subsurface Explorations of Soil and Rock*.
 - Boring logs prepared by the engineer are presented in soil boring log sheets in *Appendix A*.
 - Logs detail soil type, boundary elevation or depth, density, consistency, thickness, coloration, moisture and composition.

Photo 1: Truck mounted drill rig augering at B1



Photo 2: Concrete core drilling at B2



III. Geotechnical Testing:

Field Testing Performed:

- Standard Penetration Tests (SPT) (N_{70} in blows/foot)
- Field Unconfined Compressive Strength Tests ($q_{u\text{-field}}$ in tons per square foot)
- Field Gradation Tests

Standard Penetration Testing (SPT):

- SPT Presentation and Definition:
 - A standard penetration test is defined as the number of blows of a 140 lb. hammer falling 30 inches to drive a standard soil split spoon sampler 12 vertical inches. The number of blows is designated as "N"
 - Standard penetration tests (SPT) N are summarized for the borings with elevation on the boring logs in *Appendix A* and in *Figure 4A* and *Figure 4B*.
 - Field SPT N (blows/foot) is taken from blow count graphs provided on the boring logs.
 - Standard penetration test N is plotted for the borings in *Figure 3A* and *Figure 3B*.
- SPT Type:
 - The borings drilled for this study (see *Appendix A*) used an auto-hammer sampler drive system which delivers replicable, consistent energy for each blow.
 - This is considered an improvement over older style drill rigs which utilized a rope and cathead (donut) system and can have operator error or bias particularly when drilling in dense soils (e.g. "short stroke" as driller tired, yielding artificially high N values).
- SPT N Data Analysis of this Site:
 - Note that in the plots of N with depth in *Figure 3A* and *Figure 3B*:
 - Boring N values in *Figure 3A* (westerly portion of the site) generally show:
 - High values of N in densified granular fill, undisturbed glacial till
 - Lower values of N in marine regressive sand and reworked glacial till
 - Boring N values in *Figure 3B* (easterly portion of the site) generally show:
 - N values decrease with depth.
 - Causes of N decrease:
 - N values in silty clay (marine sediment; boring B4) are less reliable than those for cohesionless soils and are better described by the testing shown in *Figure 3C* (field unconfined compressive strength tests).
 - Incompletely densified deeply placed granular fill (boring B3)
 - Reworked glacial till (boring B4)
 - See also the N pattern variation with depth in *Figure 5A* and *Figure 5B* as well as in the blow count graphs on individual boring logs in *Appendix A*.
- SPT N Engineering Uses: SPT data can be useful in determination of values of soil bearing capacity, Young's Modulus for footing settlement evaluation, as well as input to footing base soil friction angle, seismic site class and slab subgrade modulus determination.
- Corrected SPT N:
 - Correction of raw field N_{70} values is performed based upon factors of soil overburden pressure, drill rig sampler hammer type, drill rod length, sampler liner, etc. These are employed to calibrate the field N values reported.
 - Auto hammer field N values can require initial correction by a factor of about 1.15 when using other hammer systems as a basis for calculations.
 - Final N energy adjustment to N_{55} is required for performance of granular soil foundation settlement calculations [refer to Joseph E. Bowles; *Foundation Analysis and Design*; 5th Edition; 1997].

Figure 3A: SPT Summary - West

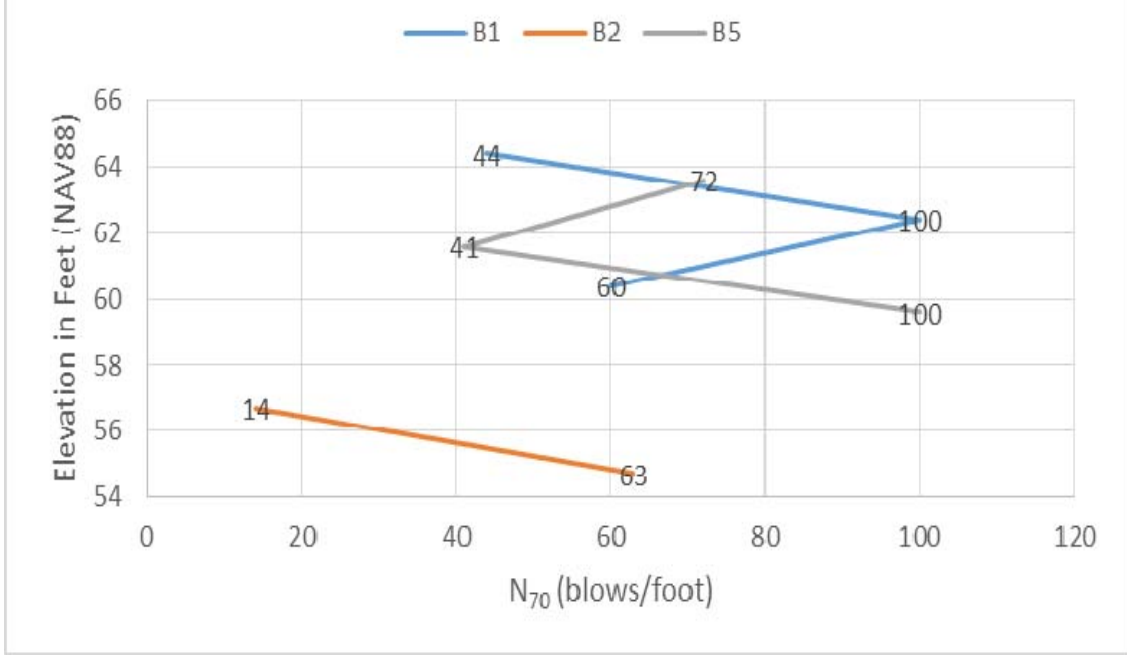
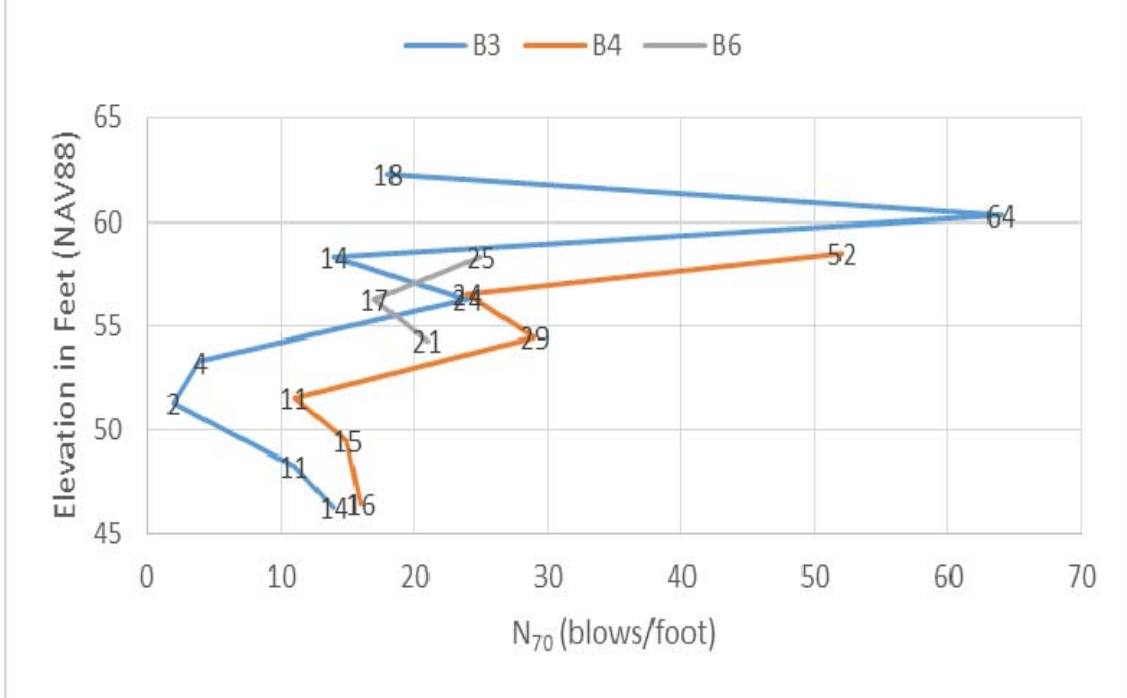
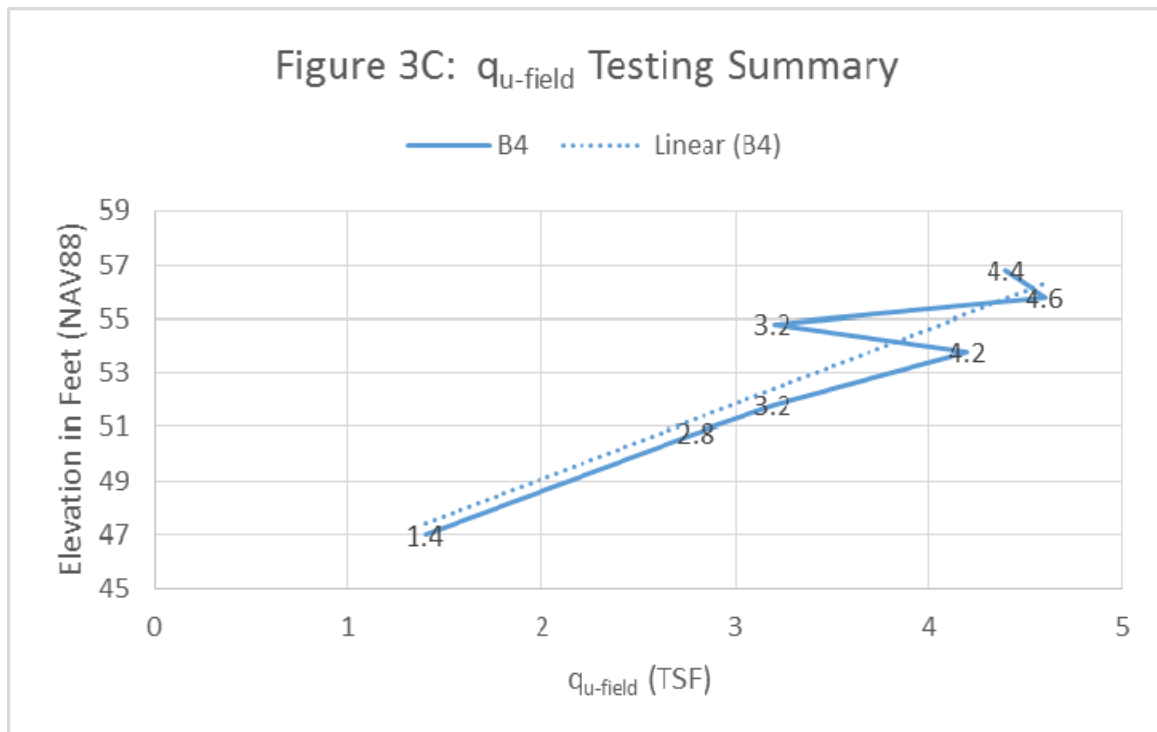


Figure 3B: SPT Summary - East



Field Compressive Strength Tests ($q_{u-field}$ in TSF):

- Test Use:
 - Field compressive strength tests are a good indicator of plastic (cohesive) soil field compressive strength variation ($q_{u-field}$ in TSF) in marine sediment (marine silty clay) with elevation.
 - The test gives preliminary level input for approximation of soil undrained shear strength.
- Presentation:
 - All $q_{u-field}$ performed for the site borings are plotted on *Figure 3C*. Only boring B4, at the east limit of the site was shown to encounter marine sediment. The actual limits of the marine sediment deposit on this site is unknown.
 - Testing average is also shown on *Figure 3C*.
 - All $q_{u-field}$ tests are given on the boring logs as well as the interval summaries plotted (*Appendix A*).
- Data Review:
 - Marine sediment was found only in boring B4 and $q_{u-field}$ tests were performed.
 - *Figure 3C* shows a drop of marine sediment field compressive strength with depth. Strength ranged from low stiff (1.4 TSF) to hard (> 4 TSF) in boring B4.
 - Medium stiff (< 1 TSF) and soft (< 0.5 TSF) silty clay was absent in the 7 borings drilled.
 - No organic soils were encountered in any boring drilled (see *Appendix A*).



Field Gradation Tests:

- Test Use: Limited field gradation tests were performed to better determine the relative percents of coarse gravel, fine gravel, coarse sand, and medium sand and fines (silt and fine sand) in recovered granular fill, marine regressive sand and glacial till soil samples.
- Limitations:
 - Field tests are limited to recovered dry or field air dried soil samples.
 - 4-sieve method does not allow for separation of silt from fine sand.

