Historic Fort Wayne

Memorandum of Agreement Mitigation Work Plan

Background:

A Memorandum of Agreement (MOA) between the Federal Highway Administration and the Michigan State Historic Preservation Officer (SHPO) regarding the Gordie Howe International Bridge (GHIB) (formerly the Detroit River Internation Crossing) was signed in December 2008. The MOA identified 13 mitigation measures specific to Historic Fort Wayne (HFW). This memo outlines a work plan for implementing the mitigation measures identified in the MOA.

The following outlines each mitigation measure and how it will be implemented. Coordination meetings regarding these measures were held with the City of Detroit on September 24, 2024, January 15, 2025, and February 24, 2025.

MOA Historic Fort Wayne Mitigation:

<u>Item #1:</u> MDOT shall pay for an update of the existing Fort Wayne Master Plan to revisit Fort entryway options.

<u>Work Plan:</u> The City of Detroit (General Services Department (GSD), Parks & Recreation, Historic Fort Wayne Office – "Fort Wayne") does not intend on updating the existing Fort Wayne Master Plan as it is currently considered a low priority. HFW is prioritizing physical projects that have impacts on landscaping and aesthetic improvements.

Item #2: MDOT shall conduct videotape documentation and seismic monitoring of structural conditions before, during and after construction for Fort buildings and structures closest to Jefferson Avenue, the north elevation of the Start Fort, and Detroit Historical Society collections stored within the Fort property. MDOT shall implement a protocol to notify the City of Detroit of any damage that may be associated with construction-related vibration.

<u>Work Plan:</u> Seismic monitoring of structural conditions before and during construction has been completed to date. The results of the monitoring will be coordinated with the Fort once the post construction monitoring is complete.

<u>Item #3:</u> MDOT shall provide wayfinding signage to assist visitors in accessing the Fort and create and print brochures showing changes in access to the Fort.

<u>Work Plan:</u> MDOT developed a signage plan that was reviewed and accepted by the City of Detroit. The WDBA communication team will coordinate with Fort Wayne and MDOT to prepare a

map/graphic to show changes in the access to the Fort. This map will be printed as a brochure and also posted on the Fort's website.

Item #4: MDOT shall construct a direct local access road to and from the plaza to Campbell Street. Campbell Street shall receive pavement, landscaping and lighting improvements from the new I-75 northbound ramp south to West Jefferson Avenue to serve as a gateway to the Fort. Campbell Street will be reconstructed as a narrow boulevard from the railroad tracks to West Jefferson Avenue. MDOT will work with the City of Detroit to investigate the possibility of renaming Campbell Street to Fort Wayne Street or another, similar name that will help identify the street as an access route to the Fort.

<u>Work Plan:</u> The design to improve Campbell Street including landscaping and lighting is complete and construction is ongoing. The City of Detroit does not want to rename Campbell Street.

<u>Item #5:</u> MDOT shall install new pavement, landscaping and lighting along West Jefferson Avenue from West End Street to Clark Street as well as along Clark Street from its interchange with I-75 to Jefferson Avenue to provide an attractive route to Fort Wayne.

Work Plan: The Jurisdictional Transfer Agreement between the City of Detroit and MDOT was entered into in 2017 after extensive negotiations to identify scope of work for various items that took into consideration and complied with all EIS green sheet and MOA mitigation items included the reconstruction of Jefferson Avenue from West End Street to Campbell Boulevard as well as Clark Street intersections with Fort Street and Jefferson Avenue. It also included the reconstruction of the new Green Boulevard and new Campbell Boulevard. New lighting, landscaping, and multiuse path connectivity is currently under construction. These new route connections will act as the main entry way and attractive route to HFW which also provides for safe pedestrian and cyclist use. While the limits originally specified in the 2008 MOA extend beyond the Jurisdictional Transfer agreement, MDOT and the City of Detroit agree that the intent is met and the new connections provide for a more attractive and safer connection to HFW.

<u>Item #6:</u> MDOT shall construct a new decorative and historically appropriate fence along the West Jefferson property line of the Fort.

Work Plan: MDOT and HFW agreed on replacing the existing chain link fence with a new wrought iron fence that is aesthetic but also respects the historic nature of the Fort. Initial input from SHPO has been provided to the City. The City of Detroit is working with local vendors to get a quote for the fence. MDOT will transfer funds to the City of Detroit HFW office through a Memorandum of Agreement (MOA) to construct the new fence with MDOT providing the appropriate level of oversight.

<u>Item #7:</u> MDOT shall construct an entryway treatment for Fort Wayne on Fort's West Jefferson Avenue frontage or on other, adjacent City-owned property to improve wayfinding and visibility as identified in the updated Historic Fort Wayne Master Plan. MDOT shall pay for the reconfiguration of those portions of existing Fort Wayne streets specifically needed to connect the new entryway.

<u>Work Plan:</u> The City of Detroit HFW office does not contemplate relocating the entrance to Fort Wayne. Improvement to the existing entrance with masonry repairs and additional landscaping will be made by HFW, and MDOT will include funds to cover the work through the MOA agreement.

<u>Item #8:</u> MDOT shall construct a security wall surrounding the plaza; the wall will receive a surface treatment aesthetically compatible with Historic Fort Wayne along its West Jefferson Avenue perimeter.

<u>Work Plan:</u> The security wall surrounding the Port of Entry is under construction. The Jefferson barrier wall features an aesthetic treatment that pays tribute to Historic Fort Wayne's unique star fort structure. The barrier is an eight-foot-high security wall with the aesthetic treatment displayed on the public side facing West Jefferson Avenue.

<u>Item #9:</u> MDOT shall landscape the 100' wide buffer area between the plaza security wall and West Jefferson Avenue, meeting Customs and Border Protection guidelines.

<u>Work Plan:</u> The buffer area between the plaza security wall and West Jefferson Avenue will be landscaped including native pollinator-positive plantings. The landscaping design was developed with the barrier wall design.

<u>Item #10:</u> MDOT shall work with Customs and Border Protection to encourage truck anti-idling measures on the plaza.

<u>Work Plan:</u> This is ongoing. MDOT has held discussions with the Customs and Border Protection to encourage truck anti-idling measures on the plaza.

<u>Item #11:</u> MDOT shall submit work plans and specifications for all of the above provisions relative to Historic Fort Wayne to the City of Detroit Recreation Department and the SHPO for review and approval.

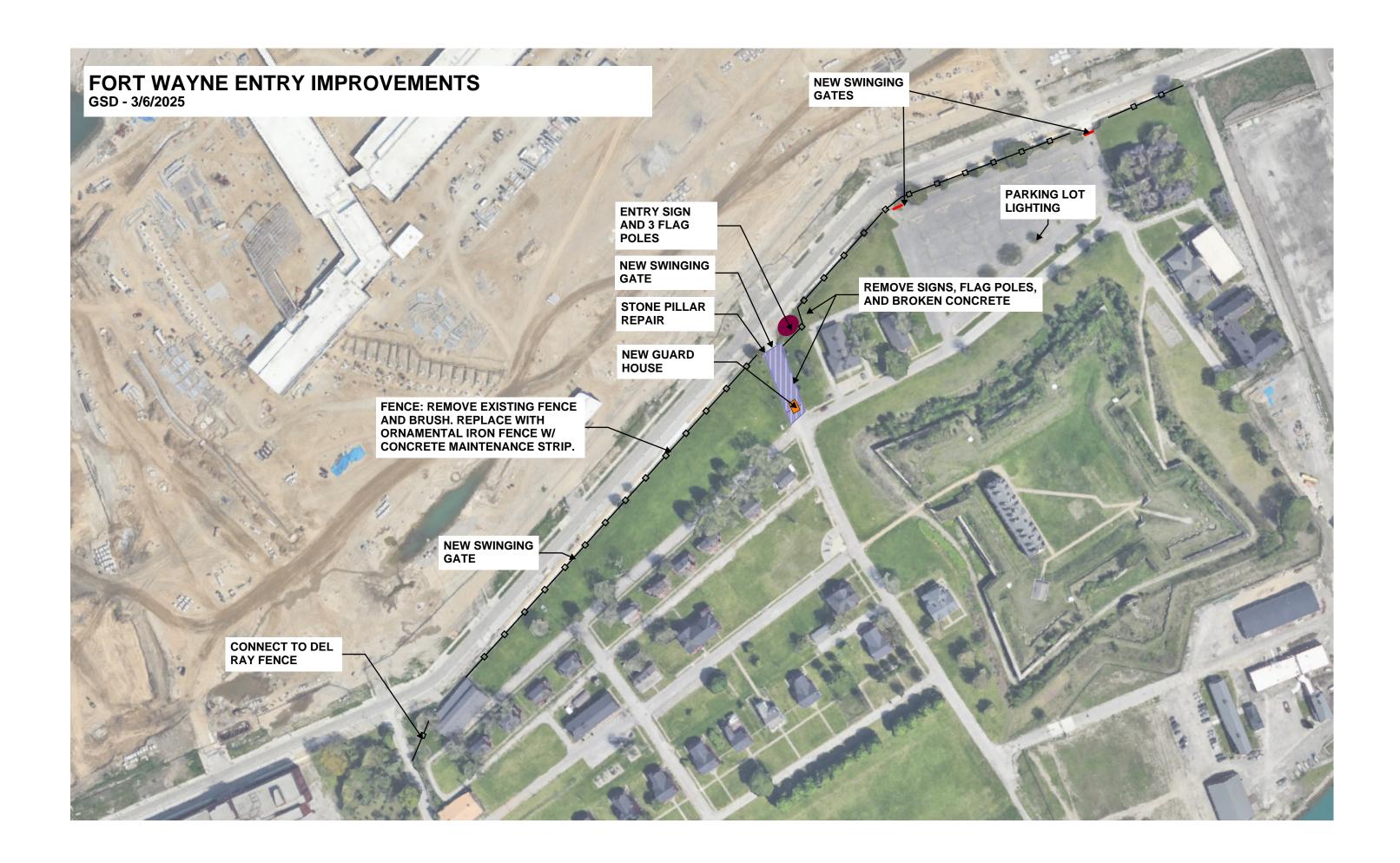
<u>Work Plan:</u> This is ongoing. MDOT and the City Detroit will continue to coordinate with SHPO for concurrence on items above.

<u>Item #12:</u> MDOT shall work with the Fort staff and the Detroit Police Department to develop a traffic management plan for large events. MDOT shall contribute toward consultant services used to create the traffic management plan.

<u>Work Plan:</u> A traffic management plan is a low priority for the City of Detroit as daily use and specific events have varying and individual traffic control needs. The wayfinding signage plans depict directional traffic flow into and out of the Fort.

Item #13: MDOT shall construct a surface parking lot to replace legal on-street parking that is eliminated to accommodate the plaza. The lot shall be of a design and construction similar to that used for Park and Ride lots, commonly found adjacent to Interstate Highway interchanges. MDOT and the City of Detroit shall verify the number of legal parking spaces that will be removed from service to the fort. The City of Detroit shall provide a clean site for the parking lot. The parking lot, once constructed, shall become the responsibility of the City of Detroit for any maintenance and policing.

<u>Work Plan:</u> There are now over 300 additional formalized/protected parking spaces along the reconfigured West Jefferson Avenue which HFW can benefit from for excess parking. MDOT offered an existing parcel adjacent to Green Steet and the RR tracks to use as a parking lot, however, in discussion with HFW, it was rejected do to due to safety, maintenance costs, and distance reasons. The City of Detroit HFW office does not have an adjacent lot for MDOT to construct a new parking lot. The HFW office is satisfied with the additional spaces that can be utilized on West Jefferson Avenue. MDOT and the City of Detroit agree that this item can be considered closed.



- 1. Lighting work at parking lot
 - a. Based on discussions between GSD and MDOT

2. Fence Replacement

- a. Remove and dispose of existing fence and any vegetation
- Install new ornamental iron fencing along the entire Northern edge of Fort Wayne. South side of Jefferson Ave, from Campbell St. to Rademacher St. Approximately 2,600 linear feet of fencing
- c. 6', vertical picket ornamental iron fence, plain bars, with rings and cast spears. Flat capped posts. Finish: Black gloss
- d. 2' wide concrete maintenance strip installed on grade

3. Entry Gates

- a. New swinging gates at 4 locations, custom made to match fencing and fit field dimensions. All gates ornamental iron.
 - i. Entrance at Brady
 - ii. Parking lot east entry
 - iii. Parking lot west entry
 - iv. Jefferson Field
- b. Brick work repair as needed on existing pillars and gates.

4. New Guard House

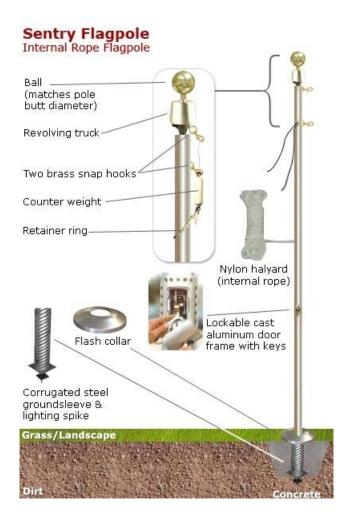
- a. New prefabricated guard building. 6' x 10' steel structure with added brick facade. To include HVAC and electrical connections.
- b. New entry gate stop arms

5. Entrance renovation

- a. Remove concrete and asphalt as needed to install guard house
- b. Install new curb around guard house, and edges of roadway
- c. Mill and resurface asphalt, replace concrete walkways
- d. Approximately 500 LF Curb, 12,000 SF mill and resurface asphalt, and 3,000 SF concrete walkway.
- e. Remove existing flag poles, "Historic Fort Wayne" overhead sign, and letter sign.
- f. Install 3 flag poles. Stainless steel, 30' 35' flag pole, in ground buried.
- g. Install 6' GSD park sign

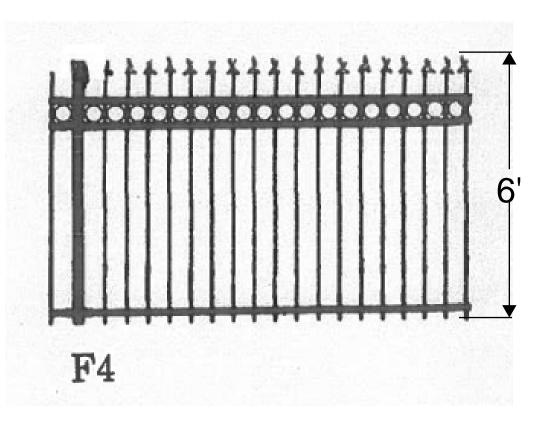


NEW GUARD SHACK



NEW FLAG POLES

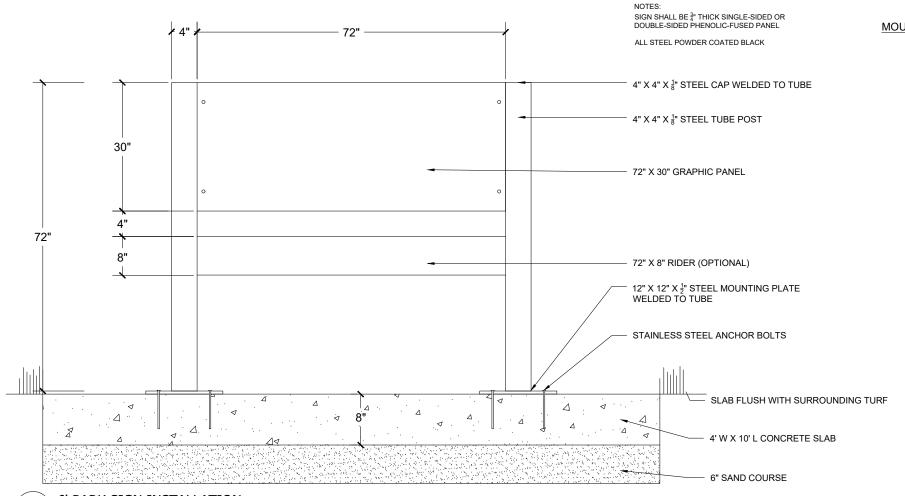




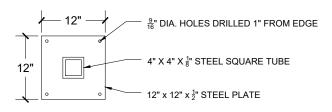




NEW FENCE - 6' ORNAMENTAL IRON WITH RINGS AND SPEARS. ON 2' WIDE CONCRETE MAINTENANCE STRIP.

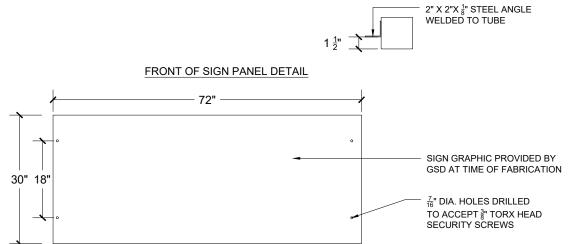


MOUNTING PLATE DETAIL



TUBE AND PLATE WELDED TOGETHER POWER COATED BLACK

TOP VIEW - MOUNTING BRACKET



2 6' PARK SIGN INSTALLATION L5.21/ NOT TO SCALE



EGIS-BLN

GHIB FORT WAYNE LIGHTING & SITE IMPROVEMENTS

DETROIT, MI

30% DESIGN APRIL, 2025



SHEET INDEX

GENERAL G1.0 TITLE SHEET G1.1 GENERAL NOTES AND INFORMATION ARCHITECTURE A1 OVERALL SITE PLAN A1.0 ENLARGED SITE PLAN @ MAIN ENTRANCE A1.1 ENLARGED SITE PLAN @ OPEN PARKING A1.2 SITE PLAN DETAILS A1.3 SITE PLAN DETAILS A1.4 SITE PLAN DETAILS A1.5 CLEANING AND WATER-REPELLENT TREATMENTS FOR HISTORIC MASONRY OF THE EXISTING PILLARS AND GATES A1.6 REPOINTING MORTAR JOINTS FOR HISTORIC MASONRY OF

LOCATION MAP



PROJECT LOCATION

DLZ PROJECT NO. 1641-674700



ARCHITECT/ENGINEER:

DLZ Florida, LLC

NA

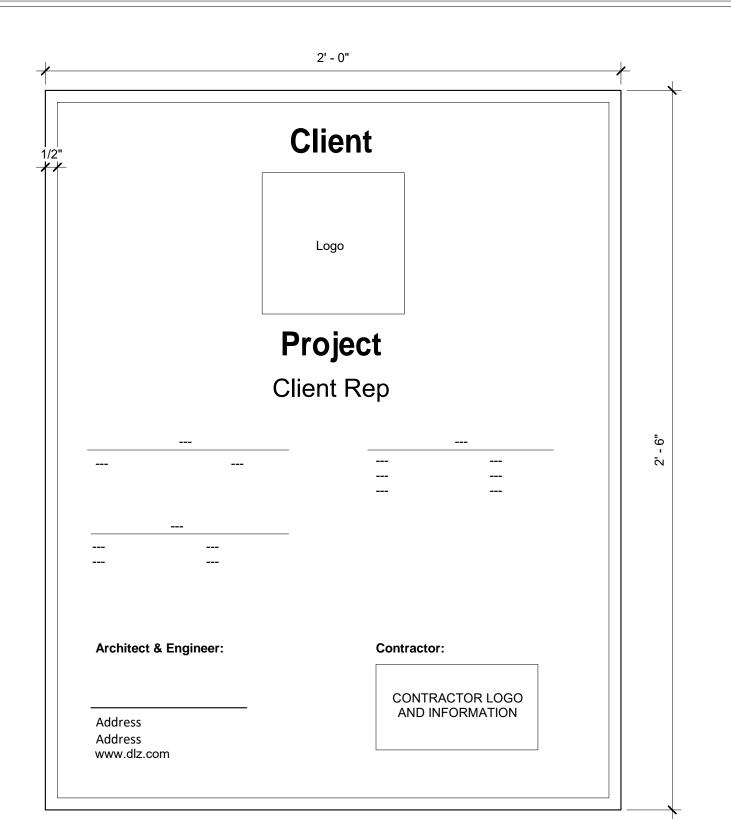
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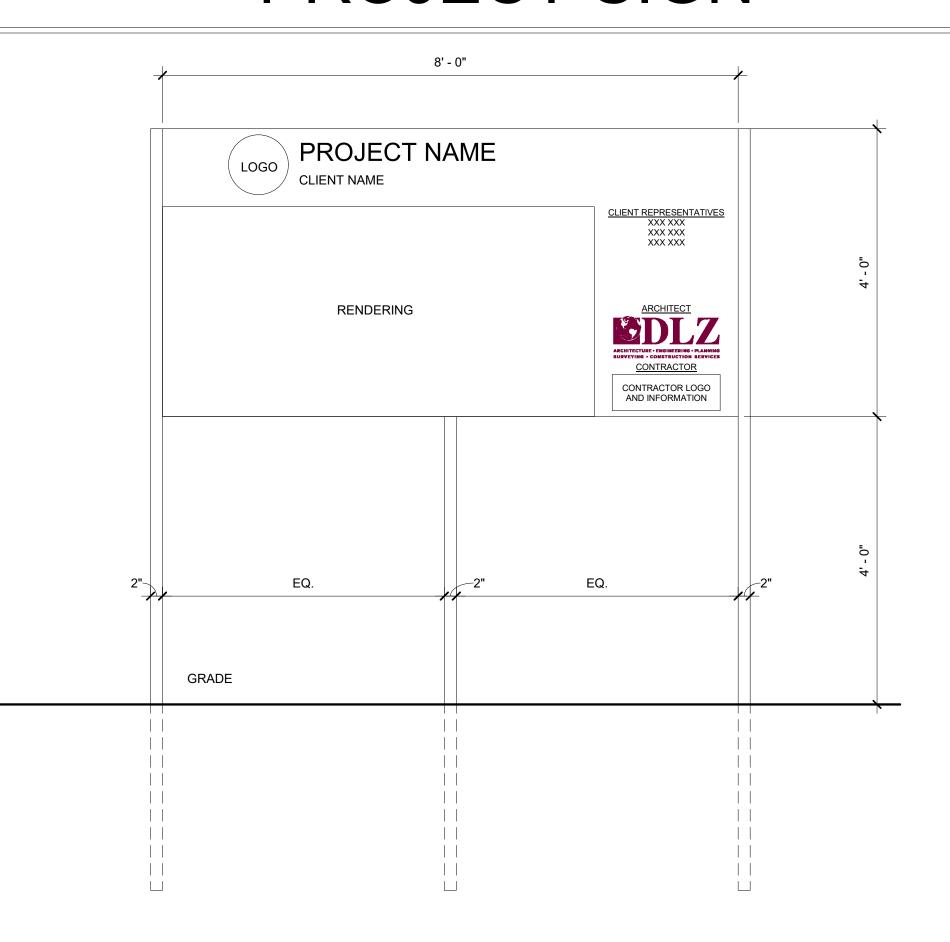
www.dlz.com

INCIPAL ARCHITECT	SITE DEVELOPMENT	CIVIL (STORM)	CIVIL (UTILITIES)	ARCHITECTURAL	STRUCTURAL	MECHANICAL	ELECTRICAL
Beaulieu AIA, LEED AP	LA of Record	Civil Engineer (Drainage) of Record	Civil Engineer (SU) of Record	Architect of Record	Corev A. Van Luchene, PE, SE	Mechanical Engineer (HVAC) of Record	Jeromy Haines.