Laboratory Soil Testing: no laboratory soil tests were performed for this phase of site review.

IV. Soil Strata:

Data Summaries:

- Profile Data Summary: general summaries of soil substrata found in the subsurface explorations are provided in *Table I*
- Subsurface Summary Drawings:
 - Refer to the subsoil profiles sketched in *Figure 4A* and *Figure 4B* to gain an initial overview of site subsurface soil and rock conditions within the proposed building area (*Figure 2*).
 - Subsoil profiles' orientations within the building area are given on the profile drawings relative to *Figure 2*.
- Profile Field Descriptions: field subsoil and rock descriptions are given in the logs of the borings presented in *Appendix A*.

Table I: Exploration Summary – Structural Borings

Test Bore No.	Ground Surface El. (ft.)	Depth Drilled (ft.)	Surface Slab & Pavement (ft.)*	All Fill (ft.)	Marine Regressive Sand (ft.)	Marine Sediment (ft.)	All Glacial Till (ft.)	Rock (ft.)
B1	66.4	9.0	0.7	3.2	---	---	---	>5.1
B2	62.7	8.9	2.5	2.7	1.0	---	1.3	>1.4
B3	64.3	19.0	0.3	15.2	3.0	---	---	>0.5
B4	62.5	20.0	2.2	---	3.3	10.0	3.5	>1.0
B5	65.6	5.8	0.3	1.9	---	---	1.8	>1.8
B6	62.3	9.0	3.0	---	2.0	---	2.5	>1.5
B7	64.1	25.3	0.2	11.3	4.0	---	9.5	>0.3

* Does not include buried slabs found in borings (see *Figure 4A*, *Figure 4B*, *Appendix A*)

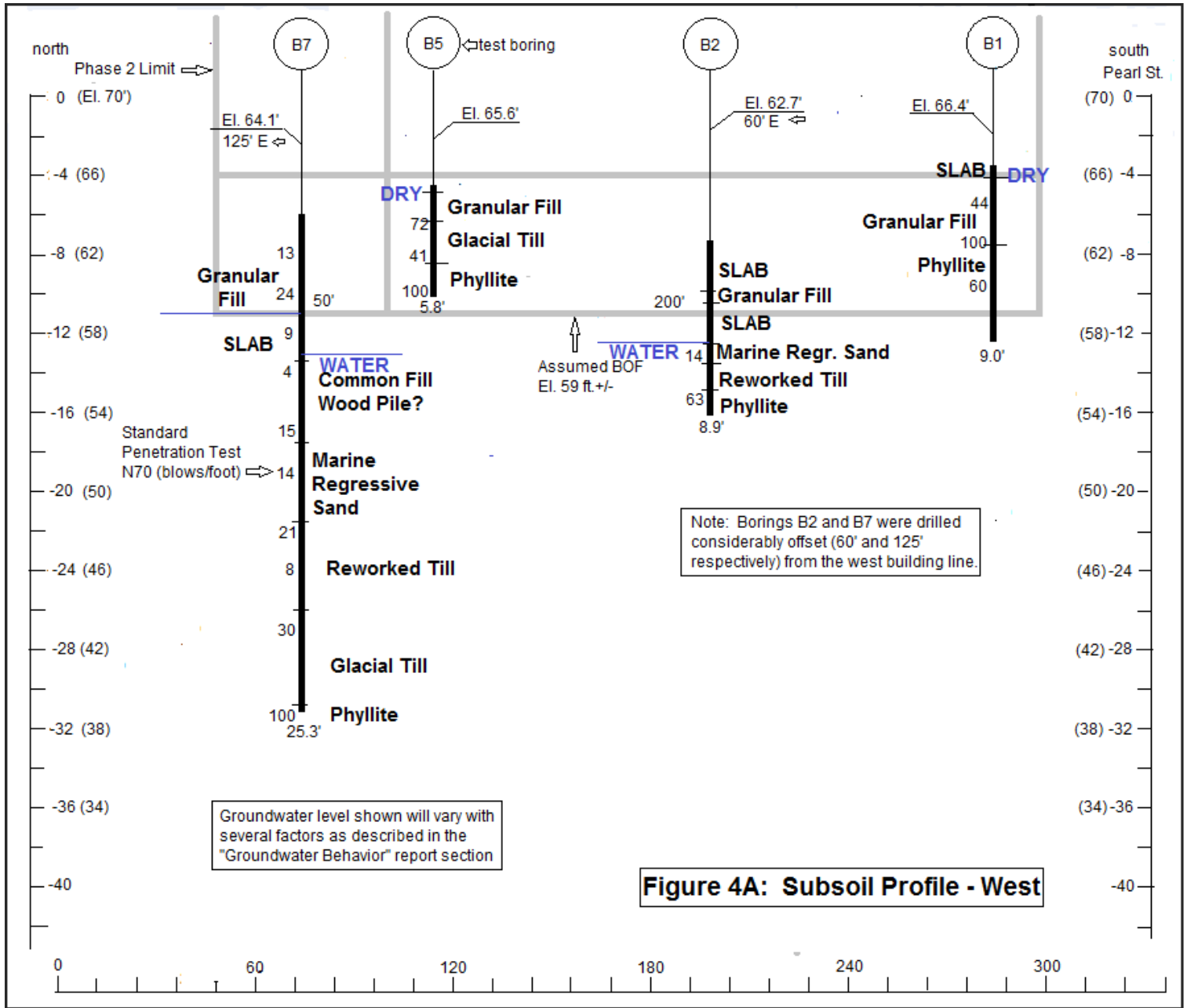


Figure 4A: Subsoil Profile - West

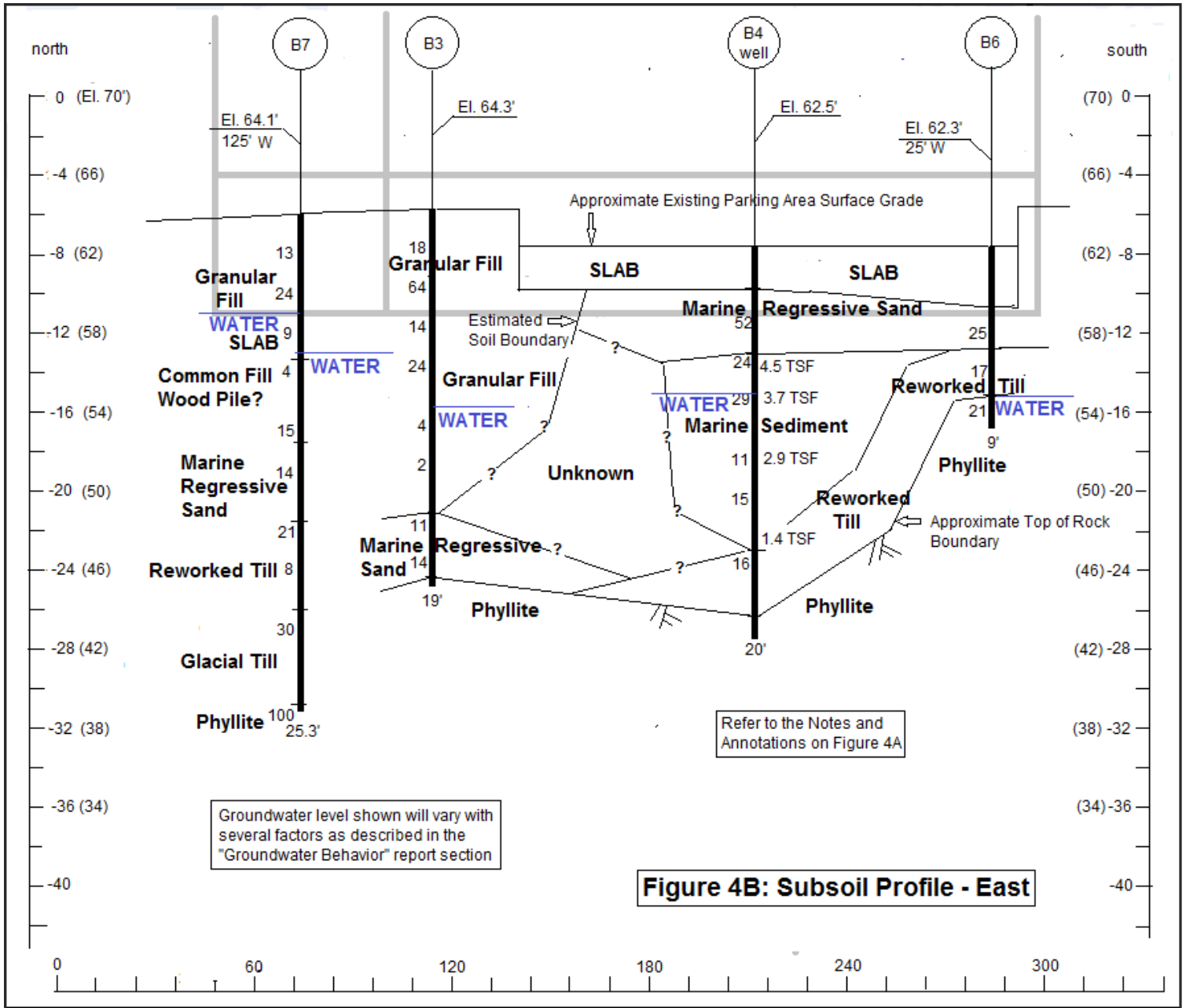


Figure 4B: Subsoil Profile - East

Soil Classification System Used for this Site Investigation:

- Soil Classification System: Project soils have been classified in accordance with the Unified Soil Classification System (USCS; MIT System). This is reflected in the test boring logs in *Appendix A*.
- Soil Descriptions: Soils are described in terms of color, grain size, moisture content, density (coarse grained soils), consistency (fine grained soils), plasticity and cementation, as appropriate.

<u>Grain</u>	<u>Size Boundaries (dia.)</u>	<u>Common Size Example</u>
Boulder	>12 in.	>Basketball
Cobble	3-in. to 12-in.	Grapefruit size
Coarse Gravel	¾-in. to 3-in.	Lemon size
Fine Gravel	#4 Sieve (4.75mm) to ¾-in.	Pea to grape size
Coarse Sand	#10 Sieve (2 mm) to #4 Sieve	Peppercorn size
Medium Sand	# 40 Sieve (.425 mm) to #10 Sieve	Sugar to table salt size
Fine Sand	#200 Sieve (.075 mm) to #40 Sieve	Powdered sugar size
Silt/Clay	<#200 Sieve (.075 mm)	Flour particle or finer

- Soil Moisture Content:
 - Dry: no moisture noted
 - Moist: some moisture observed
 - Very moist: very moist, but not saturated (possible vadose zone)
 - Wet: saturated above the liquid limit (likely groundwater zone)
- Soil Density and Consistency:
 - Density of coarse grained soils (non-plastic silts, sands, gravels): defined in terms of standard penetration test blowcount N values (refer to the summary table at the bottom of any boring log)
 - Consistency (plastic silts, clay, and organics): defined secondarily in terms of blowcount N values and primarily with respect to field unconfined compressive strength in TSF (refer to the summary table at the bottom of any boring log).
- Soil Particle Percentage Field Designation: Relative soil particle size percentages (trace, few, little, some, mostly [capitalized soil unit]): refer to summary table at bottom of any boring log. These are more accurately tallied by laboratory soil particle gradation tests.
- Subsoil Classes on this Site: USCS soil type designations utilized in this report:
 - AR = man placed fill; artificial soil stratum
 - SP = marine regressive sand, poorly graded
 - SW = marine regressive sand, well graded
 - CL = marine sediment, silty clay
 - GT = glacial till
 - WR = weathered rock

Photo 3: Bituminous & Concrete Core



Photo 4: Granular Fill



Photo 5: Marine Regressive Sand



Photo 6: Marine Sediment-silty Clay



Site Subsoil Descriptions:

- Existing Fill (AR):
 - Types: Two (2) fill types were found in the borings:
 - Granular fill:
 - Found below pavement and slabs
 - Deeply bedded near sewer lines (rear of site; see logs of boring B3 and B7)
 - May be a native marine regressive sand (*Photo 5*) excavated elsewhere and used as fill on this site. Material is a clean sand with gravel (*Photo 4*).
 - Common fill:
 - Found as likely glacial till fill (reworked (*Photo 7*) or native) excavated elsewhere and used as fill on this site.
 - Seen as a sandy silt with gravel (see log of boring B7).