DEDICATION PLAQUE



PROJECT SIGN



- PROJECT SIGN MATERIALS:
 SINGLE SIDED SIGN PANEL TO BE DIGITALLY PRINTED GRAPHICS AND LETTERING ON 6MM ALUMINUM COMPOSITE BOARD. SUPPORT BY THREE STANDARD 2" SQUARE TUBULAR GALVANIZED POSTS.
- 1. CONTRACTOR SHALL FURNISH AND INSTALL (1) PROJECT SIGN
- 3. SUBMIT COLOR SIGN PROOF, TO ARCHITECT FOR REVIEW AND APPROVAL PRIOR TO FABRICATION. 4. LETTERS SHALL BE THE COLOR "BLACK."

SYMBOLS

VERTICAL ELEVATION BUBBLE **EXTERIOR ELEVATION TARGET DETAIL TARGE** DETAIL NUMBER -— DRAWING SCALE INTERIOR ELEVATION TARGET NUMBER NORTH ARROW NUMBER BUILDING SECTION TARGET PHOTOGRAPH TARGET SHT✓ SHEET NUMBER –

GENERAL NOTES

SHEET NUMBER -

SHEET NUMBER

- :. REFER TO DRAWINGS OF EACH TRADE OR DISCIPLINE FOR ADDITIONAL GENERAL NOTES AND INFORMATION. INCLUDING CIVIL/SITE DEVELOPMENT, ARCHITECTURAL, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION AND ELECTRICAL
- . CONTRACTOR IS RESPONSIBLE FOR ALL WORK IDENTIFIED ON ALL DRAWINGS AND INFORMATION IN THE PROJECT MANUAL. AS A COMPLETE PROJECT. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE SPECIFIC SCOPE OF WORK FOR ANY SUBCONTRACTORS
- G. FIELD VERIFY ACTUAL LOCATIONS OF EXISTING UNDERGROUND UTILITIES, STRUCTURES, WATER LINES, STORM AND SANITARY LINES, GAS LINES, ELECTRICAL CONDUIT, AND OTHER UNDERGROUND UTILITIES PRIOR TO PERFORMING EARTHWORK, EXCAVATION, OR UTILITY WORK. ENGAGE THE SERVICES OF A PRIVATE UTILITY LOCATE COMPANY IF NECESSARY TO COMPLETELY LOCATE EXISTING UNDERGROUND
- H. LOCATION OF ALL TEMPORARY FACILITIES SHALL BE COORDINATED WITH OWNER AND ARCHITECT PRIOR TO MOBILIZATION ON-SITE INCLUDING BUT NOT LIMITED TO TEMPORARY STAGING AREA, MATERIAL STORAGE AREA, ACCESS DRIVE(S), PARKING AREA, TOPSOIL STOCKPILE AREA, WASTE DISPOSAL AREA, FIELD OFFICES AND TEMPORARY FACILITIES, JOB SIGN, AND TEMPORARY FENCING.
- CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL MISCELLANEOUS BLOCKING REQUIRED FOR INSTALLATION OF ALL BUILDING COMPONENTS, INCLUDING BUT NOT LIMITED TO FURNISHINGS, FIXTURES, EQUIPMENT, HARDWARE, BRACKETS, AND OWNER-PROVIDED EQUIPMENT. CONTRACTOR SHALL COORDINATE SPECIFIC REQUIREMENTS ASSOCIATED WITH EACH TRADE AND WITH OWNER'S REPRESENTATIVE.
- CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL MISCELLANEOUS WOOD AND METAL TRIM, FLASHING, CLIP ANGLES, ANCHORS, SUPPORTS, AND CLOSURE TRIM REQUIRED TO PROVIDE A COMPLETE, UNIFORM, AND WEATHERTIGHT ASSEMBLY AS REQUIRED TO ACCOMPLISH THE
- K. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S WRITTEN RECOMMENDATIONS. CONTRACTOR SHALL PROVIDE AND INSTALL ALL ACCESSORY COMPONENTS AS REQUIRED TO FULLY COMPLY WITH MANUFACTURER'S RECOMMENDATIONS.
- CONTRACTOR SHALL PROVIDE ACCESS DOORS IN ALL WALLS AND CEILINGS WHERE SERVICE OR ADJUSTMENT TO MECHANICAL, PLUMBING, FIRE PROTECTION OR ELECTRICAL ITEMS MAY BE REQUIRED. ACCESS DOORS SHALL BE OF AN APPROPRIATE SIZE REQUIRED FOR EACH APPLICATION. WHERE APPLICABLE, ACCESS DOORS SHALL MATCH THE FIRE RATING OF THE WALL ASSEMBLY.
- M. WHERE DISCREPANCIES EXIST IN THE CONTRACT DOCUMENTS INCLUDING DISCREPANCIES BETWEEN DRAWINGS AND PROJECT MANUAL. CONTRACTOR SHALL REQUEST CLARIFICATION IN WRITING FROM ARCHITECT. THE CONTRACTOR SHALL NOT ASSUME ANY ITEM TAKES PRECEDENCE OVER THE OTHER. ANY ACTION THE CONTRACTOR MAKES PRIOR TO NOTIFICATION IN WRITING SHALL BE SOLELY AT THE
- CONTRACTOR SHALL SEAL ALL PENETRATIONS IN EXTERIOR WALL AND ROOF ASSEMBLIES WITH APPROPRIATE JOINT SEALANT(S) AND FLASHING(S) TO MAINTAIN A WEATHERTIGHT AND AIRTIGHT BUILDING ENVELOPE. ALL JOINTS AND PENETRATIONS SHALL BE SEALED, GASKETED, OR WEATHER-STRIPPED TO MINIMIZE AIR LEAKAGE, INCLUDING THE FOLLOWING:
- 1. JOINTS AROUND FENESTRATION AND DOOR FRAMES. 2. JUNCTIONS BETWEEN WALLS AND FOUNDATIONS, BETWEEN WALLS AT BUILDING CORNERS, BETWEEN WALLS AND FLOORS OR ROOFS, AND BETWEEN WALLS AND ROOF OR WALL PANELS.
- 3. OPENINGS AT PENETRATIONS OF UTILITY SERVICES THROUGH ROOFS, WALLS, AND FLOORS. 4. JOINTS, SEAMS, AND PENETRATIONS OF VAPOR RETARDERS. 5. ALL OTHER OPENINGS IN THE BUILDING ENVELOPE.

ASSEMBLY AND TYPE OF PENETRATING ELEMENT. SYSTEMS SHALL BE U.L.-LISTED FOR EACH APPLICATION.

- D. COORDINATE WITH OTHER CONSTRUCTION ACTIVITIES AND CONSTRUCTION SEQUENCING WITH OTHER PROJECT(S) AND WORK BEING PERFORMED CONCURRENTLY ON-SITE.
- P. BUILDING ELEVATION 100'-0" EQUALS SITE ELEVATION _____.

DRAWING TITLE

ROOM NAME AND NUMBER

DOOR MARK TARGET

KEYNOTE TARGET

XXXX (X)

WALL TYPE TARGE

(x)—

WINDOW TARGET

NAME #

- DETAIL NUMBER

XXX

- Q. CONTRACTOR TO PROTECT ALL ITEMS WITHIN THE CONSTRUCTION LIMITS (INCLUDING SITE ELEMENTS) THAT ARE DESIGNATED TO REMAIN; ITEMS
- DAMAGED AS A RESULT OF WORK PERFORMED UNDER THIS CONTRACT SHALL BE REPAIRED OR REPLACED TO ORIGINAL CONDITION. R. ALL PENETRATIONS AND JOINTS IN FIRE-RATED WALL ASSEMBLIES AND FLOOR/CEILING ASSEMBLIES SHALL BE SEALED WITH THE FIRESTOPPING SYSTEM OR FIRE-RESISTIVE JOINT SYSTEM WHICH IS THE MOST APPROPRIATE FOR THE SPECIFIC APPLICATION BASED ON THE TYPE OF
- 3. ALL VERTICAL FENESTRATION (OPERABLE AND FIXED GLAZED ASSEMBLIES) SHALL BE LABELED BY THE MANUFACTURER WITH U-FACTOR, SHGC RATING, SAFETY RATING, AND FIRE-RESISTANCE RATING, WHERE APPLICABLE. WINDOWS AND DOORS SHALL BE CERTIFIED AS MEETING AIR
- THESE DRAWINGS SHALL NOT BE SCALED TO OBTAIN DIMENSIONS. IF THE DIMENSIONS CANNOT BE DETERMINED BY THE INFORMATION GIVEN, CONTRACTOR SHALL REQUEST CLARIFICATION FROM THE ARCHITECT. ALL DIMENSIONS ARE TO FACE OF STUD, FACE OF CMU, OR FACE OF CONCRETE, UNLESS NOTED OTHERWISE. CEILING HEIGHT DIMENSIONS ARE FROM FINISHED FLOOR TO FACE OF FINISHED CEILING MATERIALS.
- J. $\,$ CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL NECESSARY DEWATERING ACTIVITIES AS PART OF THE BASE BID AMOUNT.

ABBREVIATIONS

INSIDE FACE

INSIDE RADIUS

INFORMATION

JUNCTION BOX

INTERIOR

JUNCTION

KILN-DRIED

KITCHEN

KNOCKOUT

KICK PLATE

LAMINATED

LAVATORY

POUNDS

LARGE

LENGTH

LINEAR

LIGHTING

MATERIAL

MINIMUM

MIXTURE

METAL

NORTH

NTS

O. TO O.

OR.

PLBG.

PNEU.

P.CONC

PTN.

QUAL.

LEFT HAND

LINEAR FEET

ABBREVIATIONS:

ADDIVE	TATIONO.
A.B. A/C A.D. ADD. AFF AFG AFT AP APC A/V ADMIN. AGGR. ALT. ALUM APPROX ARCH. ASPH. ASSOC.	ANCHOR BOLT AIR CONDITIONING AREA DRAIN ADDENDUM ABOVE FINISHED FLOOR ABOVE FINISHED GRADE ATHLETIC FLOOR TILE ACCESS PANEL ACOUSTICAL PANEL CEILING AUDIO VISUAL ADMINISTRATION AGGREGATE ALTERNATE ALUMINUM APPROXIMATE ARCHITECT (ARCHITECTURAL) ASPHALT ASSOCIATE AVERAGE
B/ BB B.F. BFP BL BM BTU	BOTTOM BOND BEAM BARRIER FREE BACK FLOW PREVENTER BUILDING LINE BENCH MARK BRITISH THERMAL UNIT

VIEW NUMBER SHEET NUMBER BUILT UP BOARD **BETWEEN BTWN BLDG** BUILDING **BULLET RESISTANT BEARING BRONZE**

BSMT

CONDUIT **CABINET CATCH BASIN CORNER BAF** CUBIC FEET PER MINUT **CORNER GUARD CAST-IN-PLACE** CIRCLE OR CIRCULAR **CONTROL JOINT CENTERLINE CONSTRUCTION LINE** CLOSET

BASEMEN^T

CLOS CMU CONCRETE MASONRY UNI CO **CLEAN OUT** COMPACTE CONC. CONCRETE COND. CONDENSATE

CONT. CONTINUOUS COORD

CONSTRUCTION JOINT

CERAMIC TILE WALL CENTER OR CENTERING COLD WATER

DRINKING FOUNTAIN DEAD LOAD DOWN SPOUT DOUBLE DEGREE DEMO DEMOLISH (ED) DEPARTMENT DIAMETER

DEPT. DIM. DIMENSION DWG DRAWING DTL DETAIL

EXHAUST AIR ELECTRICAL CONTRACTOR EXHAUST FAN EIFS EXT. INSULATION FINISH SYSTEM **EXPANSION JOINT**

E.PAN. ELECTRICAL PANEL EACH WAY ELECTRIC WATER COOLER ELEVATION ELEC. ELECTRICAL OR ELECTRIC ELEV. ELEVATOR ENG. ENGINEER OR ENGINEERING EQUIP. EQUIPMENT

ET CETERA

EXIST EXISTING EXPOSED STRUCTURE **EXPANSION** EXT. **EXTERIOR** FIRE ALARM CONTROL PANEL FRESH AIR INTAKE

FURNACE FOOR DRAIN FIRE EXTINGUISHER FIRE EXTINGUISHER CABINET FIRE HOSE CABINET FLOOR MOUNTED FIN RADIATION FOOD SERVICE FIELD VERIFY

WC IN.	FABRIC WALL COVERING FINISH	QTY.	QUANTITY
LR	FLOOR	R.	RIGHT
:T	FOOT OR FEET	RAD.	RADIUS
TG	FOOTING	RA	RETURN AIR
		RB	RUBBER BASE
SA .	GAUGE	RBR	RUBBER
SC	GENERAL CONTRACTOR	RD.	ROAD
SRV	GRAVITY ROOF VENTILATOR	RD	ROOF DRAIN
SL.	GLASS	REC.	RECESSED
SND.	GROUND	REF	REFRIGERATOR
SR.	GRADE	REV.	REVISION
SWB	GYPSUM WALL BOARD	REM.	REMOVABLE
		RH	RIGHT HAND
ł.	HIGH	RHR	RIGHT HAND REVERSE
 I.В.	HOSE BIBB	RCP	REINFORCED CONCRETE PIPE
HM	HOLLOW METAL	RE:	REFER TO:
IOA	HAND-OFF-AUTOMATIC	RECPT	RECEPTACLE
IVAC	HEATING VENTILATING & AIR-CONDITIONING	-	RECTANGLE OR RECTANGULA
łW	HOT WATER	REINF	REINFORCE (D) (ING) (MENT)
łWS	HOT WATER SUPPLY	REQD.	REQUIRED
łWR	HOT WATER RETURN	REV.	REVERSE
IDWD.	HARDWOOD	RFG.	ROOFING
IDWR.	HARDWARE	RH	RIGHT HAND
HT.(HGT.)	HEIGHT	RHR	RIGHT HAND REVERSE
IDP (HIGH DENSITY PARTICALE BOARD	RLG.	RAILING
IORIZ.	HORIZONTAL	RM	ROOM
łR.	HOUR	R.R.	RAIL ROAD
IYD.	HYDRAULIC	RT.	RIGHT
		ROW (R/W)	RIGHT OF WAY
D	INSIDE DIAMETER	RVS.	REVERSE

SUPPLY AIR **SEALED CONCRETE** STORE FRONT SYSTEM STAND PIPE STAINLESS STEE STUD TO STUD SHEET VINYL SANITARY SECT SEW SEWER SHEET **SHOWER**

MAIN WATER COLLECTOR

RAIN WATER LEADER

SECTIONAL OVERHEAD SPECIFICATIONS SPKR SQUARE STANDARD STORAGE **STRUCT STRUCTURA** SUSP. SUSPENDED

LIVE LOAD LENGTH OVER AL TEMPERED TOP AND BOTTOM TONGUE AND GROOVE TEMP. CONTROL CONTRACTOR MECHANICAL CONTRACTOR TEMP. CONTROL PANEL **MECHANICAI** TEPID WATER CONTROL

MEZZANINE TILE BACKER BOARD MANUFACTURER TEMP. MAN HOLE TEMPERATURE TERR TERRAZZO **MISCELLANEOUS THROUGH** TOILET **TOLERANCE** MASONRY OPENING TYPICAL MASONRY

MOUNTED UNDER FLOOR DUCT UNDERWRITER'S LABORATORIES MOUNTING UNLESS NOTED OTHERWISE UNIT VENTILATOR NOT APPLICABLE NOT IN CONTRACT UTILITY NEAR FACE

NOT OTHERWISE PROVIDED NUMBER VAPOR NOMINAL **VARIES** NOT TO SCALE VINYL COVE BASE VITRIFIED CLAY PIPE VINYL COMPOSITION TILE OUTSIDE AIR VERT. VERTICAL OUTSIDE AIR INTAKE VEST. **VESTIBULE VENTILATE** ON CENTER

OUTSIDE DIAMETER VERIFY IN FIELD OUT TO OUT VOLUME OUTSIDE FACE VENT PIPE OUTSIDE RADIUS VENT STACK VINYL WALL COVERING OVERLOAD OFFICE OVERHEAD WATER CLOSET

OPENING OPPOSITE WOOD **OUTSIDE RADIUS** WASH FOUNTAIN ORIGINAL WATER HEATER OUNCE WROUGHT IRON PIPE ANCHOR WORKING POINT PLUMBING CONTRACTOR WIND LOAD PRESSURE DROP WALK OFF MAT WORK SINK PRE MOLDED JOINT FILLER WS WELDED WIRE FABRIC PRESSURE REDUCING VALVE PASSENGER WT. WEIGHT PATTERN **TRANSFORMER** PERPENDICULAR TRANSFER PRE-FINISHED XFR

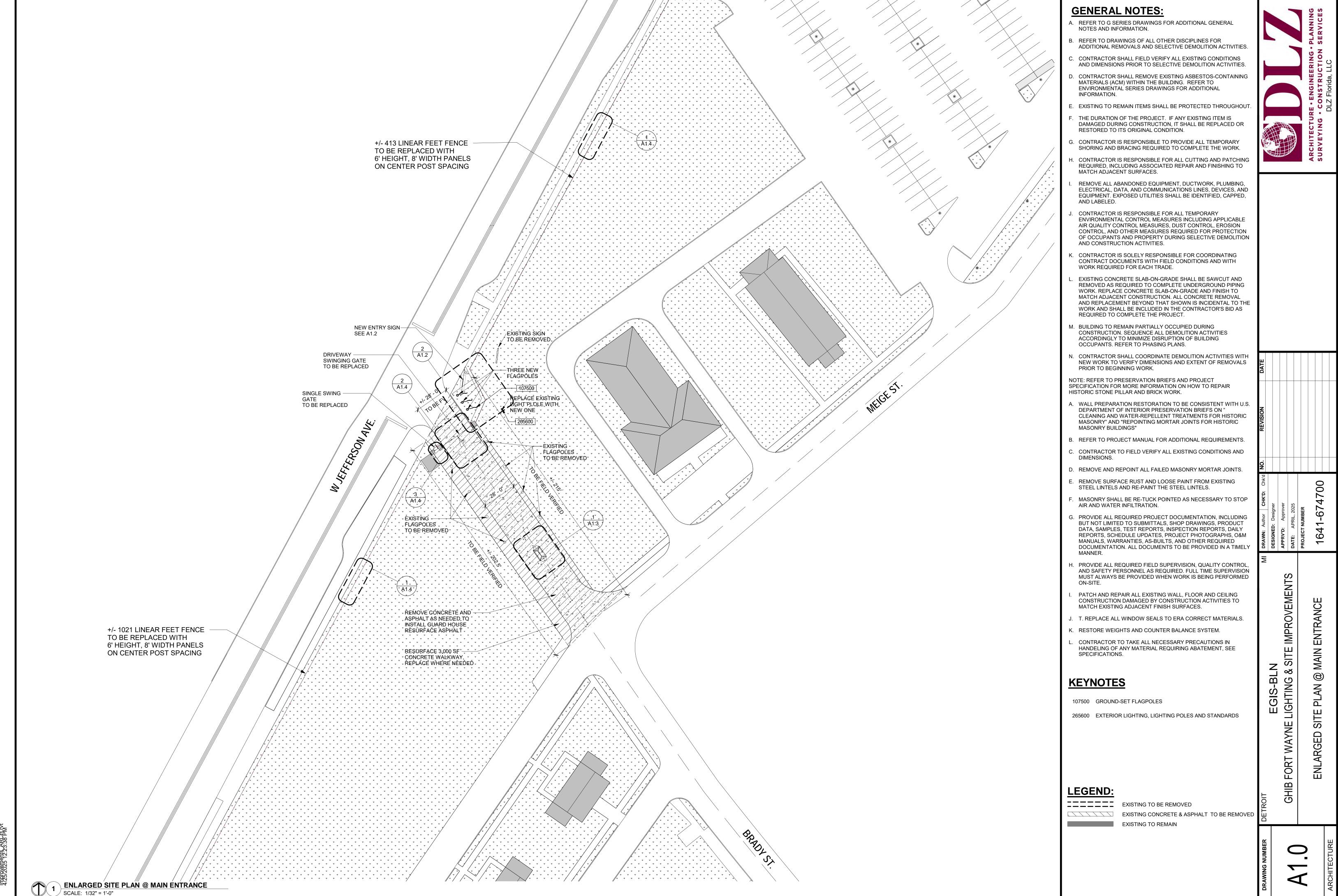
PLASTIC LAMINATE PLASTIC YARD CLEAN OUT PLUMBING YCO PLYWOOD **PNEUMATIC** PLUS OR MINUS PANEL PREFABRICATED DIAMTER CENTERLINE PROJECT PLATE PRECAST CONCRETE SLAB AND PARTITION NUMBER POLYVINYL CHLORIDE

WITH

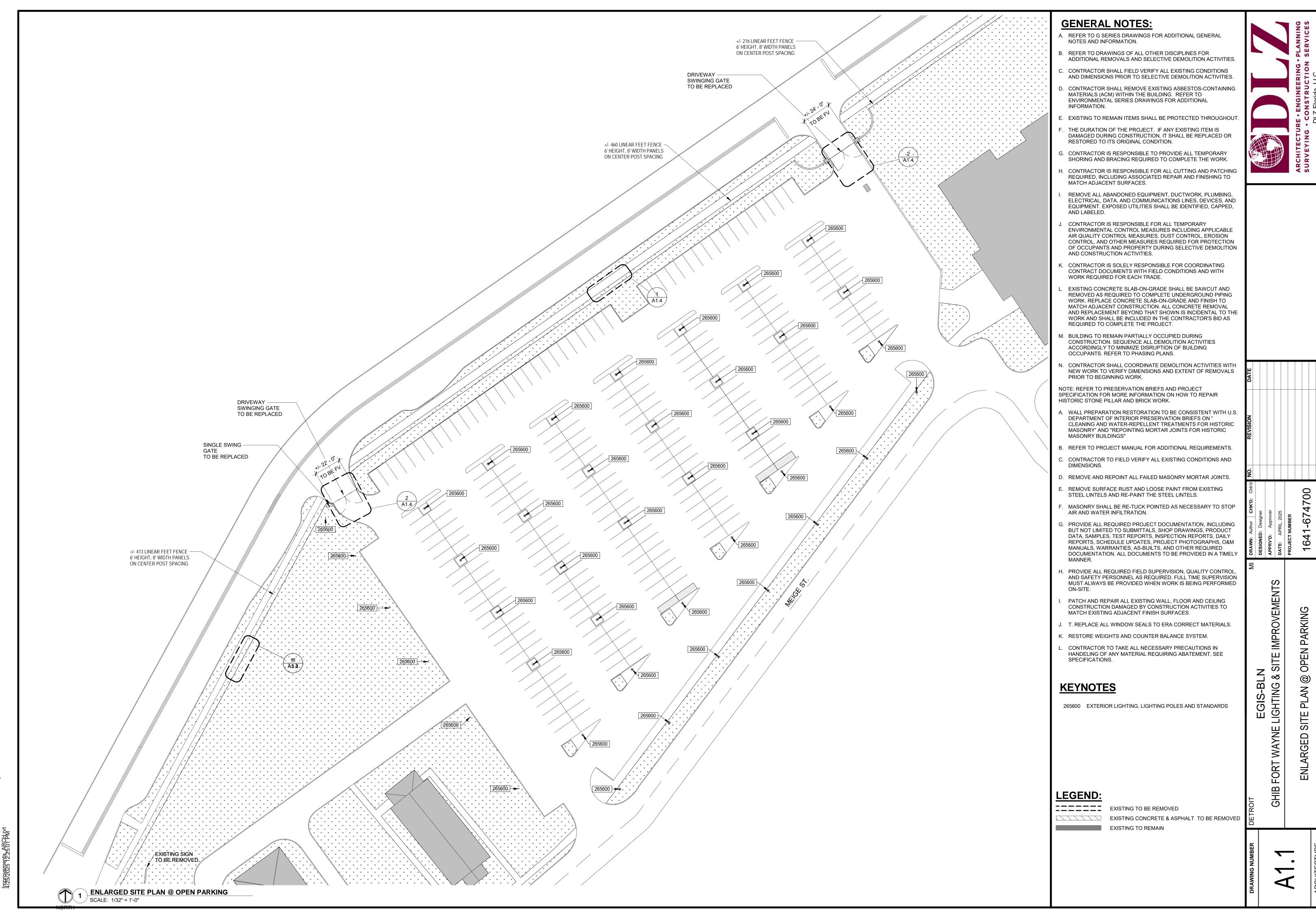
QUICK COUPLER VALVE QUARRY TILE QUALITY

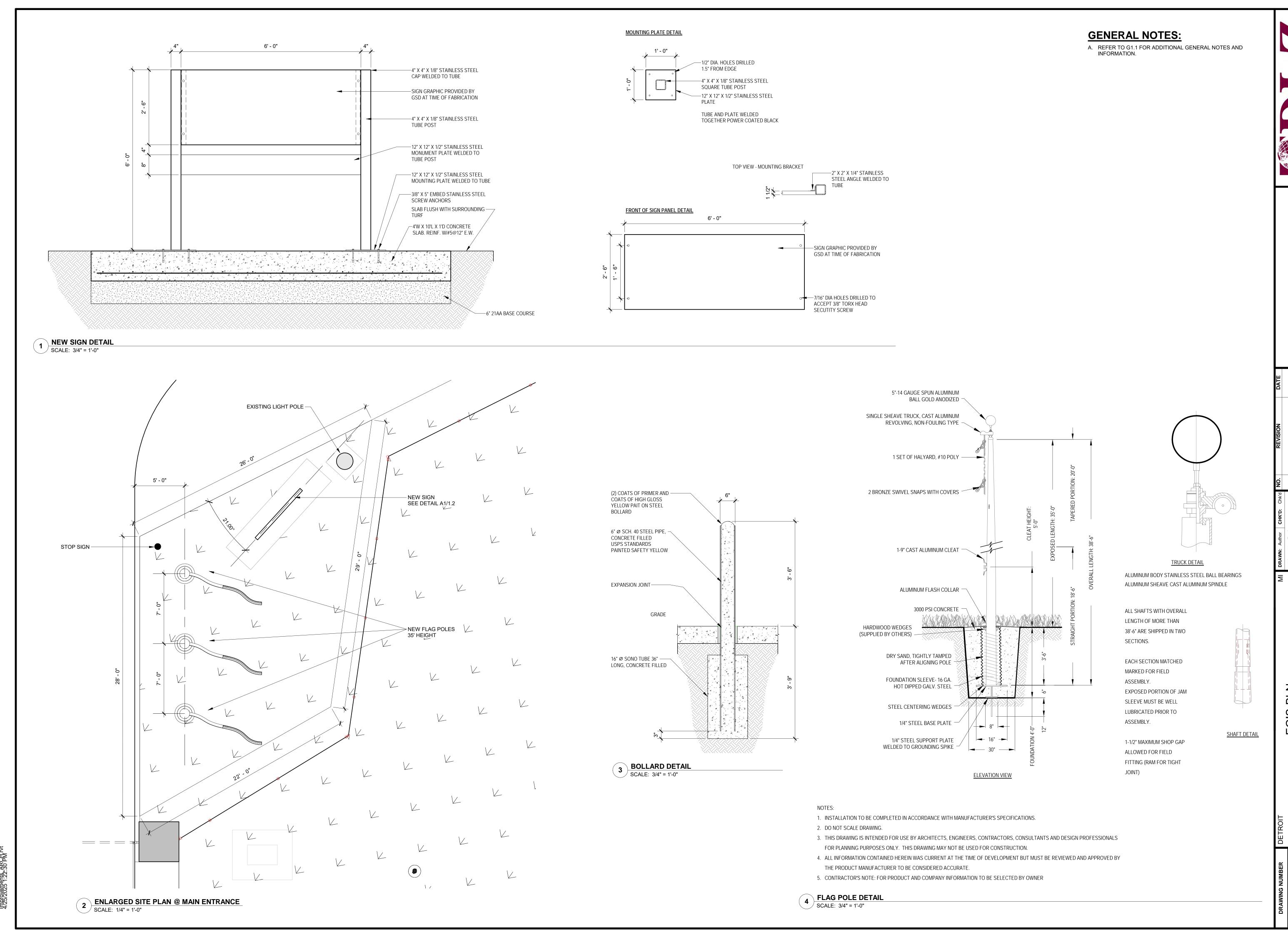
2. SHOP DRAWING - EXAMPLE OF LOGO COLORS TO BE APPROVED FOR CONTRACTOR'S USE TO MATCH.

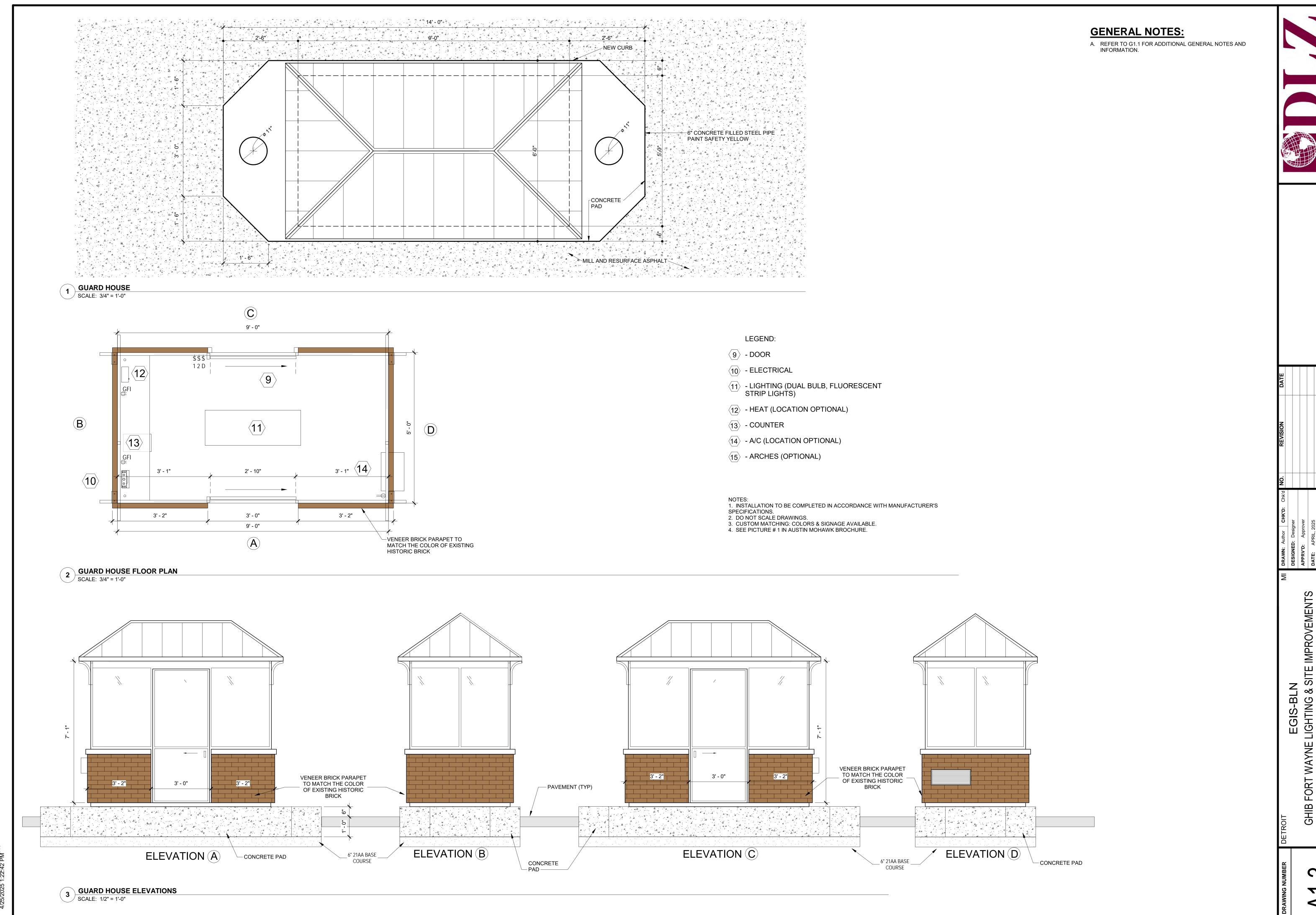
5. BACKGROUND SHALL BE THE COLOR "WHITE."



NORTH







DET,

SITE

3

apparatus is moved on to another. Soaking is often u

n combination with water washing and is also follo

by a final water rinse. Soaking is a very slow metho

it may take several days or a week-but it is a very ger method to use on historic masonry. Water Washing. Washing with low-pressure or mediu pressure water is probably one of the most commonl used methods for removing dirt or other pollutant so from historic masonry buildings (Fig. 7). Starting with very low pressure (100 psi or below), even using a gard hose, and progressing as needed to slightly higher pro -generally no higher than 300-400 psi — is always the recommended way to begin. Scrubbing with natural b or synthetic bristle brushes-never metal which can abra the surface and leave metal particles that can stain the masonry—can help in cleaning areas of the masonry t are especially dirty.

compounds that are especially effective in removing oil soil. (Examples of some of the numerous proprietary ionic detergents include Igepal by GAF, Tergitol by Un Carbide and Triton by Rohm & Haas.) Thus, the addit of a non-ionic detergent, or surfactant, to a low- or mediu pressure water wash can be a useful aid in the cleaning

Water Washing with Detergents. Non-ionic deterge

-which are not the same as soaps -are synthetic organ

n New York City. In this case, a twelve-hour water soak using S. Kaese, Wiss, Janney, Elstner Associates, Inc., N.Y., N.Y.

Other building materials also may be affected by the cleaning process. Some chemicals, for example, may have orrosive effect on paint or glass. The portions of building foure 5. Repeated water washing did not remove the staining inside elements most vulnerable to deterioration may not be visible, such as embedded ends of iron window bars. Other totally unseen items, such as iron cramps or ties which hold the masonry to the structural frame, also may migrate into the masonry. Cleaning may draw the salts to subject to corrosion from the use of chemicals or ever the surface, where they will appear as efflorescence (a from plain water. The only way to prevent problems in these cases is to study the building construction in detail powdery, white substance), which may require a second and evaluate proposed cleaning methods with this eatment to be removed. Allowances for dealing with such unknown factors, any of which can be a potential information in mind. However, due to the very likely possibility of encountering unknown factors, any cleaning problem, should be included when investigating cleaning methods and materials. Just as more than one kind of roject involving historic masonry should be viewed as masonry on a historic building may necessitate multiple unique to that particular building.

Cleaning Methods and Materials

Masonry cleaning methods generally are divided into

three major groups: water, chemical, and abrasive. Water

methods soften the dirt or soiling material and rinse the

deposits from the masonry surface. Chemical cleaners

ct with dirt, soiling material or paint to effect their

removal, after which the cleaning effluent is rinsed off the

blasting with grit, and the use of grinders and sanding

discs, all of which mechanically remove the dirt, soiling

surface). Abrasive cleaning is also often followed with a

water rinse. Laser cleaning, although not discussed here

in detail, is another technique that is used sometimes b

masonry surface with water. Abrasive methods include

material or paint (and, usually, some of the masonry

treatments. Choose the appropriate cleaner. The importance of testing leaning methods and materials cannot be over emphasize Applying the wrong cleaning agents to historic masonr can have disastrous results. Acidic cleaners can be extremel damaging to acid-sensitive stones, such as marble and limestone, resulting in etching and dissolution of these stones. Other kinds of masonry can also be damaged by incompatible cleaning agents, or even by cleaning agent that are usually compatible. There are also numerous kinds of sandstone, each with a considerably different geologi composition. While an acid-based cleaner may be safely used on some sandstones, others are acid-sensitive and can be severely etched or dissolved by an acid cleaner Some sandstones contain water-soluble minerals and can be eroded by water cleaning. And, even if the stone type is correctly identified, stones, as well as some bricks, ma contain unexpected impurities, such as iron particles, that may react negatively with a particular cleaning agent and result in staining. Thorough understanding of the physical and chemical properties of the masonry will help avoid the inadvertent selection of damaging cleaning agents

cleaning approaches, unknown conditions that are

encountered may also require additional cleaning

asonry cleaning projects. Although it may seem contrary to common sense, masonry cleaning projects should be carried out starting at the

ryators to clean small areas of historic masonry. It can be quite effective for cleaning limited areas, but it is pensive and generally not practical for most histori

or on gypsum or alabaster which are very soluble in water

conduit with the rest of the brick facade emphasizes the severity of

erosion caused by sandblasting.

HISTORIC FORT WAYNE

BRICK WORK REPAIR AND CLEANING AS NEEDED ON EXISTING PILLARS AND GATES.

Brick cleaning is a component of a historic masonry renovation project, the National Preservation Briefs provide critical guidance to ensure that the cleaning process supports, rather than detracts from, the building's historic integrity. Here's a breakdown of key considerations:

Integration into the Renovation Plan: Comprehensive Evaluation:

Cleaning should never be an isolated action. It must be part of a holistic renovation plan that addresses all aspects of the masonry's condition, including mortar joints, structural stability, and existing damage. The cleaning process itself can reveal hidden deterioration, making a pre-cleaning assessment essential.