- Fill Thickness at the borings drilled (*Table I*): highly variable

Test Boring No.	Surface Slab & Pavement (ft.)*	All Fill (ft.)
B1	0.7	3.2
B2	2.5	2.7
B3	0.3	15.2
B4	2.2	---
B5	0.3	1.9
B6	3.0	---
B7	0.2	11.3

- Fill density:
 - Granular fill was found to be:
 - Dense where found below pavement or slabs
 - Looser with depth elsewhere (see logs of B3 and B7 and *Figure 4B*)
 - Not enough common fill was found (B7 only) to make a definite statement (see *Figure 4B*)
- Fill competence:
 - Granular fill found within the existing parking area appears to be of sufficient quality and density to remain in-place below structural units.
 - Fill at the north end of the site (*Figure 4A, Figure 4B*) should not be allowed to remain in place below structural units in its current state.
 - Excavated granular fill separated from other soil units can be stockpiled for re-use as engineered fill pending confirmation by construction phase soil particle gradation tests.

Photo 7: Reworked Glacial Till

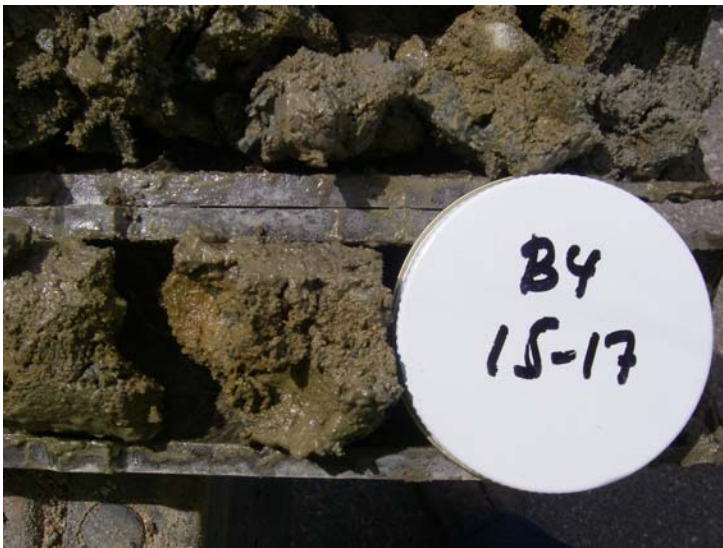


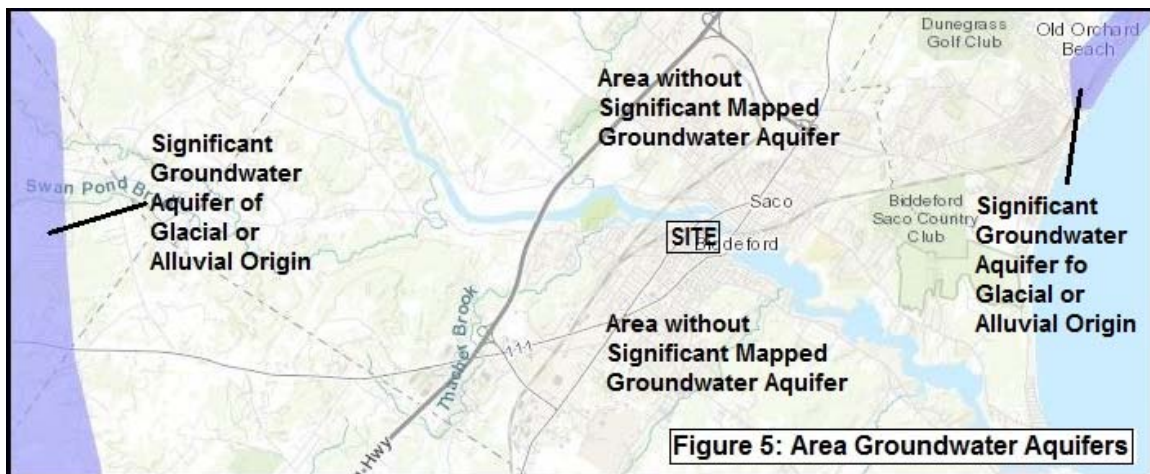
Photo 8: Phyllite bedrock from auger plug



- Organics (OH, PT): no organic soils were encountered in the borings drilled on-site
- Marine Regressive Sand:
 - Definition and Source:
 - Refer to the “Area Surficial Geology” report section (page 5).

- o Intact bedrock was found in all seven borings drilled
- o The rock type found in all cases was fine grained, moderately weathered very closely fractured phyllite bedrock (*Photo 8*). Rock fracture spacing increased with depth.
- o See also the “Area Bedrock Geology” report section on page 6 for a more detailed description of phyllite characteristics.
- o Top of bedrock elevation patterns on-site were estimated in *Figure 2* and are summarized below:

Test Boring No.	Depth Drilled into Fractured Bedrock (ft.)	Depth to Top of Bedrock (ft.)	Top of Bedrock Elevation (ft.)
B1	>5.1	3.9	62.5
B2	>1.4	7.5	55.2
B3	>0.5	18.5	45.8
B4	>1.0	19.0	43.5
B5	>1.8	4.0	61.6
B6	>1.5	7.5	54.8
B7	>0.3	25.3	38.8



V. Groundwater Behavior

- Free Water:
 - o Wet (saturated) soil was encountered:
 - In subsoils in five (5) site test borings (*Figure 4A, Figure 4B; Appendix A*)
 - The two westerly dry test borings (B1, B5; *Figure 4A*) were subsoil dry due to shallow depth to bedrock; water was expected within the fractured bedrock at depth.
 - o The site does not lie within a mapped significant groundwater aquifer (refer to *Figure 5: Area Groundwater Aquifers*).
 - o No groundwater monitoring wells were found on-site. A well was installed in boring B4 as part of this site review (*Figure 2, Figure 4B; Appendix A*).
 - o *Table II* summarizes the site groundwater data collected.
 - Note the water levels given were observed within a relatively wet period.
 - No review of possible tidally influenced water level variation relative to influence of the Saco River was undertaken.

Table II: Groundwater Observations

Loc. No.	Elevation	Date	Observation	Groundwater Depth	Groundwater El.
B1	66.4 ft.	04/13/18	Dry soil		
B2	62.7 ft.	04/12/18	Wet marine reg. sand	5.2 ft.*	57.5 ft.*
B3	64.3 ft.	04/13/18	Wet granular fill	10.0 ft.	54.3 ft.
B4-well	62.5 ft.	04/13/18	24 hr. Well Reading	7.4 ft.	55.1 ft.
B5	65.6 ft.	04/13/18	Dry soil		
B6	62.3 ft.	04/12/18	Wet fractured phyllite	7.5 ft.	54.8 ft.
B7	64.1 ft.	04/13/18	Buried slab controlled water level, unreliable-see boring log		

* Buried slab (Appendix A) may have an impact on this water level reading; level may be unreliable

- Groundwater Level Variation:
 - Clear soil mottling (color variation, typically splotches, due to past or current water presence) or rust staining/rust lines were not seen in site soil borings.
 - Rust staining and mottling can give an indication of water level approaching seasonal high groundwater level.
 - Note fill soils do not show usable rust staining or mottling.
 - Groundwater was found in five borings drilled (see “Free Water” report section and *Figure 4A* and *Figure 4B*).
 - Localized temporary and long term changes to groundwater level can be natural or man-made. These changes source from activities such as:
 - The 2016 drought condition and the relatively dry summer of 2017, although ended may still have lingering influence.
 - Saco River tidal variation
 - Winter drier season water levels.
 - Heavy rainstorms or lengthy precipitation periods
 - Leaky underground structures (pipes, tunnels)
 - Underground flow retarders (buried structures, walls, slabs, shallow bedrock)
 - Percent of land surface covered by pavement and buildings without ability to recharge.
 - Nearby construction dewatering.
 - Changes to the existing surface drainage pattern due to new site topography, trenches, infiltrators, bio-retention basins and subgrade structures.
 - Groundwater impact based upon the data collected to date (*Table II, Appendix A*):
 - Natural groundwater found in soil is not expected to impact new foundation excavations at the elevations encountered.
 - Seasonal high groundwater is initially estimated at El. 57.5 ft. and would not impact the footing excavation level shown on *Figure 4A* and *Figure 4B*; or excavations no shallower than El. 58 ft.
 - Trapped water within buried structures and shallow bedrock can impact footing excavations (see boring B7 in *Figure 4B*).
 - The building’s lowest level floor slab should not be impacted by groundwater (e.g. *Figure 4A, Figure 4B*).
 - Underground utilities on some sites are designed to be installed deeper than foundations, however such data has not been provided us to-date for this project.

Hydraulic Conductivity (K in GPD/ft.²): Laboratory soil gradation testing was not undertaken for this study and associated calculations and estimations of soil hydraulic conductivity (K) were not undertaken for any site subsoil unit.

Site Civil and Environmental Investigation and Remediation Structural Unit Impact:

- Intrusive Environmental Testing and Remediation:
 - Site civil and environmental exploration (test pits and test trenches) can damage anticipated building structural unit bearing soils.
 - Site remediation work can require removal of significant volumes of contaminated soil materials from within proposed new construction footprints and inadvertently cause structural unit bearing soil degradation.
- Protection of Structural Unit Bearing Subgrade: to protect structural bearing areas, project specifications should require:
 - Test pit and test trench areas avoid proposed project footing and slab bearing zones.
 - Test pit and test trench depths be limited to structural bearing depths minus one foot.

VI. Foundation Review and Recommendations:

Foundation System:

- Recommended Structural Unit Support:
 - A spread and continuous wall footing foundation system can be used.
 - Conventional lowest level floor slabs-on-grade can be installed.
 - Proper site preparation can be undertaken to execute a conventional shallow foundation and slab-on-grade system on most of this site.
 - However, ground improvement by installation of ungrouted aggregate piers would be required over the northeasterly portion of the building footprint.
 - This area of the site contains deep uncontrolled fills (*Figure 4B*).
 - Additional soil borings may be required to better bound the ground improvement area.

Excavated Base and Working Base:

- Working Base and Building Pad Preparation:
 - Utility relocation: expect possible water, fire and storm sewer relocation prior to site preparation.
 - The existing 2.2 ft. to 3 ft. thick parking area bituminous pavement and concrete slab may remain in place below proposed new lowest level floor slabs (*Photo 3; Figure 4B*).
 - Below proposed footings, remove any man-placed subgrade pavement, slab and foundation remnants including duct banks, pipes, sewerage and conduit. This includes the northeasterly ground improvement area.
 - Provide engineered fill (compacted structural fill) to backfill to working base elevation as needed.
 - Segregate and stockpile better quality excavated existing fill material for re-use as practicable.
 - Expect shallow depths to bedrock within the building footprint (see *Figure 2, Figure 4A*). Due to the fractured nature of the bedrock it is expected the rock can be mechanically removed to the required footing bearing elevations by excavator and hoe ram.
 - Resultant exposed working base bearing soils likely will include:
 - Engineered fill (compacted structural fill); and
 - Soil and bedrock as seen in *Figure 4A, Figure 4B* and *Appendix A*.
 - Compact any exposed granular soil with two passes of a heavy drum roller in static mode as proof compaction.
 - Replace any found weak areas in the glacial till to a depth of 2 feet with compacted structural fill.
 - Any found cobbles, boulders and large broken rock should be removed within 6 inches of exposed subgrade and backfilled with compacted engineered fill.

- Raise the grade as needed) with compacted structural fill, compacted ¾ in. crushed stone or 3 inch thick lean concrete mudmats to the bottom of footing elevations and to the slab base.

Foundation Settlement and Bearing Capacity:

- Settlement and Bearing Capacity:
 - Preliminary settlement calculations were undertaken for this structure.
 - Recommended net allowable soil bearing capacity based upon the anticipated depth of foundation embedment and the variety of soil units expected at the excavated base:

Table III: Project Net Allowable Soil Bearing Pressure

Likely Soil Unit	Net Allowable Soil Bearing Pressure
Medium Dense Marine Regressive Sand	6 KSF
Dense Marine Regressive Sand	8 KSF
Stiff to Hard Marine Sediment	6 KSF
Thin Structural Fill on Fractured Phyllite	20 KSF
Aggregate Pier Improved Granular Fill	6 KSF
UTILIZE	6 KSF

- Given proper working base preparation (above), installation of aggregate piers where needed on-site and utilization of a 6 KSF net allowable soil bearing pressure, total settlement will be:
 - Limited to < 1 inch at structural units.
 - Differential settlement is expected to be < ½ in. for properly sized foundations.
- Given the variety of material types anticipated at bearing level recommended minimum footing widths are:
 - Wall footings: 2 ft.
 - Column footings: 3 ft.

Foundation Footings Bearing on Soil and Bedrock:

- Footings Bearing on Soil:
 - Footings may be founded directly upon:
 - Compacted structural fill, compacted ¾ inch crushed stone, or 300 PSI flowable fill.
 - Undisturbed, medium dense to dense marine regressive sand.
 - Footings should be designed to bear such that:
 - **The top of footing (TOF) is ≥ 6 inches below bottom of grade slab.**
 - They are founded below a minimum 1H:1V line as drawn from the bottom exterior edge of adjacent footings or utilities.
 - Groundwater may be found within excavation zones on-site as per the conditions listed in the “Groundwater Water Behavior” report section on pages 19-20. Seepage and influx following rain and melt events should also be anticipated.
- Footing Soil Base Friction:
 - Anticipated footing base friction angle is given as:
 - Φ' = 35° (compacted structural fill over medium dense to dense sand)
 - Φ' = 35° (medium dense to dense sand)
 - Use Φ' = 35°

- Footings Bearing on Rock:
 - Bedrock removal will be required for some construction phase excavations dependent upon final design footing lowest level slab base elevations (see *Figure 2, Figure 4A*).
 - Diamond Core Drilling: no bedrock cores were taken for this project as reliable rock samples were retrieved in all borings using sampler and auger plug retrieval.
 - Mechanical Removal Methods: minor rock removal of fractured rock likely can be accomplished by mechanical methods (hoe ram).
 - Drilling and Blasting: is unlikely to be required for this site with project dimensions as given on *Figure 4A* and *Figure 4B*.
 - Upon completion of general excavation of footing pits in rock:
 - The sides and bottom surfaces of the pit should be cleaned of all loose, decomposed, highly weathered and unsound rock.
 - Pits should be washed down with clean water and high pressure air.
 - If the slope of the resulting bearing surface is steeper than 4H:1V additional rock removal should be performed to reduce the slope. Otherwise rock pinning can be considered.
 - At the time footing concrete is placed, the bearing surface of the rock footing pit should be clean and dry.

- Footing Transition from Soil to Rock:
 - A 6-in. thickness of structural fill or ¾ inch crushed stone should be placed over exposed rock in bearing transition zones as a “cushion” to prevent creation of “hard spots” and associated structural unit concrete cracking.
 - For wall footings the cushion can taper to a 0 in. thickness over a lateral run of about 10 linear feet within the transition zone.

Shear Modulus (G)

- Derivation of Shear Modulus (G) at Bearing Soil Level: [J.M Duncan & A. Bursey; *Soil Modulus Correlations; ASCE Geotechnical Special Publication; 2013*]:

G = Shear Modulus = ratio of change in shear stress divided by the resulting shear strain

$$G = E_s / [2(1 + \mu)] \quad \text{where: } E_s = \text{Young's modulus (medium dense to dense sand)}$$

$E_s = 450 \text{ KSF}$ [JE Bowles; *Foundation Analysis and Design; 1997, Table 2-8*];
 N (from *Figure 3A, Figure 3B*)
 $\mu = \text{Poisson's ratio}$
 $\mu = 0.35$ (medium dense to dense sand)

$$G = 450 \text{ KSF} / [2(1 + 0.35)]$$

$$G = 167 \text{ KSF}$$

Lowest Level Floor Slabs:

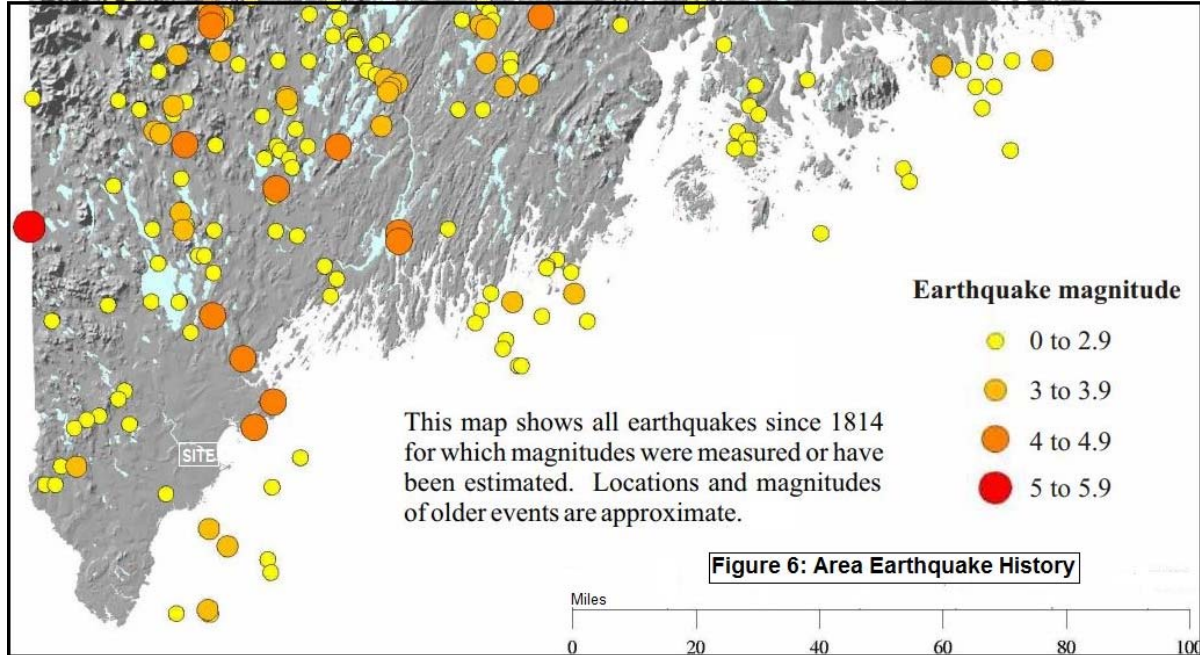
- Floor Slab Type:
 - Lowest level slabs-on-grade are assumed to be utilized for this project unless the local fire marshall allows use of bituminous concrete pavement.
 - The K_s value given assumes that slab area subgrades have been treated as indicated in the “Excavated Base and Working Base” report section (pages 21-22).

- Groundwater Levels and Lowest Level Slab:
 - Lowest level floor slab elevations are currently assumed as shown in *Figure 4A* and *Figure 4B*.
 - Refer to the groundwater information provided in the “Groundwater Behavior” report section on pages 19-20 and sketched on *Figure 4A* and *Figure 4B*. Groundwater is not expected to impact lowest level floors as shown in the figures.
 - During slab subgrade work construction dewatering due to precipitation influx and snow melt should be expected.
- Subgrade Modulus:
 - The recommended modulus of subgrade reaction (K_s) is given in *Table IV*.
 - The values given assume medium dense to dense marine regressive sand typically underlying any compacted structural fill material (*Figure 4A, Figure 4B*).

Table IV: Slab Subgrade Moduli (K_s)

Slab Area	Soil Type	K_s (KCF)
First Floor	Compacted Structural Fill or Native Sand	350 KCF
Elevators	Compacted Structural Fill or Native Sand	350 KCF

- Under Slab Pads and Slab Control Joints:
 - Slab base pads should be provided. Base pads should be at least 6 inches in thickness.
 - Pad material can consist of compacted structural fill or alternately, of compacted ¾ inch crushed stone if desired by the Structural Engineer.
 - Slab control joints should be utilized within patterns as determined by the Project Structural Engineer.



Seismic Recommendations:

- Seismic Site Hazard Review:
 - Probabilistic Site Hard Analysis [*PSHA Interactive Deagregation*; Geologic Hazards Science Center, US Geologic Survey; 2008 v.2]

- Decimal site latitude and longitude utilized in this review: (43.4954° N, -70.4549° W).
- Probability of magnitude 5 (M5.0) or greater earthquake occurrence within 50 miles of the subject site within a 50-year building design life is considered relatively low (< 3%+/-).
- Area earthquake history:
 - Typical southern Maine measured earthquakes within the past 40 years have magnitude as plotted on *Figure 6: Area Earthquake History*.
 - Past significant earthquakes with area impact recreated from the geologic record:

Year	Magnitude	Location	Intensity in Boston
1638	6.5	Central New Hampshire	MMI: V-VII
1663	7.0	Charlevoix, Quebec	MMI: V-VI
1727	5.6	Newbury, MA	MMI: V-VI
1755	5.9	Scituate, MA	MMI: IX

 MMI: Modified Mercalli Scale (subjective; observed damage and effects)

- Seismic Site Class: The collected site subsoil data has been applied to the Massachusetts adopted *International Building Code (2015)*. According to the *Building Code*
 - Analytic depth:
 - The upper 100 feet of soil and bedrock are subject to analysis.
 - Soil and rock data on-site in the Phase I building has been collected to up to 20 ft. depth.
 - Bedrock:
 - Site bedrock is a schist rock (see “Area Bedrock Geology” report section).
 - Bedrock was found in all Phase I test borings with:
 - z = 4 ft. to 19 ft. depth from ground surface as drilled.
 - Depth below Phase I footings with BOF=El. 59 ft. implies z = 0 ft. to 16 ft. depth
 - Using *Figure 2*, average Phase I site depth to rock from BOF = about 4 ft.
 - Depth to intact bedrock as measured from likely BOF ≤ 10 ft. allows assignment of seismic Site Class A or B to this project (Phase I building portion only) dependent upon rock type.
 - The soil and rock data collected allows classification of this site as seismic Site Class B (Phyllite; metamorphic rock).
- Seismic Design Factors: Preliminary estimated Earthquake Design Factors for Biddeford, Maine (Section 1613, *IBC (2015)*):
 - $S_s = 0.25g$ (short interval)
 - $S_1 = 0.08g$ (1-second interval)
 - $F_a = 1.0$ (site coefficient, classification as Site Class B)
 - $F_v = 1.0$ (site coefficient, classification as Site Class B)

Liquefaction:

- Liquefaction Factors:
 - Earthquake magnitude
 - Earthquake amplitude (duration)
 - Subsoil types and condition
- Earthquake Magnitude:
 - Collected data indicates that the probability of occurrence of an earthquake of magnitude 5 or higher is low probable during a 50 year building design life.
 - However, with a time period measured in centuries instead of decades, earthquakes of magnitude 5 or greater can be expected to occur as the earthquakes listed on page 24 indicate.

- Earthquake Duration: This topic is beyond the scope of this review.
- Subsoil Data Input: Review of the site subsoil profile was necessary for soil liquefaction determination below structural units:
 - Relevant test boring information: no significant thickness of post compaction, loose to very loose saturated silty to clean sands and non-plastic silts (SM, SP, SW, ML) would be found below structural units.
 - Drill rig, site groundwater level and measured soil strength data with depth:
 - Drill rig hammer type: auto-hammer
 - Groundwater level: within 8 ft. of ground surface (*Table II*) at the time of this review (refer also to the “Groundwater Behavior” report section)
 - Plotted field N_{70} -values from the borings with depth (*Figure 3A* and *Figure 3B*).
- Site Liquefaction Determination:
 - Review of field auto hammer N_{70} from the borings with depth with respect to *Figure 1806.4c* of the *Massachusetts Amendments (2017; 9th Edition)* for preliminary liquefaction exclusion review compared to a range of (seasonal high) groundwater levels.
 - Assumption that site subgrade preparation will be performed as described in the “Excavated Base and Working Base” report section.
 - Result: liquefaction settlement is not of concern for this site for a $\geq 5M$ earthquake.