Compatibility: Any cleaning methods or materials used must be compatible with the existing brick and mortar. This is especially important in renovations, where new materials may be

introduced. The NPS emphasizes that cleaning should not compromise the long-term durability of the masonry. Preserving Historic Fabric:

Renovations often involve alterations. The cleaning process should be carefully managed to avoid inadvertently removing or damaging historic fabric. The goal is to enhance the building's appearance while retaining its historic character.

rocess. (A non-ionic detergent, unlike most household detergents, does not leave a solid, visible residue on the nasonry.) Adding a non-ionic detergent and scrubbing rith a natural bristle or synthetic bristle brush can facilitat should be followed with a final water rinse.

team/Hot-Pressurized Water Cleaning, Steam cleaning s actually low-pressure hot water washing because the ndenses almost immediately upon leaving the ose. This is a gentle and effective method for cleaning tone and particularly for acid-sensitive stones. Steam car be especially useful in removing built-up soiling deposits nd dried-up plant materials, such as ivy disks and tendrils t can also be an efficient means of cleaning carved stone details and, because it does not generate a lot of liquid vater, it can sometimes be appropriate to use for cleaning nterior masonry (Figs. 8-9).

vater-based methods are generally the most gentle, even ey can be damaging to historic masonry. Before beginning water cleaning project, it is important to make sure that ll mortar joints are sound and that the building is vatertight. Otherwise water can seep through the walls to the interior, resulting in rusting metal anchors and

ome water supplies may contain traces of iron and coppe

Potential hazards of water cleaning. Despite the fact that

which may cause masonry to discolor. Adding a chelating r complexing agent to the water, such as EDTA (ethylene amine tetra-acetic acid), which inactivates other metall ons, as well as softens minerals and water hardness, will elp prevent staining on light-colored masonry. ny cleaning method involving water should never be

one in cold weather or if there is any likelihood of frost r freezing because water within the masonry can freeze, ake over a week to dry after cleaning, no water cleaning hould be permitted for several days prior to the first verage frost date, or even earlier if local forecasts predict

fost essential of all, it is important to be aware that using washing" and "water blasting", is very abrasive and can sily etch marble and other soft stones, as well as some pes of brick (Figs. 10-11). In addition, the distance of the ozzle from the masonry surface and the type of nozzle, as well as gallons per minute (gpm), are also important ariables in a water cleaning process that can have a nificant impact on the outcome of the project. This is by it is imperative that the cleaning be closely monitored ensure that the cleaning operators do not raise the essure or bring the nozzle too close to the masonry ir on effort to "speed up" the process. The appearance of rains of stone or sand in the cleaning effluent on the round is an indication that the water pressure may be too



ented, if necessary, with a non-ionic detergent. Photo: Nationa

products, are another material frequently used to clear storic masonry. They can remove dirt, as well as paint and other coatings, metallic and plant stains, and graffiti acids, alkalies and organic compounds. Acidic cleaners, sensitive. Paint removers are alkaline, based on organic solvents or other chemicals.

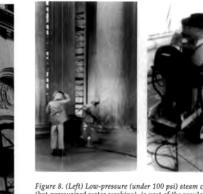
use of water. Both cleaners are also likely to contain surfactants (wetting agents), that facilitate the chemica wet first for both types of cleaners, then the chemical for an amount of time recommended by the product rinsed off with a low- or moderate-pressure cold, or of the cleaner may be necessary, and it is always a good practice to test the product manufacturer's



Chemical cleaners, generally in the form of proprieta

Chemical Cleaners to Remove Dirt

Both alkaline and acidic cleaning treatments include the reaction that removes the dirt. Generally, the masonry i cleaner is sprayed on at very low pressure or brushed onto the surface. The cleaner is left to dwell on the masonry manufacturer or, preferably, determined by testing, and sometimes hot, water wash. More than one application tions concerning dilution rates and dwell times. Because each cleaning situation is unique, dilution surface may be scrubbed lightly with natural or synthetic pristle brushes prior to rinsing. After rinsing, pH strips should be applied to the surface to ensure that the masonr has been neutralized completely.



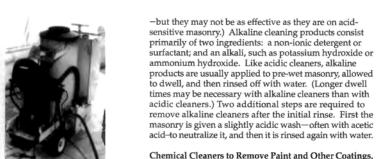
(hot-pressurized water washing), is part of the regular maintenance program at the Jefferson Memorial, Washington, D.C. The white marbi

Acidic Cleaners. Acid-based cleaning products may be used on non-acid sensitive masonry, which generally ncludes: granite, most sandstones, slate, unglazed brick and unglazed architectural terra cotta, cast stone and concrete (Fig. 12). Most commercial acidic cleaners are composed primarily of hydrofluoric acid, and often include some phosphoric acid to prevent rust-like stains from developing on the masonry after the cleaning. Acid cleaners Chemical cleaners used to remove dirt and soiling include are applied to the pre-wet masonry which should be kept wet while the acid is allowed to "work", and then removed

Alkaline Cleaners. Alkaline cleaners should be used on acid-sensitive masonry, including: limestone, polished and unpolished marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished granite. materials that are not acid sensitive - after testing, of course



Figure 9. (Left) This small steam cleaner—the size of a vacuum cleaner—offers a very controlled and gentle means of cleaning limited, or hard-to-reach reas or carved stone details. (Right) It is particularly useful for interiors where it is important to keep moisture to a minumum, such as inside the Washington Monument, Washington, D.C., where it was used to clean the commemorative stones. Photos: Audrey T. Tepper.



Removing paint and some other coatings, stains and graffiti can best be accomplished with alkaline paint removers, organic solvent paint removers, or other cleaning compounds. The removal of layers of paint from a mason surface usually involves applying the remover either by brush, roller or spraying, followed by a thorough water wash. As with any chemical cleaning, the manufacturer's commendations regarding application procedures should always be tested before beginning work.

Alkaline Paint Removers. These are usually of much the same composition as other alkaline cleaners, containing potassium or ammonium hydroxide, or trisodium nosphate. They are used to remove oil, latex and acrylic paints, and are effective for removing multiple layers of water-repellent coatings. As with other alkaline cleaners. both an acidic neutralizing wash and a final water rinse

Organic Solvent Paint Removers. The formulation of combination of solvents, including methylene chloride. methanol, acetone, xylene and toluene.





PRESERVATION

Assessing Cleaning and Water-Repellent

ause of damage to historic masonry buildings. While

not selected carefully. Historic masonry, as considered

re, includes stone, brick, architectural terra cotta, cas

tone, concrete and concrete block. It is frequently cleaned

because cleaning is equated with improvement. Cleaning

epellent coating. However, unless these procedures are

rchitectural conservator, they may result in irrevocable

ne purpose of this Brief is to provide information on the

ariety of cleaning methods and materials that are available

nethod or combination of methods. The difference between

edeposits have been removed from the right side of the cornice which has already been cleaned.

for use on the exterior of historic masonry buildings, and

o provide guidance in selecting the most appropriate

arried out under the guidance and supervision of an

y sometimes be followed by the application of a water

either or both treatments may be appropriate in some cases,

nev can be very destructive to historic masonry if they are

Freatments for Historic Masonry Buildings

BRIEFS

Robert C. Mack, AIA

National Park Service
Cultural Resources

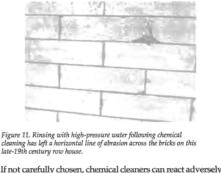
amage to the historic resource.

Anne Grimmer

Figure 10. High-pressure water washing too close to the surface has aded and, consequently, marred the limestone on this early-20th

compounds that can be used to remove paint and some ainted graffiti from historic masonry include paint emovers based on N-methyl-2-pyrrolidone (NMP), or on troleum-based compounds. Removing stains, whether they are industrial (smoke, soot, grease or tar), metallic iron or copper), or biological (plant and fungal) in origin depends on carefully matching the type of remover to the pe of stain (Fig. 13). Successful removal of stains from nistoric masonry often requires the application of a number different removers before the right one is found. The emoval of layers of paint from a masonry surface is usually ccomplished by applying the remover either by brush, oller or spraying, followed by a thorough water wash

otential hazards of chemical cleaning. Since most nical cleaning methods involve water, they have many of the potential problems of plain water cleaning. Like pecause of the possibility of freezing. Chemical cleaning hould never be undertaken in temperatures below 40 ees F (4 degrees C), and generally not below 50 degree In addition, many chemical cleaners simply do not work temperatures. Both acidic and alkaline cleaners can be dangerous to cleaning operators and, clearly, there are environmental concerns associated with the use of chemical cleaners.



is explained, and the purpose of each, the suitability of

their application to historic masonry buildings, and the

possible consequences of their inappropriate use are

The Brief is intended to help develop sensitivity to the

in working cooperatively with architects, architecture

qualities of historic masonry that makes it so special, and

to assist historic building owners and property manager

conservators and contractors (Fig. 1). Although specifically

intended for historic buildings, the information is applicable

to all masonry buildings. This publication updates and

Coating of Masonry Buildings. The Brief is not meant to be

Rather, it provides general information to raise awareness

water-repellent treatments for historic masonry buildings.

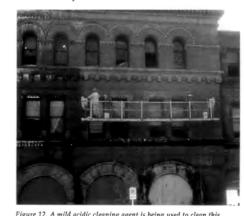
of the many factors involved in selecting cleaning and

ands Preservation Brief 1: The Cleaning and Waterproof

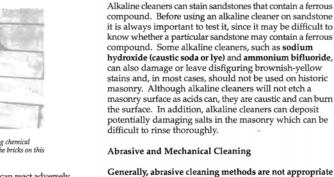
eaning manual or a guide for preparing specifications.

ressurized water washing), is being used to clean the exterior of the U.S. Tariff Commission Building, th 1, D.C., in 1839. This method was selected by an architecural conservator as the "gentlest means possible this dimarks with as those on the conjuic and column capitals, and facilitate easy removal. Note how

with many types of masonry. Obviously, acidic cleaners should not be used on acid-sensitive materials; however, it is not always clear exactly what the composition is of any stone or other masonry material. For, this reason, testing the cleaner on an inconspicuous spot on the building s always necessary. While certain acid-based cleaners may be appropriate if used as directed on a particular type nasonry, if left too long or if not adequately rinsed fro the masonry they can have a negative effect. For example, drofluoric acid can etch masonry leaving a hazy resid whitish deposits of silica or calcium fluoride salts) on the surface. While this efflorescence may usually be removed y a second cleaning-although it is likely to be expensive and time-consuming—hydrofluoric acid can also leave masonry which may be impossible to remove (Fig. 15) Other acids, particularly hydrochloric (muriatic) acid masonry, because it can dissolve lime-based mortar, lamage brick and some stones, and leave chloride deposit on the masonry.



move the dark stains on the granite arches below. Photo: Sharon C



igure 2. Biological growth as shown on this marble foundation

non-ionic detergent added to it, and scrubbing with a natural or

Reasons for cleaning. First, it is important to determine

whether it is appropriate to clean the masonry. The objective

of cleaning a historic masonry building must be considered

several major reasons for cleaning a historic masonry

removing unattractive dirt or soiling materials, or nor

removing soiling materials that may be damaging the

building: improve the appearance of the building by

historic paint from the masonry; retard deterioration by

nasonry; or **provide a clean surface** to accurately match

dentify what is to be removed. The general nature and

source of dirt or soiling material on a building must be

dentified to remove it in the gentlest means possible -

that is, in the most effective, yet least harmful, manner.

agent to remove than oil stains or metallic stains. Othe

eft on masonry after removal of ivy (Fig. 2).

Soot and smoke, for example, require a different cleaning

mmon cleaning problems include biological growth such

as mold or mildew, and organic matter such as the tendrils

Consider the historic appearance of the building. If the

roposed cleaning is to remove paint, it is important in

storically appropriate. And, it is necessary to conside

why the building was painted (Fig. 3). Was it to cover bad repointing or unmatched repairs? Was the building

ted to protect soft brick or to conceal deterior

stone? Or, was painted masonry simply a fashionable

ch case to learn whether or not unpainted masonry is

pointing mortars or patching compounds, or to conduc

carefully before arriving at a decision to clean. There are

Preparing for a Cleaning Project

condition survey of the masonry.

for use on historic masonry buildings. Abrasive cleaning methods are just that—abrasive. Grit blasters, grinders and sanding discs all operate by abrading the dirt or paint off the surface of the masonry, rather than reacting with the dirt and the masonry which is how water and chemical methods work. Since the abrasives do not differentiate between the dirt and the masonry, they can also remove the outer surface of the masonry at the same time, and result in permanently damaging the masonry. Brick, architectural terra cotta, soft stone, detailed carvings, and polished surfaces are especially susceptible to physical and aesthetic damage by abrasive methods. Brick and architectural terra cotta are fired products which have smooth, glazed surface which can be removed by abrasive blasting or grinding (Figs. 18-19). Abrasively-cleaned masonry is damaged aesthetically as well as physically. and it has a rough surface which tends to hold dirt and Abrasive cleaning processes can also increase the likelihood of subsurface cracking of the masonry. Abrasion of carved



scrapers.) Although not all the asphalt was removed, this was determined to be an acceptable level of cleanliness for the project



painted, and may suggest to the owner that it may be preferable to keep

treatment in a particular historic period? Many buildings

were painted at the time of construction or shortly thereafter;

retention of the paint, therefore, may be more appropriate

o have been painted for a long time, it is also important

to think about whether the paint is part of the character of

the historic building and if it has acquired significance over

Consider the practicalities of cleaning or paint removal.

Some gypsum or sulfate crusts may have become integral

with the stone and, if cleaning could result in removing

some of the stone surface, it may be preferable not to clean

of the paint may be more practical than removal in terms

however, removal of the paint may be desirable. For

an extent that removal is necessary to ensure a sound

Study the masonry. Although not always necessary, in

paint type, color, and layering on the masonry research

the soiling or of the paint to be removed from the masor

as well as guidance on the appropriate cleaning method

may be provided by professional consultants, includi-

architectural conservators, conservation scientists and

architectural review boards and preservation-oriented

Office (SHPO), local historic district commissions,

masonry cleaning techniques.

preservation architects. The State Historic Preservation

websites may also be able to supply useful information or

some instances it can be beneficial to have the coating or

before attempting its removal. Analysis of the nature of

surface to which the new paint will adhere.

example, the old paint layers may have built up to such

of long range preservation of the masonry. In some cases,

historically than removing it. And, if the building appears

revealed that the cornice and window hoods are metal rather than Mortar joints, especially those with lime mortar, also can be eroded by abrasive or mechanical cleaning. In some cases, the damage may be visual, such as loss of joint detail or increased joint shadows. As mortar joints constitute a nificant portion of the masonry surface (up to 20 per cent in a brick wall), this can result in the loss of a considerable amount of the historic fabric. Erosion of the mortar joints may also permit increased water penetration, which will likely necessitate repointing.



Figure 15. The whitish deposits left on the brick by a chemical paint emover may have resulted from inadequate rinsing or from the chemical being left on the surface too long and may be impossible to



often are best removed by using a poultice. A poultice kaolin or fuller's earth, or even shredded paper or paper towels), mixed with a liquid (solvent or other remover) orm a paste which is applied to the stain (Figs. 16-17) As it dries, the paste absorbs the staining material so that it is not redeposited on the masonry surface. Some mercial cleaning products and paint removers ar specially formulated as a paste or gel that will cling to a vertical surface and remain moist for a longer period of time in order to prolong the action of the chemical on the in powder form needing only the addition of the ppropriate liquid. The masonry must be pre-wet before applying an alkaline cleaning agent, but not when using



ng out too quickly. (c) As the poultice dried, it pulled the stair of the stone. (d) The poultice residue was removed carefully om the stone surface with wooden scrapers and the stone was

used with water. Photos: John Dugger.

Understanding the Building Materials

eveloping a cleaning program because inappropriate

well as on other building materials. The masonry material

materials must be correctly identified. It is sometimes

difficult to distinguish one type of stone from another; for

xample, certain sandstones can be easily confused with ones. Or, what appears to be natural stone may no

be stone at all, but cast stone or concrete. Historically, cast

stone and architectural terra cotta were frequently used in

ombination with natural stone, especially for trim elements

se substitute materials looked like real stone (Fig. 4)

uilding and its surroundings should be researched and

building maintenance records should be obtained, if

available. Sometimes if streaked or spotty areas do not

seem to get cleaner following an initial cleaning, closer

discoloration may turn out not to be dirt but the remnant

of a water-repellent coating applied long ago which has

uccessful removal may require testing several cleaning

gents to find something that will dissolve and remove the

coating. Complete removal may not always be possible.

Repairs may have been stained to match a dirty building

icing salts used near the building that have dissolved can

and cleaning may make these differences apparent. I

darkened the surface of the masonry over time (Fig. 5

inspection and analysis may be warranted. The

Other features on historic buildings that appear to be stone

uch as decorative cornices, entablatures and window

oods, may not even be masonry, but metal.

or on upper stories of a building where, from a distance,

ning can have a deleterious effect on the masonry as



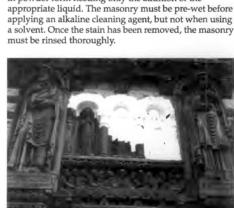


Figure 17. A poultice is being used to remove salts from the brownsto National Park Service Files.



Figure 18. The glazed bricks in the center of the pier were covered by a signboard that protected them being damaged by the sandblasting which removed the glaze from the surrounding bricks.

Abrasive Blasting. Blasting with abrasive grit or another abrasive material is the most frequently used abrasive on materials that are not usually thought of as abrasiv method. Sandblasting is most commonly associated with and not as commonly associated with traditional abrasive grit cleaning. Some patented abrasive cle abrasive cleaning. Finely ground silica or glass powder processes - one dry, one wet -use finely-ground glass glass beads, ground garnet, powdered walnut and other ground nut shells, grain hulls, aluminum oxide, plastic owder intended to "erase" or remove dirt and surface particles and even tiny pieces of sponge, are just a few of soiling only, but not paint or stains (Fig. 20). Cleaning he other materials that have also been used for abrasive baking soda (sodium bicarbonate) is another pater cleaning. Although abrasive blasting is not an appropriate process. Baking soda blasting is being used in some method of cleaning historic masonry, it can be safely used communities as a means of quick graffiti removal o clean some materials. Finely-powdered walnut shell However, it should not be used on historic masonry are commonly used for cleaning monumental bronze it can easily abrade and can permanently "etch" the graf sculpture, and skilled conservators clean delicate museum into the stone; it can also leave potentially damaging sa in the stone which cannot be removed. Most of thes objects and finely detailed, carved stone features with very abrasive grits may be used either dry or wet, although dry small, micro-abrasive units using aluminum oxide. t tends to be used more frequently



ature of this narticular process. The specially-trained operators in the chamber wear protective clothing, masks and break

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Acknowledgments

Third, completely revised and extended edition. Berlin,

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& Mack Architects, Ltd., an architectural firm that specializ historic buildings in Minneapolis, Minnesota.

Anne Grimmer is a Senior Architectural Historian in the Tecl

The original version of Preservation Brief 1: The Cleaning an

Mack, AIA. It inaugurated the Preservation Briefs series wh

The following historic preservation specialists provided tea

review of this publication: Frances Gale, Training Director National Center for Preservation Technology and Training

National Park Service, Natchitoches, LA; Judith M. Jacob,

Northeast Cultural Resources Center, National Park Service

NY: Robert M. Powers, Architectural Conservator, Power

Company, Inc., Philadelphia, PA; Antonio Aguilar, Kaaren

JoEllen Hensley, Gary Sachau, John Sandor and Audrey T. Te

ctural Conservator, Building Conservation Bran

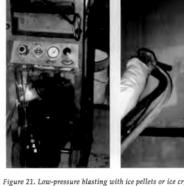
laterproof Coating of Masonry Buildings was written by Robe

Program, National Park Service, Washington, D.C.

Preservation Services Branch, Heritage Preservation Servic

XXIV, No. 4 (July-August 1996), pp. 46-49.

Figure 20. (Left) A comparison of the limestone surface of a 1920s of fine glass powder clearly shows the effectiveness of this method. But this is an abrasive technique and it has "cleaned" by removing part of the surface with the dirt. Because it is abrasive, it is generally not recommended for large-scale cleaning of historic masonry, although it may be sui



stains that have penetrated into the masonry without causing ner abrasion (right). Photos: Audrey T. Tepper. e particles, or pelletized dry ice (carbon dioxide or CO2)

his is also too abrasive to be used on most historic masonry, ut it may have practical application for removing mastics or asphaltic coatings from some substrates. Some of these processes are promoted as being more ironmentally safe and not damaging to historic masonry

re another medium used as an abrasive cleaner (Fig. 21).

uildings. However, it must be remembered that they are brasive and that they "clean" by removing a small portion of the masonry surface, even though it may be only a ninuscule portion. The fact that they are essentially then planning a masonry cleaning project. In general, rasive methods should not be used to clean historic asonry buildings. In some, very limited instances, highly itrolled, gentle abrasive cleaning may be appropriate n selected, hard-to-clean areas of a historic mason building if carried out under the watchful supervision of onal conservator. But, abrasive cleaning should ever be used on an entire building.

rinders and Sanding Disks. Grinding the masonry urface with mechanical grinders and sanding disks is other means of abrasive cleaning that should not be use n historic masonry. Like abrasive blasting, grinders and sks do not really clean masonry but instead grind away nd abrasively remove and, thus, damage the masonry urface itself rather than remove just the soiling material.