Foundation Wall Design (Restrained Walls):

- Restrained Walls: Based upon the assumptions we have made (page 3; *Figure 4A* and *Figure 4B*) there will be some depth of below grade foundation walls in this structure.
- Lateral Earth Pressure and Hydrostatic Pressure:
 - New foundation walls should be designed to resist *lateral pressures* calculated on the basis of an equivalent fluid weight of:
 - 60 PCF (not designed to resist hydrostatic pressure: drains provided)
 - 90 PCF (designed to resist hydrostatic pressure: no drains provided)
 - The recommendations assume an at-rest earth pressure coefficient (K_o) as follows [Knappett & Craig, *Craig’s Soil Mechanics*; 2012; Figure 11.11]:
 - $K_o = 0.44$ ($\Phi' = 35^\circ$)
 - Where the calculated earth pressure behind walls is < 250 PSF, it should be increased to 250 PSF to account for stresses caused by compaction within 5 lateral feet from the wall face.
- Surcharge Loads:
 - Surcharge loads are generated by adjacent loads of construction equipment, materials, stockpiles and traffic loads
 - Surcharge loads can be determined on the basis of a uniform lateral pressure equal to K_o multiplied by the vertical surcharge load applied over the full height of the wall.
- Seismically Induced Loads:
 - Seismically-induced earth pressures (*earthquake force*, F_w) should be distributed as an inverted triangle over the height of the wall.
 - $F_w = 0.1 (S_s)(F_a)(Y_t)(H)^2$
 - $S_s = 0.25g$ (see “Seismic Recommendations” report section)
 - $F_a =$ Site Coefficient = 1.0 (classification as Site Class B)
 - $Y_t =$ Total Soil Unit Weight = use 125 PCF
 - $H =$ height of foundation wall
- Total Lateral Stress: The two static lateral pressures and the seismic pressure when added yield the total lateral stress for structural design of the walls.

Structural Unit Frost Protection Depth:

- Definition:
 - Frost depth, freezing depth or frost line is the depth to which moisture in subsoil is expected to freeze.
 - Frost line varies in position (elevation) during seasonal freeze and thaw.
- Site Structural Unit Frost Protection Depth:
 - Frost line:
 - Average area frost line value: 0.9 m = 36 in. [J.E. Bowles; *Foundation Analysis and Design 5th Ed.*; 1997; Figure 7-1].
 - Extreme frost line based upon state average: 60 in. [NAVFAC DM-7.1; *Soil Mechanics Design Manual 7.1*; Figure 7; 1982].
 - Based upon local practice: recommended minimum site structural unit frost protection depth for this southern Maine near coastal property as measured from final adjacent exterior grade: = 54 in. (4.5 ft.)
- Cold Weather Work Soil Protection:
 - During construction earthwork the contractor must be prepared to provide protection and/or thawing of foundation bearing soils against freezing.
 - Footings: insulation blankets and/or ground heating hoses should be utilized if footing subgrade is exposed to freezing during cold weather periods.
 - Lowest Level Slabs:
 - Typically slab subgrade areas are thawed once basic framing is up by providing heaters after enclosing the lowest level in plastic sheeting.
 - Then any remaining required grade raise fill, treatment and placement of the slab base pad can be properly performed.

Excavation and Bracing:

- Excavation Depth \leq 4 ft.+/-:
 - Common practice is to maintain a 1H:1V temporary side slope for shallow excavation (\leq 4 ft.+/-) during construction. Benched steps can also be executed.
 - Note that the sidewall stability will be undermined by:
 - Minor sloughing when sidewall bleeding occurs either from release of groundwater in soil or drainage following storm events; and
 - Surficial exposed granular sidewall soil drying.
- Excavation $>$ 4 ft.:
 - A braced excavation is required where adequate lateral space does not exist for a temporary 1H:1V sloped excavation.
 - 7 ft. depth footing embedment with a $>$ 7 ft. building setback from Pearl Street and available land on the other 3 building sides (*Figure 2*), the potential need for excavation soil bracing is likely limited.
 - Exception may occur at the existing utility lines at the north end of the site (water, fire, sewer) dependent upon utility relocation planning.

Drainage and Waterproofing:

- General Comments/Good Practice:
 - Exterior grading at the building should be designed to carry surface water runoff away from the structure.
 - Planted areas or pavements should enhance the exterior grading performed to insure surface water runoff beyond building limits.
 - Roof downspout water or other water should not be allowed to pool near the building.

- Building Foundation Walls: based upon assumptions on page 4, *Figure 1C* and *Figure 4A* through *Figure 4B*:
 - Foundation drains: foundation drains are not considered necessary for this building
 - Below grade wall waterproofing: no below grade usable space is currently anticipated in this building design, thus waterproofing of any below grade walls is unnecessary.
- Lowest Level Floor Slab:
 - Based upon existing project assumptions (page 4, *Figure 1C*, *Figure 4A* and *Figure 4B*) no lowest level slab waterproofing is necessary.
 - Normal damp proofing could be provided if desired by the Architect consisting of either:
 - Conventional, overlapped, loose laid polyethylene sheeting; or
 - An adhered positive side moisture barrier membrane such as WR Grace FlorPrufe (typically not utilized due to cost).

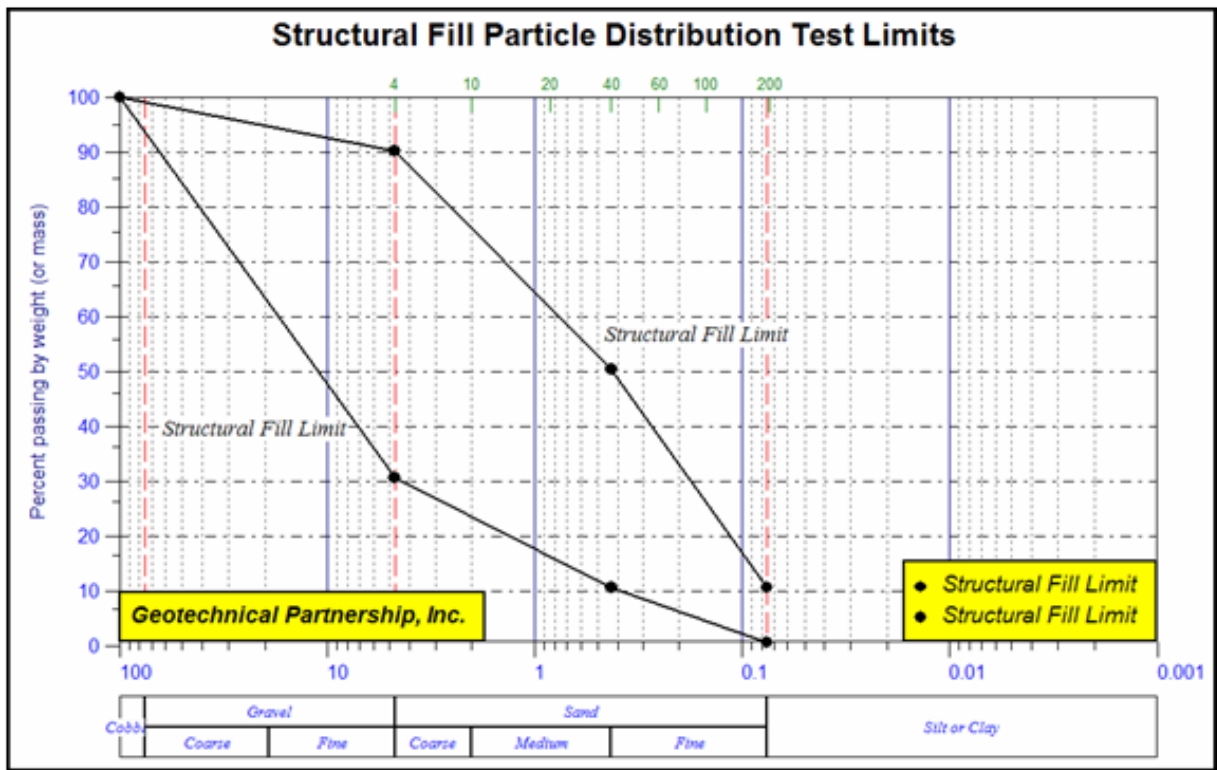
Elevator Pits:

- Pit Foundation and Slab:
 - Each elevator pit base is assumed to bear at about 4 feet below lowest level slab finish floor elevation.
 - Elevator pits may be supported upon either:
 - Continuous wall footings with a slab-on-grade; or
 - A structural mat slab.
 - Bearing soil will likely consist of crushed stone or structural fill (*Figure 4A* and *Figure 4B*) over:
 - Medium dense to dense marine regressive sand or bedrock
 - Refer to the bearing capacity recommendations provided in *Table III*.
 - If a mat slab is used, use a subgrade modulus as given in *Table IV* for mat design.
 - A minimum 12 inch thick base of structural fill or ¾ inch crushed stone over non-woven structural filter fabric (Mirafi 140N or equivalent) should be set below the slab-on-grade or structural mat.
- Elevator Pit Drainage and Waterproofing:
 - Water proofing is recommended consisting of installation of a positive side system such as PrePrufe (or equivalent).
 - Project specifications should require properly tied continuous waterstops in all construction joints and if a mat, sufficient load to resist water buoyant forces (seasonal high water, page 20).

Construction Dewatering:

- Groundwater Impact:
 - Based upon the data collected to-date, found actual groundwater levels would have some impact excavations for foundations shown on *Figure 4A* and *Figure 4B*.
 - Refer also to the “Groundwater Behavior” report sections for likely groundwater elevation anomalies and limitations and *Figure 4A* and *Figure 4B*.
- Dewatering Required:
 - Note that dewatering within existing site fill and marine regressive sand is highly unpredictable due to likely trapped water within abandoned subgrade structures (e.g. *Figure 4B*). See also *Figure 1B-1* and *Figure 1B-2* with respect to previous site structures.
 - It is expected that groundwater can be controlled by ditching to filtered sumps.

- **Pumped Discharge:**
 - Discharge of any pumped water (groundwater and surface water) should be performed in accord with all City, State and Federal regulations. Filtering of pumped water prior to discharge should be expected.
 - Permitting required by the USEPA, the State of Maine or the City of Biddeford should be reviewed. Assessment by the Project Civil Engineer should be sought.
 - The contractor would be responsible for obtaining all permits and any associated laboratory testing required for construction dewatering.
 - City requirements may require the contractor to use frac tanks to temporarily store pumped water at the work site. This should be reviewed in conjunction with the Project Civil Engineer



Engineered Fills and their Uses:

- **Crushed stone:** ¾ in. clean, hard, durable crushed stone; uses:
 - As a construction working pad
 - As a surface protection below footings
 - As drainage media in wall and under slab drainage systems.
- **Gravel:** sandy gravel, bank run gravel; max. 3-in. gravel; limit No. 200 sieve content to about 6%; uses:
 - As base in a pavement section
- **Structural fill:** hard, durable sand and gravel;
 - Common gradation limits for structural fill are given in the plot above.
 - Gradation adjustments: gradations often specify
 - Minimum of 2% passing No. 200 to aid compaction
 - Maximum of 15% passing No. 200 with the assumption that work may not proceed during wet conditions using this material (Dense Grade can be substituted)

- Structural Fill Uses (in lieu of crushed stone):
 - To form a protective base directly below footings
 - As a slab base pad
 - As a replacement fill below structural units (over-excavated soft areas)
 - As sub base in a pavement section
- Dense Grade Structural Fill/2-in. Crushed Stone: Structural fill/crushed stone meeting the following minimum requirements

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
2 in.	100
1.5 in.	70 – 100
¾ in.	50 – 85
No. 4	30 – 55
No. 50	8 – 24
No. 200	3 – 10

- Dense grade structural fill uses:
 - As a readily workable replacement for conventional or recycled concrete type structural fill when work must proceed during cold and/or wet conditions.
 - As a base pad for lowest level floor slabs and footings
- Granular Fill: absent to minor gravel; primarily medium to fine sand and silt meeting the following minimum requirements

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
4 in.	100
No. 10	30 – 95
No. 40	10 – 70
No. 200	0 – 15*

 * May be as high as 20% if field compaction can be verified

- Granular Fill Uses:
 - As under slab fill below 2 ft. depth as measured from the slab base.
 - As densified trench backfill

Re-use of Existing Site Subsoils as Engineered Fill:

- Existing Common Fill Soils: Re-use of these soils is limited to use as common fill (below planted areas).
- Existing Granular Fill and Marine Regressive Sand:
 - The existing clean granular fill and marine regressive sand may be of relatively low volume. It can be re-used as engineered fill (granular fill, structural fill) if it can be:
 - Readily separated and stockpiled.
 - Confirmed for fill quality and use by construction phase soil particle gradation testing.
 - Shown to be free of contaminants

Final Comments, Additional Review:

- Ground Improvement: a portion of the northeasterly site area will require ground improvement consisting of ungrouted aggregate piers (page 21). Installation of ground improvement should yield a minimum 6 KSF net allowable soil bearing pressure for this area.
- Additional Test Borings: additional test borings will be required to better delineate the required ground improvement area on-site.

Thank you for inviting us to perform this site study. Please contact us with any questions.

Sincerely yours,
Geotechnical Partnership, Inc.

Lisa R. Casselli, PE
Principal

Attachments: *Appendix A: Logs of Test Borings B1 through B7*

APPENDIX A: Logs of Structural Test Borings B1 to B7

Proposed Biddeford Parking Garage
Biddeford, Maine

Geotechnical Partnership, Inc.
Swampscott, MA
File No. 1727

Geotechnical Partnership, Inc.
 Swampscott, Massachusetts
 Sanford, Maine

Date Drilled : 12 & 13 April 2018
 Boring Location : Refer to Report Figure 2
 Drilling Contractor : Soil Exploration Corp.
 : Leominster, MA
 Driller : D. Ledger
 Rock Core : ---
 GPI Field Engineer : LR Casselli, PE, MASCE CS
 Elevation and Datum : El. 66.4 ft. (NAV 88)
 Drilling Mud Utilized : Not necessary
 Constant Water Head : Not necessary

Test Boring No. B1
 (1 of 1)

Drill Rig Type : Truck Mounted
 Hammer Type : Auto
 Cat-Head or Winch : NA
 Soil Casing Type : 8 in. O.D. HSA
 Sampler Type : SS - 1.375 in. I.D.; unlined
 Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: Proposed Parking Garage
 Pearl Street
 Biddeford, Maine

CLIENT: Desman Associates Boston, MA
 File No. 1727

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph	Average qu-Field	Average qu-Field (TSF)				REMARKS	
										0	1	2	3		4
0	66.4	Concrete Slab (t = 8 in.)												Groundwater=dry Well Set: no	
1	65	Tan, medium to fine SAND, trace silt, coarse sand and fine gravel (dense; moist)	AR			1	12						SS-1: 1' - 3' R=17 N=44		
2	64						18							SS-2: 3' - 5' R=10 N>100	
3	63	Tan, medium to fine SAND, little coarse to fine gravel, trace silt and coarse sand (dense; moist) --Granular Fill-- 3.9 ft.				2	26								
4	62	Gray, PHYLLITE; fine grained; very closely fractured; moderately weathered	ME			3	30								SS-3: 5' - 7' R=12 N=60
5	61	Gray, PHYLLITE; fine grained; very closely fractured; moderately weathered				4	31							SS-4: 7' - 9' Augered ahead in fractured rock P=Penetrometer	
6	60	Gray, PHYLLITE; fine grained; very closely fractured; moderately weathered					100/5"								
7	59	Gray, PHYLLITE; fine grained; very closely fractured; moderately weathered					14								
8	58	Gray, PHYLLITE; fine grained; very closely fractured; moderately weathered --Bedrock--					20								
9	57	Bottom of Exploration at 9 feet Depth					40								
10	56						100/1"								
11	55														
12	54														
13	53														
14	52														
15	51														
16	50														
17	49														
18	48														
19	48	Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%													

COHESIONLESS SOILS:	0-6 Very Loose	0-8 (DENSITY)	6-10 Loose	8-15	COHESIVE SOILS:	0-2 Very Soft (<0.25 TSF)
L: Sands; R: Gravels	11-30 Med-Dense	16-40	>30 Dense	41-50	2-4 Soft (0.25-0.5 TSF)	4-8 Med. Stiff (0.5-1.0 TSF)
	Very Dense	>50			9-20 Stiff (1.0-4.0 TSF)	>20 Hard (>4.0 TSF)

Test Boring No. B1
 (1 of 1)

Geotechnical Partnership, Inc.
 Swampscott, Massachusetts
 Sanford, Maine

Date Drilled : 12 & 13 April 2018
 Boring Location : Refer to Report Figure 2
 Drilling Contractor : Soil Exploration Corp.
 : Leominster, MA
 Driller : D. Ledger
 Rock Core : ---
 GPI Field Engineer : LR Casselli, PE, MASCE CS
 Elevation and Datum : El. 62.7 ft. (NAV 88)
 Drilling Mud Utilized : Not necessary
 Constant Water Head : Wash boring

Test Boring No. B2
 (1 of 1)

Drill Rig Type : Truck Mounted
 Hammer Type : Auto
 Cat-Head or Winch : NA
 Soil Casing Type : 8 in. O.D. HSA; 3 in. NW
 Sampler Type : SS - 1.375 in. I.D.; unlined
 Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: Proposed Parking Garage
 Pearl Street
 Biddeford, Maine

CLIENT: Desman Associates Boston, MA
 File No. 1727

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph		Average qu-Field	Average qu-Field (TSF)				REMARKS
								10	50		0	1	2	3	
0	62.7														
0.62		Bituminous Concrete Slab (t = 18 in.)	AR												Groundwater=5.2' perched on slab-not at native level Well Set: no
1.61		Concrete Slab, 1-inch rebar (t = 12 in.) --Bituminous & Concrete-- 2.5 ft.				1									SS-1: 1' - 2.5' Cored: Core drill to 18 in. Auger on rebar Roller bit through concrete
2.60		Gray, medium to fine SAND, little silt and coarse to fine gravel, few coarse sand (dense; moist) --Granular Fill-- 3.1 ft.	AR				28								
3.59		Tan, medium to fine SAND, little coarse to fine gravel, trace silt and coarse sand (dense; dry) --Granular Fill-- 3.8 ft.	AR			2	31								
4.58		CONCRETE: slab (likely from former boarding house; see Figure 1B-1) --Concrete-- 5.2 ft.	AR				60/3'								SS-2: 2.5' - 4.5' R=16 N>100 Concrete N unreliable
5.57		Tan, medium to fine SAND, trace silt (medium dense; wet) --Marine Regressive Sand-- 6.2 ft.	SP				9								
6.56		Tan, coarse to fine GRAVEL (sub-angular), some medium to fine sand, trace to few silt and coarse sand (dense; wet) --Reworked Glacial Till-- 7.5 ft.	GT			3	9								SS-3: 5.2' - 7.2' R=13 N=14
7.55		Gray, PHYLLITE; fine grained, very closely fractured, slightly to moderately weathered --Bedrock--	ME			4	21								
8.54		Bottom of Exploration at 8.9 feet Depth					23								P=Penetrometer
9.53							40								
10.52		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%					100/1"								

COHESIONLESS SOILS:	0-6 Very Loose	0-8 (DENSITY)	6-10 Loose	8-15	COHESIVE SOILS:	0-2 Very Soft (<0.25 TSF)
L: Sands; R: Gravels	11-30 Med-Dense	16-40	>30 Dense	41-50 Very Dense	>50	2-4 Soft (0.25-0.5 TSF)
						4-8 Med. Stiff (0.5-1.0 TSF)
						9-20 Stiff (1.0-4.0 TSF)
						>20 Hard (>4.0 TSF)

Test Boring No. B2
 (1 of 1)

Geotechnical Partnership, Inc.
 Swampscott, Massachusetts
 Sanford, Maine

Date Drilled : 12 & 13 April 2018
 Boring Location : Refer to Report Figure 2
 Drilling Contractor : Soil Exploration Corp.
 : Leominster, MA
 Driller : D. Ledger
 Rock Core : ---
 GPI Field Engineer : LR Casselli, PE, MASCE CS
 Elevation and Datum : El. 64.3 ft. (NAV 88)
 Drilling Mud Utilized : Not necessary
 Constant Water Head : Not necessary

Test Boring No. B3
 (1 of 1)

Drill Rig Type : Truck Mounted
 Hammer Type : Auto
 Cat-Head or Winch : NA
 Soil Casing Type : 8 in. O.D. HSA
 Sampler Type : SS - 1.375 in. I.D.; unlined
 Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: Proposed Parking Garage
 Pearl Street
 Biddeford, Maine
CLIENT: Desman Associates Boston, MA
 File No. 1727

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph	Average qu-Field	Average qu-Field (TSF)	REMARKS
0	64.3	Bituminous Concrete (t=3 in.)									Groundwater=10' Well Set: no Hole adjacent to deep sewer line SS-1: 1' - 3' R=19 N=18 SS-2: 3' - 5' R=19 N=64 SS-3: 5' - 7' R=16 N=14 SS-4: 7' - 9' R=20 N=24 SS-5: 10' - 12' R=17 N=4 SS-6: 12' - 14' R=20 N=2 SS-7: 15' - 17' R=22 N=11 SS-7: 17' - 19' R=22 N=14 P=Penetrometer
1	63	Tan-yellow, fine SAND, few silt and medium sand (medium dense; moist)	AR			1	3				
2	62	3.5 ft. --Granular Fill--					8				
3	61						10				
4	60	Tan, fine SAND, few to little silt, none to few coarse to fine gravel, trace coarse sand (dense; moist) --Granular Fill--	AR			2	46				
5	59	5.5 ft.					18				
6	58	Tan, medium to fine SAND, trace silt, coarse sand and fine gravel (medium dense; dry)				3	36				
7	57						3				
8	56	Tan, medium to fine SAND, trace silt (medium dense; dry)				4	6				
9	55						8				
10	54						9				
11	53	Tan, medium to fine SAND, few coarse sand, trace to few silt and coarse to fine gravel (very loose; wet)	AR			5	12				
12	52						12				
13	51	Tan, medium to fine SAND, few coarse sand, trace to few silt and coarse to fine gravel (very loose; wet)				6	12				
14	50	15.5 ft. --Granular Fill--					10				
15	49						10				
16	48						1				
17	47	Gray, medium to fine SAND, few coarse sand, trace silt and coarse to fine gravel (medium dense; wet) --Marine Regressive Sand--	SP			7	4				
18	46	18.5 ft.					7				
19	45	Gray, PHYLLITE; fine grained; very closely fractured; moderately weathered --Bedrock--	ME			8	8				
20	44	Bottom of Exploration at 19 feet Depth					2				
21		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%					5				
							9				
							27				

COHESIONLESS SOILS:	0-6 Very Loose	0-8 (DENSITY)	6-10 Loose	8-15	COHESIVE SOILS:	0-2 Very Soft (<0.25 TSF)
L: Sands; R: Gravels	11-30 Med-Dense	16-40	>30 Dense	41-50 Very Dense	>50	2-4 Soft (0.25-0.5 TSF)
						4-8 Med. Stiff (0.5-1.0 TSF)
						9-20 Stiff (1.0-4.0 TSF)
						>20 Hard (>4.0 TSF)

Test Boring No. B3
 (1 of 1)

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Geotechnical Partnership, Inc.
Swampscott, Massachusetts
Sanford, Maine

Date Drilled : 12 & 13 April 2018
 Boring Location : Refer to Report Figure 2
 Drilling Contractor : Soil Exploration Corp.
 : Leominster, MA
 Driller : D. Ledger
 Rock Core : ---
 GPI Field Engineer : LR Casselli, PE, MASCE CS
 Elevation and Datum : El. 62.5 ft. (NAV 88)
 Drilling Mud Utilized : Not necessary
 Constant Water Head : Not necessary

Test Boring No. B4-well
(1 of 1)

Drill Rig Type : Truck Mounted
 Hammer Type : Auto
 Cat-Head or Winch : NA
 Soil Casing Type : 8 in. O.D. HSA
 Sampler Type : SS - 1.375 in. I.D.; unlined
 Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: Proposed Parking Garage
Pearl Street
Biddeford, Maine

CLIENT: Desman Associates Boston, MA
File No. 1727

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph		Average qu-Field	Average qu-Field (TSF)				REMARKS
								10	50		0	1	2	3	
0	62.5	Bituminous Concrete Slab (t=18 ")													
1	61	Concrete Slab (t = 8 in.) --Bituminous Concrete & Concrete--	AR			1									Groundwater=7.5' Well Set: yes
2	60	2.2 ft.					14								SS-1: 1' - 3' No sample; augered through
3	59	Tan, medium to fine SAND, few silt, trace coarse sand (dense; dry) with lenses tan, coarse to fine GRAVEL (rounded), some to mostly medium to fine sand, trace silt and coarse sand (dense; dry)	SP			2	25								SS-2: 3' - 5' R=18 N=52
4	58	--Marine Regressive Sand--					27								
5	57	5.5 ft.					40								SS-3: 5' - 7' R23= N=24 P=4.4 TSF@5.7 P=4.6 TSF@6.7
6	56	Olive, silty CLAY (desiccated; hard; dry to moist)				3	14		4.5						
7	55						10								SS-4: 7' - 9' R=21 N=29 P=3.2 TSF@7.7 P=4.2 TSF@8.7
8	54	Olive, silty CLAY (desiccated; very stiff to hard; dry to moist)				4	11								
9	53						15								
10	52		CL			5	14								
11	51	Olive, silty CLAY (stiff; moist)					11								
12	50						8								
13	49	Olive, silty CLAY (rock disturbed; moist)				6	7								SS-5: 10' - 12' R=24 N=11 P=3.2 TSF@10.7 P=2.8 TSF@11.7
14	48						8								
15	47	Olive, silty CLAY (stiff; moist)					12								
16	46	15.5 ft. --Marine Sediment--				7	4								
17	45	Brown, medium to fine sandy SILT (non-plastic), little to some coarse to fine gravel (sub-angular), trace silt and coarse sand --Reworked Glacial Till--	GT				10			1.4					SS-6: 12' - 14' R=24 N=15 Pushed rock through sample, disturbed sample
18	44	19.0 ft.					6								
19	43	Gray, PHYLLITE; fine grained; very closely fracture; moderately weathered --Bedrock--	ME				11								SS-7: 15' - 17' R=19 N=16 P=1.4 TSF@15.5
20	42														Hammred in split spoon to retrieve rock sample P=Penetrometer
21		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%													