Planning A Cleaning Project nce the masonry and soiling material or paint have been entified, and the condition of the masonry has been ated, planning for the cleaning project can begin.

Testing cleaning methods. In order to determine the ossible, several cleaning methods or naterials may have to be tested prior to selecting the best one to use on the building. Testing should always begi with the gentlest and least invasive method proceeding combination of methods. All too often simple methods, such as low-pressure water wash, are not even considered yet they frequently are effective, safe, and not expensive Water of slightly higher pressure or with a non-ionic detergent additive also may be effective. It is worth repeating that these methods should always be tested prior lering harsher methods; they are safer for the building and the environment, often safer for the applicator, and relatively inexpensive. The level of cleanliness desired also should be determined prior to selection of a cleaning method. Obviously, the

ntent of cleaning is to remove most of the dirt, soiling

material, stains, paint or other coating. A "brand new

rance, however, may be inappropriate for an older building, and may require an overly harsh cleaning method to be achieved. When undertaking a cleaning project, it is important to be aware that some stains simply may not be interrupted by a stop-work order because a required permit removable. It may be wise, therefore, to agree upon a slightly lower level of cleanliness that will serve as the standard for the cleaning project. The precise amount of residual dirt considered acceptable may depend on the type of masonry, the type of soiling and difficulty of total removal, and local environmental conditions. Cleaning tests should be carried out in an area of sufficient size to give a true indication of their effectiveness. It is

preferable to conduct the test in an inconspicuous location on the building so that it will not be obvious if the test is not successful. A test area may be quite small to begin sometimes as small as six square inches, and gradually nay be increased in size as the most appropriate methods and cleaning agents are determined. Eventually the test area may be expanded to a square yard or more, and it should include several masonry units and mortar joints (Fig. 22). It should be remembered that a single building may have several types of masonry and that even simila materials may have different surface finishes. Each material and different finish should be tested separately. Cleanin tests should be evaluated only after the masonry has dried completely. The results of the tests may indicate that several methods of cleaning should be used on a single

When feasible, test areas should be allowed to weather for an extended period of time prior to final evaluation. A waiting period of a full year would be ideal in order to expose the test patch to a full range of seasons. If this is not possible, the test patch should weather for at least a month or two. For any building which is considered istorically important, the delay is insignificant compared to the potential damage and disfigurement which may result from using an incompletely tested method. The successfully cleaned test patch should be protected as it will serve as a standard against which the entire cleaning method selected for the cleaning project must be considered project will be measured. before selecting a cleaning method to avoid harm to the

Environmental considerations. The potential effect of any method proposed for cleaning historic masonry should be evaluated carefully. Chemical cleaners and paint removers may damage trees, shrubs, grass, and plants. A plan must be provided for environmentally safe removal and disposal of the cleaning materials and the rinsing effluent before beginning the cleaning project. Authorities from the local regulatory agency—usually under the jurisdiction of the federal or state Environmental Protection Agency (EPA) should be consulted prior to beginning a cleaning project, especially if it involves anything more than plain water washing. This advance planning will ensure that the cleaning effluent or run-off, which is the combination of the cleaning agent and the substance removed from the masonry, is handled and disposed of in an environmentally sound and legal manner. Some alkaline and acidic cleaners can be neutralized so that they can be safely discharged into storm sewers. However, most solvent-based cleaners cannot be neutralized and are categorized as pollutants, and must be disposed of by a licensed transport, storag and disposal facility. Thus, it is always advisable to consult with the appropriate agencies before starting to clean to ensure that the project progresses smoothly and is not

Vinyl guttering or polyethylene-lined troughs placed around the perimeter of the base of the building can serve to catch chemical cleaning waste as it is rinsed off the building. This will reduce the amount of chemicals entering and polluting the soil, and also will keep the cleaning waste contained until it can be removed safely. Some patented cleaning systems have developed special equipment to facilitate the containment and later disposal of cleaning waste.

Concern over the release of volatile organic compounds (VOCs) into the air has resulted in the manufacture of new, more environmentally responsible cleaners and paint removers, while some materials traditionally used in cleaning may no longer be available for these same reasons Other health and safety concerns have created additional cleaning challenges, such as lead paint removal, which is likely to require special removal and disposal techniques. Cleaning can also cause damage to non-masonry materials

on a building, including glass, metal and wood. Thus, it is usually necessary to cover windows and doors, and other features that may be vulnerable to chemical cleaners They should be covered with plastic or polyethylene, or a masking agent that is applied as a liquid which dries to form a thin protective film on glass, and is easily peeled off after the cleaning is finished. Wind drift, for example, can also damage other property by carrying cleaning chemicals onto nearby automobiles, resulting in etching of the glass or spotting of the paint finish. Similarly, airborne dust can enter surrounding buildings, and excess water can collect in nearby yards and basements. Safety considerations. Possible health dangers of each



igure 22. Cleaning test areas may be quite small at first and gradually ncrease in size as testing determines the "gentlest means possible" Photo: Frances Gale. leaning applicators, and the necessary precautions must water which, unlike water vapor, cannot escape through be taken. The precautions listed in Material Safety Data a water-repellent coating. The liquid water within the Sheets (MSDS) that are provided with chemical products wall, whether from condensation, leaking gutters, or other hould always be followed. Protective clothing, respirators, hearing and face shields, and gloves must be provided to
Water-repellent coatings are not consolidants. Although chemical cleaners in both liquid and vapor forms can also modern water repellents may penetrate slightly beneath cause serious injury to passers-by (Fig. 23). It may be cessary to schedule cleaning at night or weekends if the building is located in a busy urban area to reduce the potential danger of chemical overspray to pedestrians. leaning during non-business hours will allow HVAC systems to be turned off and vents to be covered to prevent proven very effective. The composition of fired products dangerous chemical fumes from entering the building which will also ensure the safety of the building's occupants.

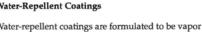
Water-Repellent Coatings and Waterproof

or the masonry contains silica.

Abrasive and mechanical methods produce dust which

can pose a serious health hazard, particularly if the abrasive

To begin with, it is important to understand that waterproof stones. However, a water-repellent coating cannot be coatings and water-repellent coatings are not the same. considered a consolidant. In some instances, a water-Although these terms are frequently interchanged and commonly confused with one another, they are completely damaged or spalling stone, may form a surface crust which, different materials. Water-repellent coatings -often if it fails, may exacerbate the deterioration by pulling off referred to incorrectly as "sealers", but which do not or even more of the stone (Fig. 25). should not seal—are intended to keep liquid water from nd leave, or pass through, the surface of the masonry (Fig. 24). Water-repellent coatings are generally transparent, or Water-repellent coatings are frequently applied to historic clear, although once applied some may darken or discolor masonry buildings for the wrong reason. They also are certain types of masonry while others may give it a glossy often applied without an understanding of what they are or shiny appearance. Waterproof coatings seal the surface and what they are intended to do. And these coatings can from liquid water and from water vapor. They are usually be very difficult, if not impossible, to remove from opaque, or pigmented, and include bituminous coatings the masonry if they fail or become discolored. Most importantly, the application of water-repellent coatings to and some elastomeric paints and coatings.



meable, or "breathable". They do not seal the surface pletely to water vapor so it can enter the masonry vall as well as leave the wall. While the first waterlent coatings to be developed were primarily acrylic ilicone resins in organic solvents, now most watert coatings are water-based and formulated from odified siloxanes, silanes and other alkoxysilanes, or netallic stearates. While some of these products are pped from the factory ready to use, other waterborne water repellents must be diluted at the job site. Unlike arlier water-repellent coatings which tended to form a ilm" on the masonry surface, modern water-repellen tings actually penetrate into the masonry substrate htly and, generally, are almost invisible if properly oplied to the masonry. They are also more vapor permeable than the old coatings, yet they still reduce the apor permeability of the masonry. Once inside the wall, water vapor can condense at cold spots producing liquid

the masonry surface, instead of just "sitting" on top of it, which is to "consolidate" and replace lost binder to strengthen deteriorating masonry. Even after many years of laboratory study and testing few consolidants have such as brick and architectural terra cotta, as well as many types of building stone, does not lend itself to consolidation.

ome modern water-repellent coatings which contain a binder intended to replace the natural binders in stone that have been lost through weathering and natural erosion are described in product literature as both a water repellen and a consolidant. The fact that newer water-repellent oatings penetrate beneath the masonry surface instea of just forming a layer on top of the surface may indeed convey at least some consolidating properties to certain repellent or "preservative" coating, if applied to alread

historic masonry is usually unnecessary.

Most historic masonry buildings, unless they are painted, have survived for decades without a water-repellent coating and, thus, probably do not need one now. Water enetration to the interior of a masonry building is seldon due to porous masonry, but results from poor or deferred maintenance. Leaking roofs, clogged or deteriorated gutters and downspouts, missing mortar, or cracks and open joints around door and window openings are almost always the cause of moisture-related problems in a history masonry building. If historic masonry buildings are kept watertight and in good repair, water-repellent coatings Rising damp (capillary moisture pulled up from the ground), or condensation can also be a source of excess moisture in masonry buildings. A water-repellent coating vill not solve this problem either and, in fact, may be likely to exacerbate it. Furthermore, a water-repellent coating should never be applied to a damp wall. Moistur in the wall would reduce the ability of a coating to adhere

igure 23. A tarpaulin protects and shields pedestrians from potentia

armful spray while chemical cleaning is underway on the granite

exterior of the U.S. Treasury Building, Washington, D.C.

moisture to go even higher in the wall because it can slow down evaporation, and thereby retain the moisture in the essive moisture in masonry walls may carry waterborn soluble salts from the masonry units themselves or from the mortar through the walls. If the water is permitted to come to the surface, the salts may appear on the masonry surface as efflorescence (a whitish powder) upon evaporation. However, the salts can be potentially dangerous if they remain in the masonry and crystallize

to the masonry and to penetrate below the surface. But,

masonry because, although a water-repellent coating is

permeable to water vapor, liquid water cannot pass throug

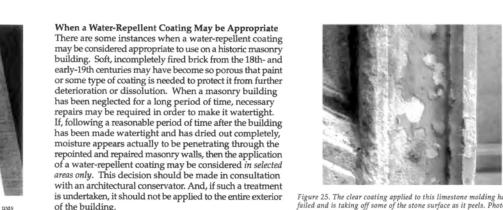
In the case of rising damp, a coating may force the

if it did adhere, it would hold the moisture inside the





beneath the surface as subflorescence. Subflorescence ventually may cause the surface of the masonry to spal particularly if a water-repellent coating has been applied which tends to reduce the flow of moisture out from the subsurface of the masonry. Although many of the new water-repellent products are more breathable than their predecessors, they can be especially damaging if applied masonry that contains salts, because they limit the flow of moisture through masonry.



Anti-graffiti or barrier coatings are another type of clear problem which it may help solve. If the problem oating—although barrier coatings can also be pigmentedthat may be applied to exterior masonry, but they are not occurs on only part of the building, it is best to treat only that area rather than an entire building. Extreme exposures ormulated primarily as water repellents. The purpose of hese coatings is to make it harder for graffiti to stick to such as parapets, for example, or portions of the building a masonry surface and, thus, easier to clean. But, like vater-repellent coatings, in most cases the application of anti-graffiti coatings is generally not recommended for historic masonry buildings. These coatings are often quite shiny which can greatly alter the appearance of a historic masonry surface, and they are not always effective (Fig 26). Generally, other ways of discouraging graffiti, such s improved lighting, can be more effective than a coating However, the application of anti-graffiti coatings may be appropriate in some instances on vulnerable areas of oric masonry buildings which are frequent targets o graffiti that are located in out-of-the-way places where onstant surveillance is not possible.

Some water-repellent coatings are recommended by oduct manufacturers as a means of keeping dirt and ollutants or biological growth from collecting on the surface of masonry buildings and, thus, reducing the need for frequent cleaning. While this at times may be true, in some cases a coating may actually retain dirt more than uncoated masonry. Generally, the application of a waterrepellent coating is not recommended on a historic masonry ouilding as a means of preventing biological growth. ome water-repellent coatings may actually encourage biological growth on a masonry wall. Biological growth on masonry buildings has traditionally been kept at bay rough regularly-scheduled cleaning as part of a maintenance plan. Simple cleaning of the masonry with low-pressure water using a natural- or synthetic-bristled scrub brush can be very effective if done on a regular basis. Commercial products are also available which can be sprayed on masonry to remove biological growth.

In most instances, a water-repellent coating is not necessary if a building is watertight. The application of for historic masonry buildings unless there is a specific



ed and is taking off some of the stone surface as it peels. Photo:

subject to driving rain can be treated more effectively an less expensively than the entire building. Water-repellent coatings are not permanent and must be reapplied built-up water pressure (Fig. 27).

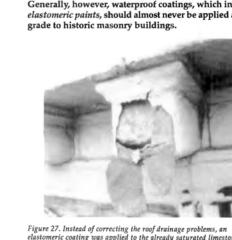


Figure 26. The anti-graffiti or barrier coating on this column is very reveal areas of bare concrete where the coating was incompletely

periodically although, if they are truly invisible, it can be Summary difficult to know when they are no longer providing the

intended protection. Testing a water-repellent coating by applying it in one small area may not be helpful in determining its suitability for the building because a limited test area does not allow an adequate evaluation of such a treatment. Since water nay enter and leave through the surrounding untreated areas, there is no way to tell if the coated test area is breathable." But trying a coating in a small area may help to determine whether the coating is visible on the surface or if it will otherwise change the appearance of the masonry. Waterproof Coatings

damage because the water will not be able to escape. During cold weather this water in the wall can freez causing serious mechanical disruption, such as spalling In addition, the water eventually will get out by the path of least resistance. If this path is toward the interior, damage to interior finishes can result; if it is toward the exterior, it can lead to damage to the masonry caused by

masonry. If water does enter the wall from the ground or

from the inside of a building, the coating can intensify the

In theory, waterproof coatings usually do not caus

problems as long as they exclude all water from the

In most instances, waterproof coatings should not be applied to historic masonry. The possible exception to is might be the application of a waterproof coating to below-grade exterior foundation walls as a last resort to stop water infiltration on interior basement walls. Generally, however, waterproof coatings, which include elastomeric paints, should almost never be applied above

lastomeric coating was applied to the already saturated limeston cornice. An elastomeric coating holds moisture in the masonry became t does not "breathe" and does not allow liquid moisture to escape. I the water pressure builds up sufficiently it can cause the coating break and pop off as shown in this example, often nulling pieces of masonry with it. Photo: National Park Service Files

A well-planned cleaning project is an essential step in preserving, rehabilitating or restoring a historic masonry building. Proper cleaning methods and coating treatments, when determined necessary for the preservation of the masonry, can enhance the aesthetic character as well as the structural stability of a historic building. Removing years of accumulated dirt, pollutant crusts, stains, graffiti or paint, if done with appropriate caution, can extend the life and longevity of the historic resource. Cleaning that is carelessly or insensitively prescribed or carried out by sperienced workers can have the opposite of the intended effect. It may scar the masonry permanently, and may actually result in hastening deterioration by introducing harmful residual chemicals and salts into the masonry of causing surface loss. Using the wrong cleaning method or using the right method incorrectly, applying the wrong kind of coating or applying a coating that is not needed can result in serious damage, both physically and aesthetically, to a historic masonry building. Cleaning a historic masonry building should always be done using the gentlest means possible that will clean, but not damage the building. It should always be taken into consideration before applying a water-repellent coating or a waterproof

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coating to a historic masonry building whether it is reall

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Technical Preservation Services Branch, Heritage Preservat es Program, National Park Service, Washington, D.C. Kay D. Weeks, Heritage Preservation Services Program, Nat Park Service, Washington, D.C. This publication has been prepared pursuant to the Natio Historic Preservation Act of 1966, as amended, which directs Secretary of the Interior to develop and make available inform oncerning historic properties. Comments on the usefulnes s publication may be directed to: Sharon C. Park, FAIA, C chnical Preservation Services Branch, Heritage Prese

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BRICK WORK REPAIR AND CLEANING AS NEEDED ON EXISTING PILLARS AND GATES. Brickwork repair in a historic masonry renovation has the following Key Preservation Principles

 Understanding Historic Fabric Renovation projects often involve alterations, making it paramount to understand the original materials and construction techniques. The NPS stresses the importance of thorough documentation and analysis.

This knowledge informs repair decisions, ensuring compatibility and preserving the building's historic integrity. Prioritizing Repair Over Replacement: Replacement should only be considered as a last resort. This philosophy minimizes the loss of original materials and craftsmanship.

 Material Compatibility: A critical aspect of historic masonry repair is using materials that are compatible with the original brick and mortar. The NPS emphasizes that using mortar that is too strong can damage historic brick. Therefore, careful selection of mortar that matches the original in composition and strength is very important.

Proper Repair Techniques:

Repointing: Careful removal of deteriorated mortar and proper application of new, compatible mortar. Brick replacement: When replacement is necessary, matching the original brick in size, color, texture, and composition.

Lime, itself, when mixed with water into a paste is very plastic and creamy. It will remain workable and soft indefinitely, if stored in a sealed container. Lime calcium hydroxide) hardens by carbonation absorbi carbon dioxide primarily from the air, converting itself to calcium carbonate. Once a lime and sand mortar is mixed and placed in a wall, it begins the process of carbonation. If lime mortar is left to dry too rapidly, carbonation of the mortar will be reduced, resulting in poor adhesion and poor durability. In addition, lime mortar is slightly water soluble and thus is able to re-seal any hairline cracks that may develop during the life of he mortar. Lime mortar is soft, porous, and changes little in volume during temperature fluctuations, the making it a good choice for historic buildings. Because of qualities, high calcium lime mortar may be considered for many repointing projects, not just those involving

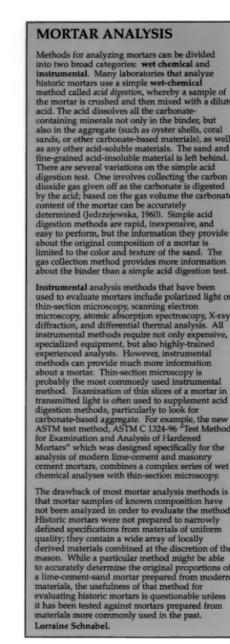
or repointing, lime should conform to ASTM C 207, Type S, or Type SA, Hydrated Lime for Masonry assure high plasticity and water retention. The use of quicklime which must be slaked and soaked by hand restoration projects if time and money allow.