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COHESIONLESS SOILS:	0-6 Very Loose	0-8 (DENSITY)	6-10 Loose	8-15	COHESIVE SOILS:	0-2 Very Soft (<0.25 TSF)
L: Sands; R: Gravels	11-30 Med-Dense	16-40	>30 Dense	41-50 Very Dense	>50	2-4 Soft (0.25-0.5 TSF)
						4-8 Med. Stiff (0.5-1.0 TSF)
						9-20 Stiff (1.0-4.0 TSF)
						>20 Hard (>4.0 TSF)

Test Boring No. B4-well

(1 of 1)

Geotechnical Partnership, Inc.
 Swampscott, Massachusetts
 Sanford, Maine

Date Drilled : 12 & 13 April 2018
 Boring Location : Refer to Report Figure 2
 Drilling Contractor : Soil Exploration Corp.
 : Leominster, MA
 Driller : D. Ledger
 Rock Core : ---
 GPI Field Engineer : LR Casselli, PE, MASCE CS
 Elevation and Datum : El. 62.3 ft. (NAV 88)
 Drilling Mud Utilized : Not necessary
 Constant Water Head : Not necessary

Test Boring No. B6
 (1 of 1)

Drill Rig Type : Truck Mounted
 Hammer Type : Auto
 Cat-Head or Winch : NA
 Soil Casing Type : 8 in. O.D. HSA
 Sampler Type : SS - 1.375 in. I.D.; unlined
 Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: Proposed Parking Garage
 Pearl Street
 Biddeford, Maine

CLIENT: Desman Associates Boston, MA
 File No. 1727

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph		Average qu-Field	Average qu-Field (TSF)				REMARKS
								10	50		0	1	2	3	
0	62.3	Bituminous Concrete Slab (t = 18 in.)													Groundwater=7.5 Well Set: no
1	61	Concrete Slab (t=18") --Bituminous & Concrete-- 3.0 ft.	AR			1									SS-1: 1' - 3' Augered through
2	60														SS-2: 3' - 5' R=18 N=25
3	59	Tan, medium to fine SAND, little coarse to fine gravel (sub-rounded), trace to few silt, trace coarse sand (medium dense; dry) --Marine Regressive Sand-- 5.0 ft.	SP			2	11	12	13	13					SS-3: 5' - 7' R=16 N=17
4	58														
5	57	Brown, silty medium to fine SAND to SAND, little to some coarse to fine gravel (sub-angular), few coarse sand (medium dense; moist) --Reworked Glacial Till-- 7.5 ft.	GT			3	11	11	10	30					SS-4: 7' - 9' R=19 N=21
6	56														P=Penetrometer
7	55	Gray, PHYLLITE, fine grained; very closely fractured; moderately weathered; wet --Bedrock--	ME			4	11	10	30						
8	54														
9	53	Bottom of Exploration at 9 feet Depth													
10	52	Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%													
11															

COHESIONLESS SOILS:	0-6 Very Loose	0-8 (DENSITY)	6-10 Loose	8-15	COHESIVE SOILS:	0-2 Very Soft (<0.25 TSF)
L: Sands; R: Gravels	11-30 Med-Dense	16-40	>30 Dense	41-50 Very Dense	>50	2-4 Soft (0.25-0.5 TSF)
						4-8 Med. Stiff (0.5-1.0 TSF)
						9-20 Stiff (1.0-4.0 TSF)
						>20 Hard (>4.0 TSF)

Test Boring No. B6
 (1 of 1)

Geotechnical Partnership, Inc.
 Swampscott, Massachusetts
 Sanford, Maine

Date Drilled : 12 & 13 April 2018
 Boring Location : Refer to Report Figure 2
 Drilling Contractor : Soil Exploration Corp.
 : Leominster, MA
 Driller : D. Ledger
 Rock Core : ---
 GPI Field Engineer : LR Casselli, PE, MASCE CS
 Elevation and Datum : El. 64.1 ft. (NAV 88)
 Drilling Mud Utilized : Not necessary
 Constant Water Head : Not necessary

Test Boring No. B7
 (1 of 1)

Drill Rig Type : Truck Mounted
 Hammer Type : Auto
 Cat-Head or Winch : NA
 Soil Casing Type : 8 in. O.D. HSA
 Sampler Type : SS - 1.375 in. I.D.; unlined
 Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: Proposed Parking Garage
 Pearl Street
 Biddeford, Maine

CLIENT: Desman Associates Boston, MA
 File No. 1727


Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph		Average qu-Field	Average qu-Field (TSF)				REMARKS
								10	50		0	1	2	3	
0	64	Bituminous Concrete (t = 1.5 in.)													Groundwater=5'
1	63	Tan to tan-yellow, fine SAND, little medium sand, few silt (medium dense; moist)	AR			1	3								Perched on slab; old building location
2	62	3.8 ft. --Granular Fill--					5								Well Set: no
3	61						8								SS-1: 1' - 3'
4	60	Brown, medium to fine SAND, little coarse to fine gravel, few to little silt, trace coarse sand (medium dense to dense; moist)	AR			2	7								R=20 N=13
5	59	6.5 ft. --Granular Fill--					10								SS-2: 3' - 5'
6	58						14								R=17 N=24
7	57	CONCRETE: building slab; see Figure 1B-1	AR			3	4								SS-3: 5' - 7'
8	56	7.0 ft. --Concrete--	AR				3								R=12 N=9
9	55	Gray, coarse to fine SAND, few silt (very loose; wet)	AR			4	6								SS-4: 7' - 9'
10	54	7.7 ft. --Granular Fill--					2								R=19 N=4
11	53	Brown, medium to fine sandy SILT (non-plastic), little coarse to fine gravel, trace coarse sand (medium dense; wet)	AR			5	2								SS-5: 10' - 12'
12	52	9.5 ft. --Common Fill--					7								R=7 N=15
13	51	CONCRETE and WOOD (pile?)	SW			6	8								SS-6: 12' - 14'
14	50	11.5 ft. --Concrete and Wood--					5								R=13 N=14
15	49	Gray, medium to fine SAND, little to some coarse to fine gravel (sub-rounded), few to little coarse sand, few silt (medium dense; wet)	GT			7	9								SS-7: 15' - 17'
16	48	15.5 ft. --Marine Regressive Sand--					5								R=15 N=21
17	47	Gray, coarse to fine GRAVEL (sub-angular), some medium to fine sand, little silt, few coarse sand (dense; wet)	GT			8	7								SS-8: 17' - 19'
18	46	Gray, medium to fine SAND, some coarse to fine gravel (sub-angular), little to some silt, few coarse sand (loose; wet)	GT				14								R=12 N=8
19	45	20.0 ft. --Reworked Glacial Till--					25								Weak zone
20	44	Gray, medium to fine SAND, little coarse to fine gravel (sub-angular), few silt (medium dense; wet)	GT			9	3								SS-9: 20' - 22'
21	43						5								R=6 N=30
22	42						5								
23	41	Gray, coarse to fine SAND, little coarse to fine gravel (sub-angular), few silt					20								
24	40	--Glacial Till--					20								
25	39	Gray, PHYLLITE; fine grained	ME			10	10								SS-10: 25' - 25.3'
26	38	--Bedrock--					7								R=3 N>100
27	37						14								N unreliable, rock
28	36														P=Penetrometer
29	36	Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%													

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COHESIONLESS SOILS:	0-6 Very Loose	0-8 (DENSITY)	6-10 Loose	8-15	COHESIVE SOILS:	0-2 Very Soft (<0.25 TSF)
L: Sands; R: Gravels	11-30 Med-Dense	16-40	>30 Dense	41-50 Very Dense	>50	2-4 Soft (0.25-0.5 TSF)
						4-8 Med. Stiff (0.5-1.0 TSF)
						9-20 Stiff (1.0-4.0 TSF)
						>20 Hard (>4.0 TSF)

Test Boring No. B7

(1 of 1)



Code Analysis

for the

City of Biddeford Parking Garage Biddeford, ME

Submitted Under Contract No. 18-001, 2018 by

DESMAN

Design Management

18 Tremont St.
Suite 300
Boston, MA 02108
617.778.9882

APPLICABLE CODES:

1. 2015 INTERNATIONAL BUILDING CODE (IBC)
2. 2018 MAINE UNIFORM BUILDING CODE
3. MAINE STATE PLUMBING CODE, ADOPTED PURSUANT TO TITLE 32, M.R.S §3404-B
4. 2015 NATIONAL ELECTRICAL CODE (NEC)
5. 2009 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
6. CITY OF BIDDEFORD ZONING BYLAW
7. 2010 ADA STANDARDS FOR ACCESSIBLE DESIGN
8. 2015 NFPA #1; FIRE CODES AND STANDARDS ADOPTED PURSUANT TO TITLE 25 M.R.S §§ 2452 AND 2465

INTERNATIONAL BUILDING CODE (2015)

CHAPTER 3 - USE AND OCCUPANCY CLASSIFICATION

311.3 Use Group:

Low-Hazard Storage Group S-2 (Parking Garages Open or Enclosed)

CHAPTER 4 - SPECIAL DETAILED REQUIREMENTS BASED ON USE & OCCUPANCY

SECTION 406.4 PUBLIC PARKING GARAGES

406.4.1 MIN. Clear height required = 7'-0"

Provided: 8'-9" at grade, 8'-0" at typical levels

Van accessible clearance required = 8'-2"

Provided: 8'-9"

406.4.2 Guards:

Guards serving as vehicle barrier shall be provided in accordance with sections 406.4.3 and 1015.

406.4.3 Vehicle Barriers:

2'-9" High Barriers shall be placed at end of drive lanes and at end of parking spaces where vert. distance to the ground/surface below is greater than 1 foot. Per section 1607.8.3 Vehicle barriers system shall resist a concentrated load of 6,000 pounds horizontally in any direction, in accordance with section 4.5.3 of ASCE 7.

Provided: 3'-6" min. Height guards.

406.4.4 Ramps:

Vehicle ramps shall not exceed a slope of 1:15 (6.67 percent)

Provided: grade: 6.25 percent

typical: 5.7 percent

406.4.5 FLOOR SURFACE:

Parking surfaces shall be of concrete or similar noncombustible and nonabsorbent materials. Asphalt parking surfaces are permitted at ground level.

Provided: concrete surfaces throughout parking garage

Floors shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

Provided: sloping floors throughout in accordance with ACI 362 "Guide for the Design of Durable Parking Structures"

SECTION 406.5 OPEN PARKING GARAGES

406.5.2 OPENINGS:

For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier must be at least 20% of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall constitute a minimum of 40 % of the perimeter of the tier. Interior walls shall be at least 20% open with uniformly distributed openings.

406.5.4 AREA AND HEIGHT:

406.5.4.1 SINGLE USE:

Open Parking Garage Used Exclusively For Parking Motor Vehicles Shall Be Permitted To Comply With Table 406.5.4

TABLE 406.5.4

Type IIB construction = 50,000 SF per tier & 8 tiers in height

Provided area: 35,876 sf

Provided height: 5 tiers, total height 45'-0" based on an average building perimeter elevation

Elevation of highest structure is 59'-0" (elevator roof)

406.5.6 FIRE SEPARATION AND DISTANCE:

Exterior walls and openings in exterior walls shall comply with tables 601 & 602. The distance to an existing lot line shall be determined in accordance with table 602 & section 705.

406.5.7 MEANS OF EGRESS:

Where persons other than parking attendants are permitted, open parking garages shall meet the egress requirements of chapter 10.

406.5.8 STANDPIPE:

Open parking garages shall be equipped with a standpipe system as required by section 905.3.

406.5.9 ENCLOSURE OF VERTICAL OPENINGS:

Enclosures shall not be required for vertical openings except as specified in section 406.5.7.

406.3.12 VENTILATION:

Ventilation, other than the percentage of openings specified in section 406.5.2 shall not be required.

SECTION 406.6 ENCLOSED PARKING GARAGES

406.6.1 HEIGHTS AND AREAS

Enclosed vehicle parking garages and portions thereof that do not meet the definition of open parking garages are limited to the heights specified in sections 504 and 506 as modified by section 507. Roof parking is permitted.

CHAPTER 6 - TYPES OF CONSTRUCTION

CONSTRUCTION CLASSIFICATION= IIB (SEE TABLE 406.5.4)

TABLE 601: FIRE RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS

Type IIB Construction:

- Primary structural frame = 0 hour
- Bearing walls (exterior & interior) = 0 hours
- Floor construction & secondary members= 0 hour
- Roof construction & secondary members= 0 hour

TABLE 602: FIRE RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE

Distance to property line: $X \geq 30'$ Type IIB, use group S-2 = 0 hour fire resistance rating at exterior walls.

Footnote "C" - Open parking garage complying with Section 406 shall not be required to have a Fire-Resistance Rating

CHAPTER 7 - FIRE-RESISTANCE-RATED CONSTRUCTION

705.5: The required fire-resistance rating of exterior walls with a fire separation distance of greater than 10 feet (3048 mm) shall be rated for exposure from the inside.

TABLE 705.8: MAXIMUM AREA OF EXTERIOR WALL OPENINGS

Footnote "g" - the area of openings in an open parking structure with a fire separation distance of greater than 10 feet shall not be limited.

708.1 GENERAL

Elevator lobby separations as required by section 3006.2.

713.14 ELEVATOR, DUMBWAITER, AND OTHER HOISTWAYS

Elevator, dumbwaiter, and other hoistway enclosures shall be constructed in accordance with Section 713 and Chapter 30.

CHAPTER 9 – FIRE PROTECTION SYSTEMS

Chapter 9: Fire Protection Requirements:

General note: all fire protection equipment, proposed locations and applicability of referenced codes are subject to the review of the fire official(s) having jurisdiction.

SECTION 905 STANDPIPE SYSTEMS

905.2 INSTALLATION STANDARD

Standpipe systems shall be installed in accordance with this section and NFPA 14. Fire Department connections shall be in accordance with Section 912.

905.3 REQUIRED INSTALLATIONS

Standpipe systems shall be installed where required by Sections 905.3.1 through 905.3.8.

905.3.1 HEIGHT

Class III standpipe systems shall be installed throughout buildings where the floor level of the highest story is located more than 30 feet above the lowest level of fire department vehicle access or where the floor level of the lowest story is located more than 30 feet below the highest level of fire department vehicle access.

Exception 2

Class 1 manual standpipes are allowed in open parking garages where the highest floor is located not more than 150 ft above the lowest level of fire department access vehicle access

Exception 3

Class 1 manual dry standpipes are allowed in open parking garages that are subject to freezing temperatures provided that the hose connections are located as required for class ii standpipes in accordance with section 905.5.

905.4 LOCATION OF CLASS I STANDPIPE HOSE CONNECTIONS:

6. Where the most remote portion of a non-sprinklered floor or story is more than 150 feet from a hose connection or the most remote portion of a sprinklered floor or story is more than 150 feet from a hose connection, the fire code official is authorized to require that additional hose connection be provided in approved locations.

906 Portable Fire Extinguishers

906.1 Where required: Portable fire extinguishers shall be required in the following locations:
New and existing group S occupancies

907 Fire Alarm and Detection Systems

907.2 WHERE REQUIRED

IBC Code does not indicate alarm or detection system requirements for open parking structures with an S-2 use group classification or S use occupancies.

NFPA 88A "Standard for Parking Structures" Section 6.6 Detection, Alarm and Communications Systems;

6.6.3; Fire alarm systems shall not be required in open parking structures.

Provided: Fire alarm system to provided throughout.

CHAPTER 10 - MEANS OF EGRESS

TABLE 1004.1.2: maximum floor area allowances per occupant
Parking garages = 200 gross s.f. Floor area per occupant

CALCULATION FOR NUMBER OF OCCUPANTS BY LEVEL:

FLOOR LEVEL	GROSS AREA	OCCUPANTS
GRADE	SF	168
SECOND	35,482 SF	177
THRID	35,482 SF	177
FOURTH	35,482 SF	177
FIFTH	29,256 SF	146

1005.1 EGRESS WIDTH PER OCCUPANT SERVED

WITHOUT SPRINKLER SYSTEM

STAIRWAYS 0.3
OTHER EGRESS COMPONENTS 0.2

STAIRS

177/2 OCCUPANTS x 0.3 = 26.5 INCHES per ea. stairway
PROVIDED: 48 INCHES

DOORS

177 OCCUPANTS / 2 STAIRS = 89 OCCUPANTS / STAIR X 0.2= 18 INCHES (MIN DOOR WIDTH = 36 INCHES)

PROVIDED: 36 INCHES

1009.3 STAIRWAYS:

Exception 6: Area of refuge not required in exit ways serving open parking garages.

1009.4 ELEVATORS

Exception 1: elevators are not required to be accessed from an area of refuge or horizontal exit in open parking garages.

1011.3 HEADROOM

Headroom minimum required = 80 inches in non-vehicle areas.

1011.4 WALKLINE:

Walkline across winder treads shall be concentric to the direction of travel through the turn and located 12 inches from the side where the winders are narrower.

1011.5 STAIR TREADS AND RISERS

Stair riser heights shall be 7 inches maximum and 4 inches minimum.

Provided: 7"

Stair tread depths shall be 11 inches minimum.

Provided: 11"

1011.6 STAIRWAY LANDINGS.

The width of landings shall not be less than the width of stairways they serve. Every landing shall be a min. Dimension Measured in direction of travel equal to the width of the stairway.

Max. Width at straight run = 60"

Max. Door projection (fully open) = 7"

1015.4 OPENING LIMITATIONS:

Required guards shall not have openings which allow passage of a sphere 4 inches in diameter from the walking surface to the required guard height.

Exception 1: from a height of 36 inches to 42 inches guards shall not have openings which allow passage of the sphere 4-3/8 inches in diameter

Exception 2: triangular openings at open sides of stair shall not allow passage of a sphere 6 inches in diameter.

SECTION 1006 EXIT TRAVEL DISTANCE

Table 1006.1.1 Minimum number of exits or access to exits from Story

Occupant load per story: 1-500 2 exits required

SECTION 1017 EXIT TRAVEL DISTANCE

1017.2 LIMITATIONS

Exception 1: travel distance in open parking garages is permitted to be measure to the closest riser of open exit stairways.

TABLE 1017.2: EXIT ACCESS TRAVEL DISTANCE

Occupancy S-2 without sprinkler system = 300 feet maximum.

Maximum travel distance provided = 182 ft (typical level)

1017.2 MEASUREMENT

Exit access travel distance shall be measured from the most remote point within a story along the natural and unobstructed path of horizontal and vertical egress travel to the distance to an exit.

Exception: in open parking garages, exit access travel distance is permitted to be measured to the closet rise of an exit access stairway or the closest slope of exit access ramp.

CHAPTER 13 – ENERGY EFFICIENCY

1301.1.1 CRITERIA

Buildings Shall Be Designed And Constructed With The International Energy Conservation Code.

CHAPTER 30 – ELEVATORS AND CONVEYING SYSTEMS

3006.2 HOISTWAY OPENING PROTECTION REQUIRED:

Exception 1. Protection of elevator hoistway door openings is not required where the elevator serves only open parking garages in accordance with Section 406.5.

INTERNATIONAL ENERGY CONSERVATION CODE (2015)

505.5.2 INTERIOR LIGHTING POWER

The total interior lighting power (watts) is the sum of all interior lighting powers for all areas in the building covered by this permit. The interior lighting power is the floor area for each building area type listed in table 505.5.2 times the value from table 505.5.2 for that area.

TABLE 505.5.2: INTERIOR LIGHTING POWER ALLOWANCES

Parking garage = 0.3 w/ft²
Grade level: 33,628 x 0.3 = 10,088 w
Typical level: 35,482 x 0.3 = 10,647 w

2010 ADA STANDARDS FOR ACCESSIBLE DESIGN

SECTION 208: PARKING & PASSENGER LOADING ZONES

208.1: For total parking spaces totaling 501 to 1,000, 2% of total parking provided:

513 parking spaces proposed = 11 accessible spaces required
Provided: 12 accessible stalls

208.2.4: For every six accessible parking spaces, but not less than one, shall be van-accessible parking space to be provided.

11 total accessible spaces required = 2 van accessible parking spaces required.
Provided: 2 van accessible stalls

SECTION 502: PARKING SPACES

502.1 General. Car and van parking spaces shall comply with 502. Where parking spaces are marked with lines, width measurements of parking spaces and access aisles shall be made from the centerline of the markings.

EXCEPTION: Where parking spaces or access aisles are not adjacent to another parking space or access aisle, measurements shall be permitted to include the full width of the line defining the parking space or access aisle.

502.2 Vehicle Spaces. Car parking spaces shall be 96 inches (2440 mm) wide minimum and van parking spaces shall be 132 inches (3350 mm) wide minimum, shall be marked to define the width, and shall have an adjacent access aisle complying with 502.3.

EXCEPTION: Van parking spaces shall be permitted to be 96 inches (2440 mm) wide minimum where the access aisle is 96 inches (2440 mm) wide minimum.

502.3 Access Aisle. Access aisles serving parking spaces shall comply with 502.3. Access aisles shall adjoin an accessible route. Two parking spaces shall be permitted to share a common access aisle.

502.3.1 Width. Access aisles serving car and van parking spaces shall be 60 inches (1525 mm) wide minimum.

502.3.2 Length. Access aisles shall extend the full length of the parking spaces they serve.

502.3.3 Marking. Access aisles shall be marked so as to discourage parking in them.

502.4 Floor or Ground Surfaces. Parking spaces and access aisles serving them shall comply with 302. Access aisles shall be at the same level as the parking spaces they serve. Changes in level are not permitted.

EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

502.5 Vertical Clearance. Parking spaces for vans and access aisles and vehicular routes serving them shall provide a vertical clearance of 98 inches (2490 mm) minimum.

CITY OF BIDDEFORD ZONING BYLAW

SECTION 49 OFF-STREET PARKING AND LOADING

3. Parking.

- a) Access to parking stalls should not be from major interior travel lanes, and shall not be immediately accessible from any public way.
- b) Parking areas shall be designed to permit each motor vehicle to proceed to and from the parking space provided for it without requiring the moving of any other motor vehicles.

- c) Parking aisles shall be oriented perpendicular to stores or businesses for easy pedestrian access and visibility.
- d) All parking spaces and access drives shall be at least five feet from any side or rear lot line, except for the additional requirements in buffer yards.
- e) Lighting of parking areas may be required at the discretion of the governing body. All artificial lighting used to illuminate any parking space or spaces shall be so arranged that no direct rays from such lighting shall fall upon any neighboring property or streets.
- f) Parking stalls and aisle layout shall conform to the following standards:

Table 6-49A

Parking Stall Size

Parking Angle (degrees)	Stall Width	Skew Width	Stall Depth	Aisle Width
90	9 feet 0 inches	N/A	18 feet 0 inches	24 feet 0 inches
60	8 feet 6 inches	10 feet 5 inches	18 feet 5 inches	16 feet 0 inches one-way
45	8 feet 6 inches	12 feet 9 inches	17 feet 0 inches	12 feet 0 inches one-way
30	8 feet 6 inches	17 feet 0 inches	16 feet 5 inches	12 feet 0 inches

- g) Painted stripes shall be used to delineate parking stalls. Stripes shall be a minimum of four inches in width. Where double lines are used, they shall be separated a minimum of one foot on center.
- h) In aisles utilizing diagonal parking, arrows shall be painted on the pavement to indicate proper traffic flow.
- i) Bumpers and/or wheel stops shall be provided where overhang of parked cars might restrict traffic flow on adjacent through roads, restrict pedestrian movement on adjacent walkways, or damage landscape materials.