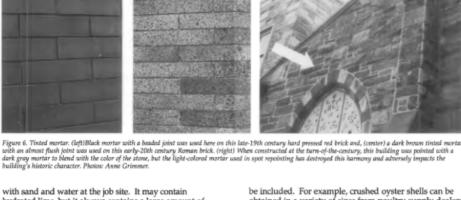
Lime putty. Lime putty is slaked lime that has a putty of aste-like consistency. It should conform to ASTM C ! Mortar can be mixed using lime putty according to ASTM C 270 property or proportion specification. Portland cement. More recent, 20th-century mortar has used portland cement as a primary binding material. straight portland cement and sand mortar is extremely movements. When mixed with water, portland cemen

forms a harsh, stiff paste that is quite unworkable, becoming hard very quickly. (Unlike lime, portland rement will harden regardless of weather conditions and does not require wetting and drying cycles.) Some portland cement assists the workability and plasticity of he mortar without adversely affecting the finished project; it also provides early strength to the mortar and speeds setting. Thus, it may be appropriate to add some ortland cement to an essentially lime-based mortar when repointing relatively soft 18th or 19th centur orick under some circumstances when a slightly harder mortar is required. The more portland cement that is and the faster the initial set. or repointing, portland cement should conform to ASTM

White, non-staining portland cement may provide a better color match for some historic mortars than the should not be assumed, however, that white portland ement is always appropriate for all historic building ince the original mortar may have been mixed with gre cement. The cement should not have more than 0.60 per cent alkali to help avoid efflorescence

Masonry cement. Masonry cement is a preblended mortar mix commonly found at hardware and home repair stores. It is designed to produce mortars with a compressive strength of 750 psi or higher when mixed





th an almost flush joint was used on this early-20th century Roman brick. (right) When constructed at the turn-of-the-century, this building was pointed with ris gray mortar to blend with the color of the stone, but the light-colored mortar used in spot repointing has destroyed this harmony and adversely impacts the liding's historic character. Photos: Anne Grimmer. be included. For example, crushed oyster shells can be obtained in a variety of sizes from poultry supply dealers. ydrated lime, but it always contains a large amount of ortland cement, as well as ground limestone and other Pigments. Some historic mortars, particularly in the late vorkability agents, including air-entraining agents. lecause masonry cements are not required to contain century, were tinted to match or contrast with the orick or stone (Fig. 6). Red pigments, sometimes in the ydrated lime, and generally do not contain lime, they form of brick dust, as well as brown, and black pigments roduce high strength mortars that can damage histori rere commonly used. Modern pigments are available which can be added to the mortar at the job site, but they isomry. For this reason, they generally are not recommen for use on historic masonry buildings. should not exceed 10 per cent by weight of the portland cement in the mix, and carbon black should be limited to

2 per cent. Only synthetic mineral oxides, which are

alkali-proof and sun-fast, should be used to prevent

Modern components. Admixtures are used to create

Air-entraining agents, for example, help the mortar to

ccelerators are used to reduce mortar freezing prior

cations, not something routinely added by the masons.

nasonry projects. The use of antifreeze compounds is

not recommended. They are not very effective with high

rescence later. A better practice is to warm the sand

lime mortars and may introduce salts, which may cause

reezing. No definitive study has determined whether

action and enhance plasticity, but in areas of extreme

osure requiring high-strength mortars with lower meability, air-entrainment of 10-16 percent may be

Mortar Type and Mix). Bonding agents are not a substitute for proper joint preparation, and they should

generally be avoided. If the joint is properly prepared

there will be a good bond between the new mortar and the adjacent surfaces. In addition, a bonding agent is

difficult to remove if smeared on a masonry surface (Fig. 7)

esirable (see formula for "severe weather exposure" in

Generally, modern chemical additives are unnecessary

and may, in fact, have detrimental effects in historic

and water, and to protect the completed work from

setting while retarders help to extend the mortar life in hot

climates. Selection of admixtures should be made by the architect or architectural conservator as part of the specifi-

pecific characteristics in mortar, and whether they hould be used will depend upon the individual projec

Lime mortar (pre-blended). Hydrated lime mortars, and pre-blended lime putty mortars with or without a matched sand are commercially available. Custom pre-blended lime mortars containing sand may not provide an exact match; however, if the project calls for total repointing, a pre-blended lime mortar may be wor onsidering as long as the mortar is compatible in strengtl vith the masonry. If the project involves only selected pot" repointing, then it may be better to carry out a mortar analysis which can provide a custom pre-blende lime mortar with a matching sand. In either case, if a preblended lime mortar is to be used, it should contain type S or SA hydrated lime conforming to ASTM C 20 Water. Water should be potable-clean and free from acids, alkalis, or other dissolved organic materials.

Other Components Historic components. In addition to the color of the and, the texture of the mortar is of critical importance luplicating historic mortar. Most mortars dating from ne mid-19th century on—with some exceptions—have a airly homogeneous texture and color. Some earlier nortars are not as uniformly textured and may contain imps of partially burned lime or "dirty lime", shell which often provided a source of lime, particularly is coastal areas), natural cements, pieces of clay, lampblac other pigments, or even animal hair. The visual acteristics of these mortars can be duplicated through the Replicating such unique or individual mortars will

use of similar materials in the repointing mortar. equire writing new specifications for each project. If possible, suggested sources for special materials shou

→ PRESERVATION

Repointing Mortar Joints in Historic Masonry Buildings

John P. Speweik

Robert C. Mack, FAIA



Mortar Type and Mix

Mortars for repointing projects, especially those involving

historic buildings, typically are custom mixed in order to

durability. The actual specification of a particular mortar type should take into consideration all of the factors

ions, present condition of the masonry, function

affecting the life of the building including: current site

of the new mortar, degree of weather exposure, and skill

actly the same. Modern materials specified for use in

epointing mortar should conform to specifications of

the American Society for Testing and Materials (ASTM) or comparable federal specifications, and the resulting

Specifying the proportions for the repointing mortar for

specific job is not as difficult as it might seem. Five

mix, have been established by ASTM to distinguish hig

designated them in decreasing order of approximate

portland cement, although it is seldom used today

the desired physical properties. Unless specified

otherwise, measurements or proportions for mortar mixes are always given in the following order: ceme

strength mortar from soft flexible mortars. The ASTM

ne letters identifying the types are from the words

MASON WORK using every other letter.) Type K has he highest lime content of the mixes that contain

designation "L" in the accompanying chart identifies a

straight lime and sand mix. Specifying the appropriate

lime-sand. Thus, a Type K mix, for example, would be

referred to as 1-3-10, or 1 part cement to 3 parts lime to

visual qualities should be included in the specifications.

neral strength as Type M (2,500 psi), Type S (1,800 psi) pe N (750 psi), Type O (350 psi) and Type K (75 psi).

of the mason. Thus, no two repointing projects are

mortar should conform to ASTM C 270. Mortar for

nortar types, each with a corresponding recom

ensure the proper physical and visual qualities. These materials can be combined in varying proportions to

create a mortar with the desired performance and

Masonry — brick, stone, terra-cotta, and concrete block s found on nearly every historic building. Structures with all-masonry exteriors come to mind immediately foundations or chimneys. Although generally considere permanent," masonry is subject to deterioration. cially at the mortar joints. Repointing, also know simply as "pointing" or—somewhat inaccurately—"tuck inting"*, is the process of removing deteriorated mo from the joints of a masonry wall and replacing it with new mortar (Fig. 1). Properly done, repointing restores the visual and physical integrity of the masonry. Improperly done, repointing not only detracts from the pearance of the building, but may also cause physical image to the masonry units themselves. he purpose of this Brief is to provide general guidance n appropriate materials and methods for repointing

ric masonry buildings and it is intended to b building owners, architects, and contractors. The Brief should serve as a guide to prepare specifications for repointing historic masonry buildings. It should also help develop sensitivity to the particular needs of histori asonry, and to assist historic building owners in orking cooperatively with architects, architectural conservators and historic preservation consultants, and ntractors. Although specifically intended for historic Ildings, the guidance is appropriate for other mason Ildings as well. This publication updates Preservation Briefs 2: Renointing Mortar Joints in Historic Brick Building to include all types of historic unit masonry. The scope the earlier Brief has also been expanded to acknowledge that the many buildings constructed in the first half of the century are now historic and eligible for listing in the National Register of Historic Places, and that they may have been originally constructed with portland

of a raised mortar joint or lime putty joint on top of flush mortar joint

The strength of a mortar can vary. If mixed with higher

amounts of portland cement, a harder mortar is obtained. The more lime that is added, the softer and

workability. A mortar strong in compressive strength might be desirable for a hard stone (such as granite) pier

wall of soft brick. Masonry deterioration caused by sal

leposition results when the mortar is less permeable that

e masonry unit. A strong mortar is still more permeable

than hard dense stone. However, in a wall constructed of

oft bricks where the masonry unit itself has a relatively

high permeability or vapor transmission rate, a soft, high

lime mortar is necessary to retain sufficient permeability

Repointing is both expensive and time consuming due to

e extent of handwork and special materials required

It is preferable to repoint only those areas that require

But, if 25 to 50 per cent or more of a wall needs to b

rk rather than an entire wall, as is often specifi

repointed, repointing the entire wall may be more co-

be more sensible when access is difficult, requiring the

adgement based on a variety of factors. Recognizing

In scheduling, seasonal aspects need to be consider

and 95 degrees F (8 and 38 degrees C) will prevent

mortar. Ideally, repointing should be done in shade

process, especially during hot weather. If necessary

appropriate modifications to scaffolding.

shade can be provided for large-scale projects with

freezing or excessive evaporation of the water in the

s at the outset will help to prevent many jobs from

first. Generally speaking, wall temperatures between 40

way from strong sunlight in order to slow the drying

The relationship of repointing to other work proposed

he building must also be recognized. For example, it

repointing, it is generally better to postpone repointing

paint removal or cleaning is anticipated, and if the

in the foreseeable future). Each project requires

erection of expensive scaffolding (unless the majority

he mortar is sound and unlikely to require replacemen

Budgeting and Scheduling

becoming prohibitively expensive

ime mortar would be preferable for a historic

more plastic the mortar becomes, increasing its

holding up a bridge deck, whereas a softer, more

1 2

Historical Background

Mortar consisting primarily of lime and sand has been used as an integral part of masonry structures for ousands of years. Up until about the mid-19th century, me or quicklime (sometimes called lump lime) was elivered to construction sites, where it had to be slaked, or combined with water. Mixing with water caused it to boil and resulted in a wet lime putty that was left to mature in a pit or wooden box for several weeks, up to a ear. Traditional mortar was made from lime putty, or ked lime, combined with local sand, generally in a atio of 1 part lime putty to 3 parts sand by volume Often other ingredients, such as crushed marine shells nother source of lime), brick dust, clay, natural ments, pigments, and even animal hair were also added to mortar, but the basic formulation for lime putty the advent of portland cement or its forerunner, Roman cement, a natural, hydraulic cement.

Portland cement was patented in Great Britain in 1824 It was named after the stone from Portland in Dorset which it resembled when hard. This is a fast-curing, hydraulic cement which hardens under water. Portland ment was first manufactured in the United States in 1872, although it was imported before this date. But it was not in common use throughout the country until the early 20th century. Up until the turn of the century r "minor ingredient" to help accelerate mortar set time. By the 1930s, however, most masons used a mix of equa parts portland cement and lime putty. Thus, the mortal ound in masonry structures built between 1873 and 1930 in range from pure lime and sand mixes to a wide variety of lime, portland cement, and sand combination In the 1930s more new mortar products intended to hasten and simplify masons' work were introduced in the U.S. These included masonry cement, a premixed, pagged mortar which is a combination of portland ment and ground limestone, and hydrated lime machine-slaked lime that eliminated the necessity of slaking quicklime into putty at the site.

Identifying the Problem Before Repointing The decision to repoint is most often related to some mortar, cracks in mortar joints, loose bricks or stone damp walls, or damaged plasterwork. It is, however deficiencies that result from other problems (Fig. 2). The root cause of the deterioration—leaking roofs or gutters lifferential settlement of the building, capillary action causing rising damp, or extreme weather exposure hould always be dealt with prior to beginning work.

Without appropriate repairs to eliminate the source of the problem, mortar deterioration will continue and any epointing will have been a waste of time and money. Use of Consultants. Because there are so many possible auses for deterioration in historic buildings, it may be lesirable to retain a consultant, such as a historic architect or architectural conservator, to analyze the uilding. In addition to determining the most appropriate solutions to the problems, a consultant can

Mortar not cleaned out to

Mortar cleaned out to a

Figure 9. Comparison of incorrect and correct preparation of mortar joints for repointing. Drawing: Robert C. Mack, FAIA, and David W. Look, AIA.

until after completion of these activities. However, if the

mortar has eroded badly, allowing moisture to penetrate

epairs, should be scheduled so that they do not interfe

with repointing and so that all work can take maximum advantage of erected scaffolding.

Building managers also must recognize the difficulties

that a repointing project can create. The process is time

consuming, and scaffolding may need to remain in place

quantities of dust which must be controlled, especially a

air intakes to protect human health, and also where it

might damage operating machinery. Entrances may be

blocked from time to time making access difficult for

both building tenants and visitors. Clearly, building

managers will need to coordinate the repointing wor

The ideal way to select a contractor is to ask knowledge

able owners of recently repointed historic buildings for

provide lists of other repointing projects for inspection

project is selected through a competitive bidding proc

control. In this situation it is important to ensure that

the specifications stipulate that masons must have a

historic masonry buildings to be eligible to bid on the

project. Contracts are awarded to the lowest responsib

minimum of five years' experience with repointing

More commonly, however, the contractor for a repointing

recommendations. Qualified contractors then can

with other events at the site.

for an extended period of time. The joint preparation

process can be quite noisy and can generate large

deeply into the wall, repointing should be accomplished

uniform depth-about 1" dee

damaged edges of brick.

idges of brick damaged by tool



Figure 2. Much of the mortar on this building has been leached away by vater from a leaking downspout. The downspout must be replaced and any ther drainage problems repaired before repointing. Photo: Robert C. Mack

prepare specifications which reflect the particular require ts of each job and can provide oversight of the work in progress. Referrals to preservation consultants ently can be obtained from State Historic Conservation of Historic and Artistic Works (AIC), the Association for Preservation Technology (APT), and local hapters of the American Institute of Architects (AIA).

Finding an Appropriate Mortar Match

Preliminary research is necessary to ensure that the proposed repointing work is both physically and visually appropriate to the building. Analysis of unweathered portions of the historic mortar to which the new mortar will be matched can suggest appropriate mixes for the pointing mortar so that it will not damage the building ecause it is excessively strong or vapor impermeable Examination and analysis of the masonry units-brick. stone or terra cotta—and the techniques used in the original onstruction will assist in maintaining the building's historic appearance (Figs. 3-4). A simple, non-technical evaluation of the masonry units and mortar can provide permeability of each-critical factors in selecting the

repointing mortar—while a visual analysis of the historic mortar can provide the information necessary for

developing the new mortar mix and application techniques

bidder, and bidders who have performed poorly on other

The contract documents should call for unit prices as well

determine in advance what the cost addition or reduction

will be for work which varies from the scope of the base bid. If, for example, the contractor has fifty linear feet

as a base bid. Unit pricing forces the contractor to

less of stone repointing than indicated on the contract documents but thirty linear feet more of brick repoint

it will be easy to determine the final price for the work

ne unit price also should reflect quantities; one linear

Test Panels. These panels are prepared by the contractor

preferably not on the front or other highly visible location

of the building—may be necessary to include all types of masonry, joint styles, mortar colors, and other problems

likely to be encountered on the job. If cleaning tests, for

Figure 10. Using a hammer and masonry chisel is the least damaging and,

hus, generally the preferred method of removing old mortar in preparation or repointing historic masonry. Photo: John P. Speweik.

using the same techniques that will be used on the

emainder of the project. Several panel locations-

Note that each type of work-brick repointing, stone

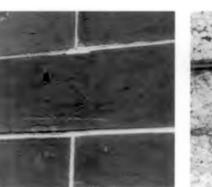
foot of pointing in five different spots will be more

expensive than five contiguous linear feet.

Execution of the Work

his basis, even if they have the lowest prices.

Although not crucial to a successful repointing project, for projects involving properties of special historic significance a mortar analysis by a qualified laboratory can be useful by providing information on the original ingredients. lowever, there are limitations with such an analysis, and replacement mortar specifications should not be based solely on laboratory analysis. Analysis requires interpretation, and there are important factors which affect he condition and performance of the mortar that cannot be established through laboratory analysis. These may include: the original water content, rate of curing, weath ditions during original construction, the method of mixing and placing the mortar, and the cleanliness and condition of the sand. The most useful information that car come out of laboratory analysis is the identification of sand by



The new mortar must have greater vapor permeabil

nasonry units.

retain high permeability.)

Properties of Mortar

and be softer (measured in compressive strength) than the

The new mortar must be as vapor permeable and as soft

or softer (measured in compressive strength) than the historic mortar. (Softness or hardness is not necessarily ar

Mortars for repointing should be softer or more

permeable than the masonry units and no harder or

lamage to the masonry units. It is a common error to

assume that hardness or high strength is a measure of appropriateness, particularly for lime-based historic

ontraction, moisture migration, or settlement must be

Figure 12.. A power grinder, operated correctly by a skilled mason may be

Under certain circumstances, thin diamond-bladed

tools most successfully remove old mortar without

damaging the masonry units when they are used in

repointing. Where horizontal joints are uniform and

fairly wide, it may be possible to use a power mason

tion with hand tools in preparation fo

w to assist the removal of mortar, such as by cutting

along the middle of the joint; final mortar removal fro

the sides of the joints still should be done with a hand

blades can sometimes be used successfully to cut ou

speeds, thus minimizing the possibility of damage to

joints without damaging the masonry. Caulking cutters are slow; they do not rotate, but vibrate at very high

masorry units (Fig. 13). Although mechanical tools make used safely in limited circumstances to cut out

orizontal joints in preparation for repointing, they

should never be used on vertical joints because of the

mortar without damaging the surrounding masonry

units also necessitates highly skilled masons experience

n working on historic masonry buildings. Confractors

danger of slipping and cutting into the brick above or

grinders may be used to cut out horizontal joints only o

hard portland cement mortar common to most early-20th

entury masonry buildings (Fig. 12). Usually, automatic

mortars. Stresses within a wall caused by expansion

ndication of permeability; old, hard lime mortars can still

radation and color. This allows the color and the texture of the mortar to be matched with some accuracy because sand is the largest ingredient by volume. In creating a repointing mortar that is compatible with the nasonry units, the objective is to achieve one that matches the historic mortar as closely as possible, so that the new material can coexist with the old in a sympathetic supportive and, if necessary, sacrificial capacity. The exact physical and chemical properties of the historic mortar are not of major significance as long as the new mortar conforms to the following criteria:

 The new mortar must match the historic mortar in color. texture and tooling. (If a laboratory analysis is under it may be possible to match the binder components and their proportions with the historic mortar, if those materials The sand must match the sand in the historic morta

Figure 11. The damage to the edges and corners of these historic bricks was

example, are also to be undertaken, they should be

carried out in the same location. Usually a 3 foot by

foot area is sufficient for brickwork, while a somewhat

establish an acceptable standard of work and serve as a

minimum depth of 2 to 2-1/2 times the width of the joint

ire removal of the mortar to a depth of approximat

ar may need to be removed to a depth of several

benchmark for evaluating and accepting subsequent

Ioint Preparation. Old mortar should be removed to

v 1/2 to 1 inch; for stone masonry with wide joints.

inches. Any loose or disintegrated mortar beyond this

Although some damage may be inevitable, careful joint

traditional manner of removing old mortar is ugh the use of hand chisels and mash hammers

(Fig. 10). Though labor-intensive, in most instances this

nowever, is through the use of power saws or grinders.

rous for historic masonry, particularly soft brick

st brick walls, almost always will result in damage to

preparation can help limit damage to masonry units

nethod poses the least threat for damage to historic

masonry units and produces the best final product

The use of power tools by unskilled masons can be

Using power saws on walls with thin joints, such as

The most common method of removing mortar,

he masonry units by breaking the edges and b

overcutting on the head, or vertical joints (Fig. 11

However, small pneumatically-powered chisels

generally can be used safely and effectively to remove

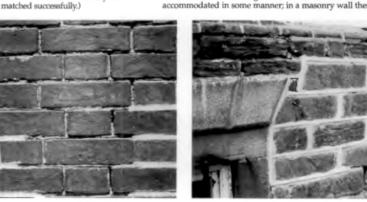
mortar on historic buildings as long as the masons

maintain appropriate control over the equipment.

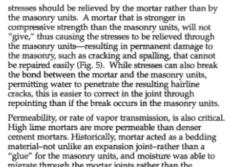
to ensure an adequate bond and to prevent morta pouts" (Fig. 8). For most brick joints, this will

minimum depth also should be removed (Fig. 9).

The color and texture of the new mortar will usually fall into place if the sand is matched successfully.



tone foundation. Photos: Lee H. Nelson, FAIA.



material-not unlike an expansion joint-rather than a "glue" for the masonry units, and moisture was able to migrate through the mortar joints rather than the masonry units. When moisture evaporates from the masonry it deposits any soluble salts either on the surface as efflorescence or below the surface as subflorescence. While salts deposited on the surface of masonry units are usually relatively harmless, salt crystallization within masonry unit creates pressure that can cause parts of the outer surface to spall off or delaminate. If the mortar does not permit moisture or moisture vapor to migrate out of the wall and evaporate, the result will be damage to the

Components of Mortar Sand. Sand is the largest component of mortar and the material that gives mortar its distinctive color, texture and cohesiveness. Sand must be free of impurities, such as salts or clay. The three key characteristics of sand are: particle shape, gradation and void ratios.



microscope, particles of sand generally have either rounded edges, such as found in beach and river sand, or sharp, angular edges, found in crushed o manufactured sand. For repointing mortar, rounded natural sand is preferred for two reasons. It is usuall similar to the sand in the historic mortar and provide better visual match. It also has better working quali r plasticity and can thus be forced into the joint mor easily, forming a good contact with the remaining historic mortar and the surface of the adjacent m readily available, it is usually possible to locate a suppl The gradation of the sand (particle size distribution) plays a very important role in the durability and cohesive properties of a mortar. Mortar must have a

When viewed under a magnifying glass or low-pow

certain percentage of large to small particle sizes in or to deliver the optimum performance. Acceptable guidelines on particle size distribution may be found i ASTM C 144 (American Society for Testing and Materials). However, in actuality, since neither hist nor modern sands are always in compliance with AS'

C 144, matching the same particle appearance and gradation usually requires sieving the sand. A scoop of sand contains many small voids between individual grains. A mortar that performs well fills a these small voids with binder (cement/lime combin or mix) in a balanced manner. Well-graded sand generally has a 30 per cent void ratio by volume. The 30 per cent binder by volume generally should be use unless the historic mortar had a different binder: aggregate ratio. This represents the 1:3 binder to sand

ios often seen in mortar specifications For repointing, sand generally should conform to AS' C 144 to assure proper gradation and freedom from impurities; some variation may be necessary to match the original size and gradation. Sand color and textur lso should match the original as closely as possible provide the proper color match without other additive Lime. Mortar formulations prior to the late-19th centu used lime as the primary binding material. Lime is derived from heating limestone at high temperature which burns off the carbon dioxide, and turns the limestone into quicklime. There are three types of limestone—calcium, magnesium, and dolomitic— differentiated by the different levels of magnesium carbonate they contain which impart specific qualities nortar. Historically, calcium lime was used for mortarather than the dolomitic lime (calcium magnesium carbonate) most often used today. But it is also important to keep in mind the fact that the historic li nd other components of mortar, varied a great deal because they were natural, as opposed to modern lin which is manufactured and, therefore, standardized

Because some of the kinds of lime, as well as other components of mortar, that were used historically an onger readily available, even when a conscious effort i Figure 5. The use of hard, portland-cement mortar that is less permeable than he soft bricks has resulted in severe damage to this brick wall. Moistur trapped in the wall was unable to evaporate through the mortar which achievable due to the differences between modern an intended to be sacrificial, and thus protect the bricks. As a result the moists

to keep the water to a minimum for two reasons: first drier mortar is cleaner to work with, and it can be compacted tightly into the joints; second, with no exce water to evaporate, the mortar cures without shrinkag cracks. Mortar should be used within approximately minutes of final mixing, and "retempering," or adding more water, should not be permitted. Using Lime Putty to Make Mortar. Mortar made with lime putty and sand, sometimes referred to as roughage or course stuff, should be measured by volume, and ma require slightly different proportions from those used with hydrated lime (Fig. 14). No additional water is usually needed to achieve a workable consistency because enough water is already contained in the putt Sand is proportioned first, followed by the lime putty, then mixed for five minutes or until all the sand is noroughly coated with the lime putty. But mixing, in the amiliar sense of turning over with a hoe, sometimes r

their use is approved. Using any of these power tools may also be more acceptable on hard stone, such as quartzite or granite. than on terra cotta with its glass-like glaze, or on soft brick or stone. The test panel should determine the acceptability of power tools. If power tools are to be permitted, the contractor should establish a quality

control program to account for worker fatigue and Mortar should be removed cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp, but with no standing water present. For masonry walls—limestone, sandstone and common brick-that are extremely

absorbent, it is recommended that a continual mist of water be applied for a few hours before repointing begins Mortar Preparation. Mortar components should be measured and mixed carefully to assure the uniformity of visual and physical characteristics. Dry ingredients the addition of any water. Sand must be added in a damp, loose condition to avoid over sanding. Repointing mortar is typically pre-hydrated by adding water so it will just hold together, thus allowing it to stand for a period of time before the final water is added. Half the water should be added, followed by mixing for approximately 5 minutes. The remaining vater should then be added in small portions unt mortar of the desired consistency is reached. The total volume of water necessary may vary from batch to batch, depending on weather conditions. It is important

maintenance will help preserve the freshly repointed

inting some time in the future. Nevertheless, if the

istoric mortar joints proved durable for many years, then

Ashurst, John & Nicola. Practical Building Conservation. Vol. 3

Cliver, E. Blaine, "Tests for the Analysis of Mortar Samples

Coney, William B., AIA. Mosonry Repointing of Twentieth-Century Buildings. Illinois Preservation Series. Number 10. Springfield, IL: Division of Preservation Services, Illinois

Davidson, J.J. "Masonry Mortar." Canadian Building Diges

Mortars, Plasters and Renders. New York: Halsted Press, a Division of John Wiley & Sons, Inc., 1988.

careful repointing should have an equally long life, ultimately

are intended to be sacrificial and will probably require

Conclusion

Selected Reading

No. 1 (1974), pp. 68-73.

Historic Preservation Agency, 1989.

se mixed together ahead of time and stored ind on or off site, which eliminates the need for piles of sand brown sugar, must be protected from the air in sealed s with a wet piece of burlap over the top o ealed in a large plastic bag to prevent evaporation a premature carbonation. The lime putty and sand mixt n be recombined into a workable plastic state months later with no additional water. If portland cement is specified in a lime putty and sand

cement should first be mixed into a slurry paste before adding it to the lime putty and sand. Not only will this throughout the mixture, but if dry portland cement is added to wet ingredients it tends to "ball up," jeopardiz ing dispersion. (Usually water must be added to the lim been added the mortar can no longer be stored.

Filling the Joint. Where existing mortar has been removed to a depth of greater than 1 inch, these deep areas should be filled first, compacting the new mortal several layers. The back of the entire joint should be filled successively by applying approximately 1/4 inch o mortar, packing it well into the back corners. This

Speweik, John P. The History of Masonry Mortar in Am

For larger repointing projects the lime putty and sand can

outty and sand anyway once the portland cement is stage and mixed for a full five minutes. The mortar hould be used within 30 minutes to 1 1/2 hours and it should not be retempered. Once portland cement has

not be sufficient if the best possible performance is to be

btained from a lime putty mortar. Although the old

nortar has largely been forgotten, recent field work has

confirmed that lime putty and sand rammed and beate with a wooden mallet or ax handle, interspersed by

workability and performance. The intensity of this acti increases the overall lime/sand contact and removes ar

surplus water by compacting the other ingredients. It

may also be advantageous for larger projects to use a mortar pan mill for mixing. Mortar pan mills which h

long tradition in Europe produce a superior lime putt

ortar not attainable with today's modern paddle and

ractice of chopping, beating and ramming the

chopping with a hoe, can significantly improve

drum type mixers.

Figure 16. Comparison of visual effect of full mortar joints vs. slightly recessed haracter of the original brickwork. Drawing: Robert C. Mack, FAIA Figure 15. The profile of the repointed joints on the left replicate the history

5 6

application may extend along the wall for several hardness, another 1/4 inch layer of mortar—approximatel the same thickness-may be applied. Several layers wi the masonry. It is important to allow each layer time to harden before the next layer is applied; most of the mortar shrinkage occurs during the hardening process and layering thus minimizes overall shrinkage When the final layer of mortar is thumb-print hard, t joint should be tooled to match the historic joint (Fig. 15 Proper timing of the tooling is important for uniform color and appearance. If tooled when too soft, the color

lime putty; (e) hand mixing mortar; and, (f) sample of mortar after mixing. Photos: John P. Speweik

will be lighter than expected, and hairline cracks may occur; if tooled when too hard, there may be dark streaks called "tool burning," and good closure of the mortar against the masonry units will not be achieved If the old bricks or stones have worn, rounded edges, i is best to recess the final mortar slightly from the face of he masonry. This treatment will help avoid a join which is visually wider than the actual joint; it also will damaged, thus admitting water (Fig. 16). After tooling, excess mortar can be removed from the edge of the brushing with a natural bristle or nylon brush. Metal bristle brushes should never be used on historic masonry.

Curing Conditions. The preliminary hardening of highme content mortars—those mortars that contain mor me by volume than portland cement, i.e., Type O (1:2: takes place fairly rapidly as water in the mix is lost to the porous surface of the masonry and through oration. A high lime mortar (especially Type "L" eft to dry out too rapidly can result in chalking, poor adhesion, and poor durability. Periodic wetting of th repointed area after the mortar joints are thumb-print hard and have been finish tooled may significantly misting using a hand sprayer with a fine nozzle can be simple to do for a day or two after repointing. Loca nitially it may be as often as every hour and gradual reduced to every three or four hours. Walls should be vered with burlap for the first three days after epointing. (Plastic may be used, but it should be tented keep the walls damp and protects them from direct unlight. Once carbonation of the lime has begun, it will continue for many years and the lime will gain strengt as it reverts back to calcium carbonate within the wall Aging the Mortar. Even with the best efforts at matching e existing mortar color, texture, and materials, there

ortioning lime putty; (c) placing lime putty on top of sand; (d) mixing sand over



new work, partly because the new mortar has been

matched to the unweathered portions of the histori nortar. Another reason for a slight mismatch may be at the sand is more exposed in old mortar due to the slight erosion of the lime or cement. Although spot inting is generally preferable and some color rence should be acceptable, if the difference betw old and new mortar is too extreme, it may be advisable n some instances to repoint an entire area of a wall, or ar entire feature such as a bay, to minimize the difference between the old and the new mortar. If the mortars have been properly matched, usually the best way to deal with surface color differences is to let the mortars age naturally. Other treatments to overcome these or staining the new mortar, should be carefully tested taining the new mortar to achieve a better color match

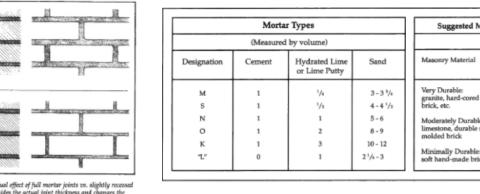
is generally not recommended, but it may be appropriate some instances. Although staining may provide an nitial match, the old and new mortars may weather at different rates, leading to visual differences after a few seasons. In addition, the mixtures used to stain the mortar may be harmful to the masonry; for example, they may ntroduce salts into the masonry which can lead to Cleaning the Repointed Masonry. If repointing work is

other than to remove the small amount of mortar from ne edge of the joint following tooling. This can be done with a stiff natural bristle or nylon brush after the nortar has dried, but before it is initially set (1-2 hours wooden paddle or, if necessary, a chisel. Further cleaning is best accomplished with plain water

and natural bristle or nylon brushes. If chemicals must

arefully executed, there will be little need for cleaning Figure 17. This photograph shows the significant visual change to the

ioints. Photo: Lee H. Nelson, FAIA



alternative to repointing brick buildings, in particular. This process involves the application of a thin coat of

mortar/brick interface. To be effective the grout mus

widening the joint visually. The change in the joint

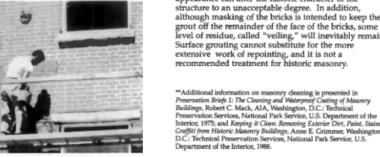
pearance can alter the historic character of the

tend slightly onto the face of the masonry units, thu

ement-based grout to the mortar joints and the

se used, they should be selected with extreme caution Improper cleaning can lead to deterioration of the and efflorescence. New mortar joints are especially susceptible to damage because they do not become fully acids, should never be used on dry masonry. The masonry should always be completely soaked once with water fore chemicals are applied. After cleaning, the wall should be flushed again with plain water to remove al

traces of the chemicals Several precautions should be taken if a freshly repointed nasonry wall is to be cleaned. First, the mortar shoul sufficient, depending on weather and exposure; as nentioned previously, the mortar will continue to cure prepared to evaluate the effects of different cleaning



Sheltered Moderate Severe

methods. Generally, on newly repointed masonry walls, only very low pressure (100 psi) water washing supple-mented by stiff natural bristle or nylon brushes should be For the Owner/Administrator. The owner or adminis used, except on glazed or polished surfaces, where only repointing is likely to be a lengthy and expensive process. First, there must be adequate time for New construction "bloom" or efflorescence occasionall appears within the first few months of repointing and cause of problems. Then, there will be time needed for usually disappears through the normal process of ration of the contract documents. The work itsel weathering. If the efflorescence is not removed by uming and noisy, and scaffolding ral processes, the safest way to remove it is by dry nay cover the face of the building for some time. brushing with stiff natural or nylon bristle brushes Therefore, the owner must carefully plan the work avoid problems. Schedules for both repointing ar followed by wet brushing. Hydrochloric (muriatic) acid generally ineffective, and it should not be used to other activities will thus require careful coordination move efflorescence. It may liberate additional salts avoid unanticipated conflicts. The owner must avoid which, in turn, can lead to more efflorescence historic building is to retain its visual integrity and the Surface Grouting is sometimes suggested as an

iob is to be durable. For the Architect/Consultant. Because the primary rol of the consultant is to ensure the life of the building. special problems found in older buildings is essentia he consultant must assist the owner in planning fo ical problems relating to research and con t is the consultant's responsibility to determine the cause of the mortar deterioration and ensure that it is corrected be prepared to spend more time in project inspections than is customary in modern construction. For the Masons. Successful repointing depends on the masons themselves. Experienced masons understand

special requirements for work on historic building

entire masonry crew must be willing and able to perform

the specifications may not be in conformance with standar

practice. At the same time, the masons should not hesital

o question the specifications if it appears that the work

specified would damage the building.

and the added time and expense they require. The

Visually Examining the Mortar and the Masonry Units

A simple in-situ comparison will help determine the rdness and condition of the mortar and the masonr units. Begin by scraping the mortar with a screwdrive and gradually tapping harder with a cold chisel and nason's hammer. Masonry units can be tested in the same way beginning, even more gently, by scraping with a fingernail. This relative analysis which is derived from the 10-point hardness scale used to describe minerals, provides a good starting point for selection of an ropriate mortar. It is described more fully in "The ferenced in Selected Reading at the end of this Brief.

Mortar samples should be chosen carefully, and picked nweathered mortar, if possible. Portions of the buildin nay have been repointed in the past while other areas ay be subject to conditions causing unusual deteriora-n. There may be several colors of mortar dating from ifferent construction periods or sand used from differen ources during the initial construction. Any of these ons can give false readings to the visual or physic racteristics required for the new mortar. Variations hould be noted which may require developing more Remove with a chisel and hammer three or four

inweathered samples of the mortar to be matched from several locations on the building. (Set the largest sample aside—this will be used later for comparison with the repointing mortar). Remov a full representation of samples will allow selection of "mean" or average mortar sample. Mash the remaining samples with a wooden mall

or hammer if necessary, until they are separated into eir constituent parts. There should be a good nandful of the material. Examine the powdered portion—the lime and/or cement matrix of the mortar. Most particularly, note the color. There is a tendency to think of historic mortars as having white binders, but grey portla rement was available by the last quarter of the 19th

grey. Thus, in some instances, the natural color of the historic binder may be grey, rather than white. The mortar may also have been tinted to create a colore ortar, and this color should be identified at this poir Carefully blow away the powdery material (the lime With a low power (10 power) magnifying glas examine the remaining sand and other materials such

Note and record the wide range of color as wel

as the varying sizes of the individual grains of sand, impurities, or other materials.

Color. Regardless of the color of the binder or colored

additives, the sand is the primary material that gives mortar

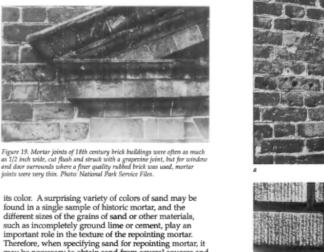
Other Factors to Consider

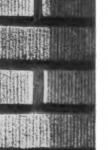
such as incompletely ground lime or cement, play an important role in the texture of the repointing mortar. Therefore, when specifying sand for repointing mortar, it may be necessary to obtain sand from several sources and to combine or screen them in order to approximate the range of sand colors and grain sizes in the historic mortar sample Pointing Style. Close examination of the historimasonry wall and the techniques used in the original construction will assist in maintaining the visual

es of the building (Fig. 18). Pointing styles and he methods of producing them should be examined. is important to look at both the horizontal and the ertical joints to determine the order in which they wen soled and whether they were the same style. Some te-19th and early-20th century buildings, for examp have horizontal joints that were raked back while the tical joints were finished flush and stained to match Pointing styles may also differ from one facade to another; front walls often received greater attention t tar detailing than side and rear walls (Fig. 19) fuckpointing is not true repointing but the

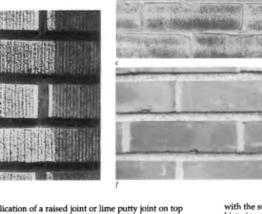
> range of colors, textures, and sizes, particularly with hand-made brick or rough-cut, locally-quarried stone. Replacement units should blend in with the full range of masonry units rather than a single brick or stone. Matching Color and Texture of the Repointing Mortar New mortar should match the unweathered interior check the match is to make a small sample of the







joint, often in a contrasting color.



of flush mortar joints (Fig. 20). Penciling is a purely Masonry Units. The masonry units should also be examined so that any replacement units will match th historic masonry. Within a wall there may be a wide

proposed mix and allow it to cure at a temperature o mately 70 degrees F for about a week, or it car e baked in an oven to speed up the curing; this sample is then broken open and the surface is compared with the final price based on the actual cost to the contractor



with the surface of the largest "saved" sample of If a proper color match cannot be achieved through th use of natural sand or colored aggregates like crush marble or brick dust, it may be necessary to use a modern mortar pigment. During the early stages of the project, it should be ermined how closely the new mortar should mate the historic mortar. Will "quite close" be sufficient, or i

learly so that the contractor has a reasonable idea hov nuch time and expense will be required to develop an The same judgment will be necessary in matching eplacement terra cotta, stone or brick. If there is a nown source for replacements, this should be include in the specifications. If a source cannot be determined prior to the bidding process, the specifications should include an estimated price for the replacement materials

A good repointing job is meant to last, at least 30 years, Speweik, John P. "Repointing Right: Why Using Moder and preferably 50-100 years. Shortcuts and poor Wortar Can Damage a Historic House." Old-Ho Vol. XXV, No. 4 (July-August 1997), pp. 46-51. raftsmanship result not only in diminishing the histori aracter of a building, but also in a job that looks ba al Notes on Brick Construction. Brick Institute of Americ and will require future repointing sooner than if the work had been done correctly (Fig. 17). The morta Moisture Resistance of Brick Masonry: Maintenance." joint in a historic masonry building has often been called a wall's "first line of defense." Good repoints: 'Mortars for Brick Masonry," 8 Revised II, November 1 tices guarantee the long life of the mortar joint, th or Brick Masonry," 8A Revised, September 1988.
"Mortar for Brick Masonry-Selection and Controls," 8B wall, and the historic structure. Although careful

eissued. September 1988. (July/August 1976). Guide Specifications for Brick Masonry, Part V Mortar a Grout."11E Revised. September 199: Bonds and Patterns in Brickwork." 30 Reissued. Useful Addresses Brick Institute of America 11490 Commerce Park Driv

Reston, VA 22091

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CBD 163. Ottawa, ONT: Division of Building Research National Research Council of Canada, 1974. Ferro, Maximillian L., AIA, RIBA. "The Russack System fo The authors and the editor wish to thank the following for the Hooker, Kenneth A. "Field Notes on Repointing Magazine of Masonry Construction. Vol. 4, No. 8 (August 1991), pp. 326-328. ickels-Tayes, Ph.D., Architectural Conservator, Biohistory tington Woods, MI; and the following National Park Serviol d staff, including: E. Blaine Cliver, Chief, Historic America lings Survey/Historic American Engineering Record: Dou

Jedrzejewska, H. "Old Mortars in Poland: A New Method of Investigation." Studies in Conservation. Vol. 5, No. 4 (1960), pp. 132-138. Lime's Role in Mortar." Aberdeen's Magazine of M Construction. Vol. 9, No. 8 (August 1996), pp. 364-368. Phillips, Morgan W. "Brief Notes on the Subjects of Analyzi Paints and Mortars and the Recording of Moulding Profiles The Trouble with Paint and Mortar Analysis." Bulletin of the Association for Preservation Technology. Vol. 10, No. 2 (1978), pp. 77-89.

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onal Park Service, 1849 C Street, N.W. Suite NC200, Washingto of Masonry Construction, Vol. 7, No. 9 (September 1994), pp. 419-422. Sickels-Taves, Lauren B. "Creep, Shrinkage, and Mortars in

National Park Service are appreciated.

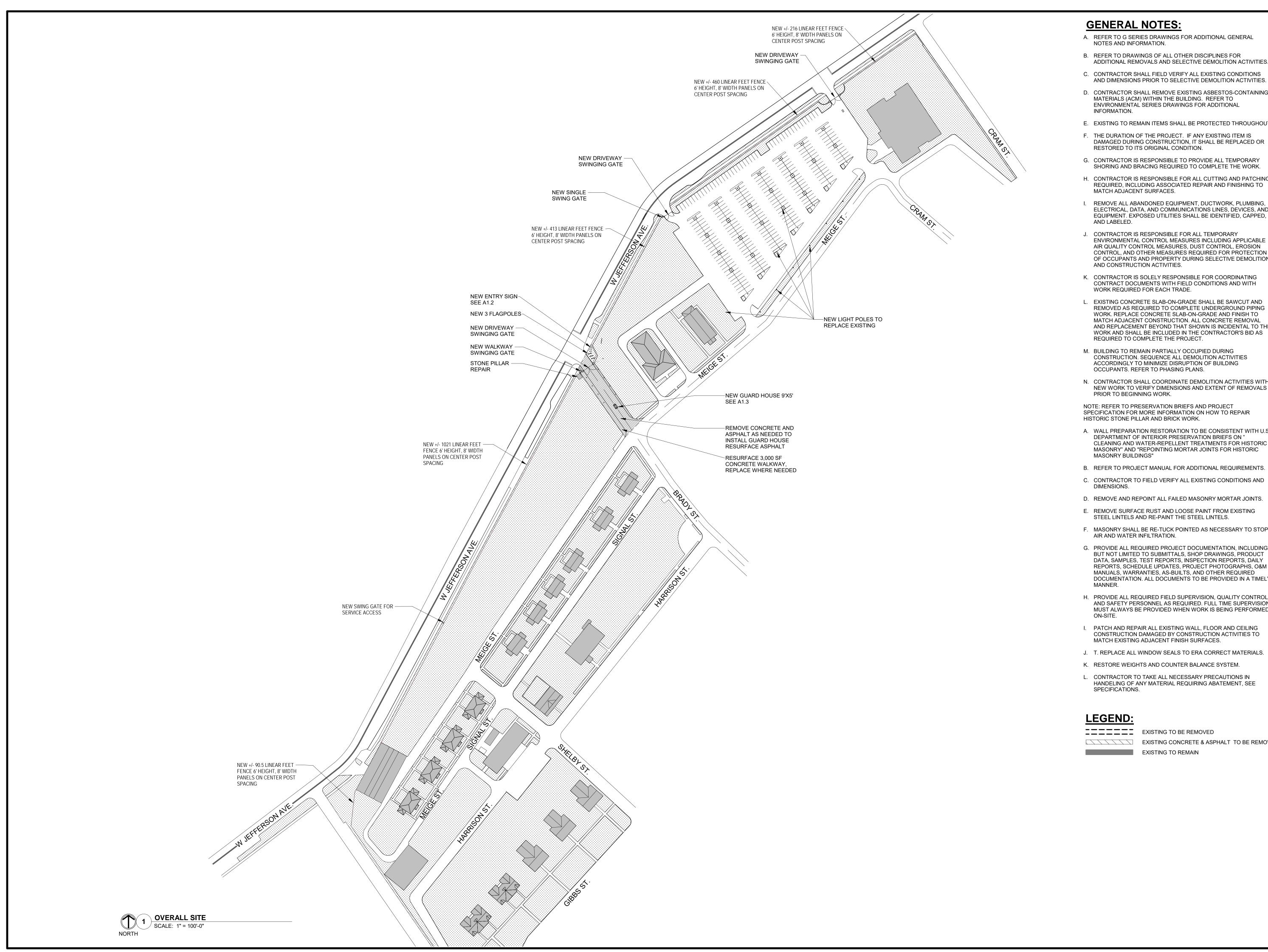
The original version of this brief, Resoluting Martar Joints in Histori

reservation Act of 1966, as amended, which directs the Secretary of

Traditional lime mortars have a consistency that enables the mortar to to a repointing tool while in a vertical position. Photo: John P. Speweik

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 $\mathbf{\Omega}$



GENERAL NOTES:

- A. REFER TO G SERIES DRAWINGS FOR ADDITIONAL GENERAL NOTES AND INFORMATION.
- B. REFER TO DRAWINGS OF ALL OTHER DISCIPLINES FOR
- ADDITIONAL REMOVALS AND SELECTIVE DEMOLITION ACTIVITIES. C. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS
- D. CONTRACTOR SHALL REMOVE EXISTING ASBESTOS-CONTAINING MATERIALS (ACM) WITHIN THE BUILDING. REFER TO ENVIRONMENTAL SERIES DRAWINGS FOR ADDITIONAL
- E. EXISTING TO REMAIN ITEMS SHALL BE PROTECTED THROUGHOUT.
- F. THE DURATION OF THE PROJECT. IF ANY EXISTING ITEM IS DAMAGED DURING CONSTRUCTION, IT SHALL BE REPLACED OR
- G. CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL TEMPORARY SHORING AND BRACING REQUIRED TO COMPLETE THE WORK.
- H. CONTRACTOR IS RESPONSIBLE FOR ALL CUTTING AND PATCHING REQUIRED, INCLUDING ASSOCIATED REPAIR AND FINISHING TO MATCH ADJACENT SURFACES.
- I. REMOVE ALL ABANDONED EQUIPMENT, DUCTWORK, PLUMBING, ELECTRICAL, DATA, AND COMMUNICATIONS LINES, DEVICES, AND EQUIPMENT. EXPOSED UTILITIES SHALL BE IDENTIFIED, CAPPED, AND LABELED.
- J. CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY ENVIRONMENTAL CONTROL MEASURES INCLUDING APPLICABLE AIR QUALITY CONTROL MEASURES, DUST CONTROL, EROSION CONTROL. AND OTHER MEASURES REQUIRED FOR PROTECTION OF OCCUPANTS AND PROPERTY DURING SELECTIVE DEMOLITION AND CONSTRUCTION ACTIVITIES.
- K. CONTRACTOR IS SOLELY RESPONSIBLE FOR COORDINATING CONTRACT DOCUMENTS WITH FIELD CONDITIONS AND WITH WORK REQUIRED FOR EACH TRADE.
- L. EXISTING CONCRETE SLAB-ON-GRADE SHALL BE SAWCUT AND REMOVED AS REQUIRED TO COMPLETE UNDERGROUND PIPING WORK. REPLACE CONCRETE SLAB-ON-GRADE AND FINISH TO MATCH ADJACENT CONSTRUCTION. ALL CONCRETE REMOVAL AND REPLACEMENT BEYOND THAT SHOWN IS INCIDENTAL TO THE WORK AND SHALL BE INCLUDED IN THE CONTRACTOR'S BID AS REQUIRED TO COMPLETE THE PROJECT.
- M. BUILDING TO REMAIN PARTIALLY OCCUPIED DURING CONSTRUCTION. SEQUENCE ALL DEMOLITION ACTIVITIES ACCORDINGLY TO MINIMIZE DISRUPTION OF BUILDING OCCUPANTS. REFER TO PHASING PLANS.
- N. CONTRACTOR SHALL COORDINATE DEMOLITION ACTIVITIES WITH NEW WORK TO VERIFY DIMENSIONS AND EXTENT OF REMOVALS PRIOR TO BEGINNING WORK.

NOTE: REFER TO PRESERVATION BRIEFS AND PROJECT SPECIFICATION FOR MORE INFORMATION ON HOW TO REPAIR HISTORIC STONE PILLAR AND BRICK WORK.

- A. WALL PREPARATION RESTORATION TO BE CONSISTENT WITH U.S. DEPARTMENT OF INTERIOR PRESERVATION BRIEFS ON " CLEANING AND WATER-REPELLENT TREATMENTS FOR HISTORIC MASONRY" AND "REPOINTING MORTAR JOINTS FOR HISTORIC MASONRY BUILDINGS"
- B. REFER TO PROJECT MANUAL FOR ADDITIONAL REQUIREMENTS.
- C. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS.
- D. REMOVE AND REPOINT ALL FAILED MASONRY MORTAR JOINTS.
- E. REMOVE SURFACE RUST AND LOOSE PAINT FROM EXISTING STEEL LINTELS AND RE-PAINT THE STEEL LINTELS.
- F. MASONRY SHALL BE RE-TUCK POINTED AS NECESSARY TO STOP AIR AND WATER INFILTRATION.
- G. PROVIDE ALL REQUIRED PROJECT DOCUMENTATION, INCLUDING BUT NOT LIMITED TO SUBMITTALS, SHOP DRAWINGS, PRODUCT DATA, SAMPLES, TEST REPORTS, INSPECTION REPORTS, DAILY REPORTS, SCHEDULE UPDATES, PROJECT PHOTOGRAPHS, O&M MANUALS, WARRANTIES, AS-BUILTS, AND OTHER REQUIRED DOCUMENTATION. ALL DOCUMENTS TO BE PROVIDED IN A TIMELY
- H. PROVIDE ALL REQUIRED FIELD SUPERVISION, QUALITY CONTROL, AND SAFETY PERSONNEL AS REQUIRED. FULL TIME SUPERVISION MUST ALWAYS BE PROVIDED WHEN WORK IS BEING PERFORMED
- I. PATCH AND REPAIR ALL EXISTING WALL, FLOOR AND CEILING CONSTRUCTION DAMAGED BY CONSTRUCTION ACTIVITIES TO MATCH EXISTING ADJACENT FINISH SURFACES.
- J. T. REPLACE ALL WINDOW SEALS TO ERA CORRECT MATERIALS.
- K. RESTORE WEIGHTS AND COUNTER BALANCE SYSTEM.
- L. CONTRACTOR TO TAKE ALL NECESSARY PRECAUTIONS IN HANDELING OF ANY MATERIAL REQUIRING ABATEMENT, SEE SPECIFICATIONS.

EXISTING TO BE REMOVED

EXISTING CONCRETE & ASPHALT TO BE REMOVED EXISTING TO REMAIN

FACP

GAA

F/SD

PC

WAP

PHOTOCELL

FIRE ALARM CONTROL PANEL

FIRE ALARM MONITOR POINT, TAMPER SWITCH.

FIRE ALARM INTERMEDATE ADDRESSABLE MODULE

INSTALL DEVICE WITH BOTTOM AT +16" AFF., U.O.N.

CABLE. INSTALL DEVICE AT +84" AFF., U.O.N

CONDUIT CONCEALED IN GROUND OR FLOOR.

LIGHT FIXTURES SCHEDULE ON DRAWING E__.

BRANCH CIRCUIT HOME-RUN SYMBOLOGY:

- SEMI CIRCLE INDICATES GROUND CONDUCTOR

- LONG LINE INDICATES NEUTRAL CONDUCTOR(S)

- SHORT LINE INDICATES PHASE CONDUCTOR(S)

---- BC ---- DIRECT BURIED CONDUIT FOR COMMUNICATIONS CABLES

---- BE ---- DIRECT BURIED CONDUIT FOR ELECTRICAL POWER CABLES

---- BFO ---- DIRECT BURIED CONDUIT FOR SECURITY FIBER OPTIC CABLES

---- G ---- DIRECT BURIED BARE COPPER GROUNDING ELECTRODE CABLE

'HH-EX' INDICATES ELECTRICAL HANDHOLE #X

WITH EXOTHERMIC WELD CABLE CONNECTION

'HH-CX' INDICATES COMMUNICATION HANDHOLE #X

SITE ELECTRICAL SYMBOLS:

ELECTRICAL HANDHOLE

POWER, DATA, COAX OUTLET FOR TV.

CONDUIT TURN UP AND TURN DOWN RESPECTIVELY.

OVERHEAD DOOR SAFETY INTERLOCKS. REFER TO SPECIFICATION

REFER TO SPECIFICATION 083613 FOR MORE INFORMATION.

2'-0" GROUND BUS BAR. REFER TO DETAIL #__, DRAWING E__.

LOCAL KEYED OPEN-STOP-CLOSE OVERHEAD DOOR CONTROL STATION.

COMBINATION TELEPHONE/DATA 2-PORT OUTLET SINGLE GANG. FOR EACH

DEVICE 1-DATA/1-TELEPHONE JACK WITHIN THAT RECEPTACLE. INSTALL

CAT. 6 DATA OUTLET SINGLE GANG. INSTALL DEVICE AT +18" AFF., U.O.N.

DEVICE 1-DATA/1-TELEPHONE JACK WITHIN THAT RECEPTACLE. INSTALL

WITHIN A 4" x 4" EXTRA DEEP BOX. PROVIDE (2) CAT.6 CABLES U.O.N.

6 CABLE/JACK TO BE REPLACED WITH ONE USB CABLE/JACK.

COMBINATION TELEPHONE/DATA 2-PORT OUTLET SINGLE GANG. FOR EACH

INSTALL DEVICE WITH BOTTOM AT +16" AFF., U.O.N. USB INIDICATES ONE CAT

COMBINATION TELEVISION/DATA 2-PORT OUTLET SINGLE GANG. FOR EACH

DEVICE 1-DATA/1-TELEVISION JACK WITHIN THAT RECEPTACLE. INSTALL

WITHIN A 4" x 4" EXTRA DEEP BOX. PROVIDE (1) CAT.6 CABLE AND (1) COAX

(1) HDMI INTERFACE OUTLET. PROVIDE 2-GANG BOX WITH ADAPTER RING FOR

SINGLE GANG PLATE AND 1-1/4" EMT UP ABOVE CEILING AND STUBBED OUT

WITH BUSHING. INSTALL DEVICE AT HEIGHT INDICATED ONPLANS. FURNISH

PLAIN OLD TELEPHONE SYSTEM OUTLET. PROVIDE (1) CAT 6 CABLE WITH (1)

AND INSTALL PRE-TERMINATED HDMI CABLE BETWEEN INTERFACES AS

INDICATED ON PLANS. INSTALL DEVICE WITH BOTTOM AT +16" AFF., U.O.N

RJ11 JACK. INSTALL DEVICE WITH BOTTOM AT +16" AFF., U.O.N

FIRE AND SMOKE DAMPER. REFER TO DETAIL #__, ON SHEET E__.

LIGHT FIXTURE. "A" INDICATES FIXTURE TYPE. "a" INDICATES SWITCH LEG.

"L1#" INDICATES CIRUIT NUMBER FIXTURE IS CONNECTED TO. REFER TO

LIGHT FIXTURES WITH HALF SOLID SHADING INDICATES FIXTURE IS USED

EM = FIXTURE SUPPLIED WITH EMERGENCY POWER CONTROL MODULE,

CONTROLLED. REFER TO LIGHT FIXTURE SCHEDULE ON DRAWING E .

CEILING MOUNTED PUBLIC ADDRESS SPEAKER, TIED TO TELEPHONE PAGING SYSTEM

WALL MOUNTED PUBLIC ADDRESS SPEAKER, TIED TO TELEPHONE PAGING SYSTEM

FOR EMERGENCY EGRESS LIGHTING. "A" INDICATES FIXTURE TYPE

N.L. = NIGHT LIGHT, CONTINUOUS OPERATION, NON-CONTROLLED.

WIRELESS ACCESS POINT (WAP). PROVIDE TWO (2) CAT 6 CABLES.

---- BHV ---- DIRECT BURIED CONDUIT FOR HIGH VOLTAGE CABLE (CABLE BY ELECTRIC UTILITY)

3/4" DIAMETER X 10'-0" COPPER CLAD GROUNDING ELECTRODE GROUNDING ROD

WITHIN A 4" x 4" EXTRA DEEP BOX. PROVIDE (2) CAT.6 CABLES U.O.N.

FIRE ALARM MONITOR POINT, FLOW SWITCH,

GENERATOR ALARM ANNUNCIATOR PANEL.

083613 FOR MORE INFORMATION.

PROVIDE (1) CAT.6 CABLE U.O.N.

FIRE ALARM MONITOR POINT, BACKFLOW PREVENTOR/PRESSURE INDICATING SWITCH.

NON-FUSED DISCONNECT SWITCH, SEE DRAWINGS FOR DETAILED REQUIREMENTS.

COMBINATION STARTER/DISCONNECT, SEE DRAWINGS FOR DETAILED REQUIREMENTS.

VARIABLE FREQUENCY DRIVE, SEE DRAWINGS FOR DETAILED REQUIREMENTS. VARIABLE FREQUENCY DRIVE AND DISCONNECT COMBINATION, SEE DRAWINGS FOR DETAILED REQUIREMENTS.

NON-COMBINATION MAGNETIC MOTOR STARTER NUMBER INDICATES NEMA RATING, 3 SIZE 1 U.O.N.

MOTOR. SMOKE DAMPER. CONNECT TO LEGALLY REQURIED 120VAC BRANCH CIRCUIT. DAMPER SHALL OPEN UPON ENERGIZATINO (OR FAIL CLOSED UPON DE-ENERGIZED) POWER TO SMOKE DAMPER(S) ASSOCIATE WITH AHU SHALL BE CONTROLLED BY THE FIRE ALARM CONTROL PANEL. UPON DUCT DETECTOR SMOKE DETECTION AT AHU, ASSOCIATED DAMPER(S) SHALL CLOSE (BE DE-ENERGIZED), REFER TO DETAIL #____, ON DRAWING E FOR SMOKE DAMPER WIRING DETAIL. REFER TO DRAWING E___

> **AND E**___ FOR LOCATION OF AHU(S) REQUIREING DUCT SMOKE DETECTOR(S) **PULLBOX**

ADDRESSABLE FIRE ALARM HEAT DETECTOR, CEILING MOUNT COMBINATION RATE-OF-RISE (15° PER MINUTE) AND/OR FIXED (135°) AS NOTED IN SPECIFICATION 284621.11

ADDRESSABLE FIRE ALARM PHOTOELECTRIC SMOKE DETECTOR. CEILING MOUNT. REFER TO DETAIL #__, DRAWING E__.

ADDRESSABLE FIRE ALARM PHOTOELECTRIC SMOKE DETECTOR. WALL MOUNT ON RECESSED DEVICE BOX. REFER TO DETAIL #__, DRAWING E__.

FIRE ALARM DUCT MOUNTED SMOKE DETECTOR, HOUSING, AND SAMPLING TUBE ON RETURN SIDE. INTERLOCK WITH DAMPER/FAN MOTOR CONTROL TO SHUTDOWN UNIT UPON DETECTION. PROVIDE AND WIRE AN ILLUMINATED REMOTE TEST SWTICH INTERLOCKED TO THE EQUIPMENT; **REFER TO DETAIL #__, DRAWING E__**, LOCATION SHALL BE READILY ACCESSIBLE TO FIREMAN FOR SMOKE MANAGEMENT CONTROL.

ILLUMINATED REMOTE TEST SWITCH INTERLOCKED TO SHUTDOWN AIR HANDLING EQUIPMENT. AS "SIMULATED TEST" OF DUCT SMOKE DETECTOR ACTIVATION AND AHU SHUTDOWN BY IAM INTERLOCK. LOCATION SHALL BE READILY ACCESSIBLE FOR FIREMEN FOR SMOKE MANAGEMENT CONTROL.

FIRE ALARM HORN WITH VISUAL STROBE. WP = WEATHERPROOF STYLE DEVICE.

FIRE ALARM VISUAL STROBE ANNUNCIATOR. FIRE ALARM MANUAL PULL STATION.

FIRE ALARM HOLD OPEN DEVICE.

ONE-LINE DIAGRAM SYMBOLS: REMOTE FIRE ALARM ANNUNCIATOR PANEL

MAIN LUG ONLY PANELBOARD. "PANEL" INDICATES PANEL DESIGNATION. (PANEL) "120/208" INDICATES PANEL OPERATING VOLTAGE. "3Ø, 4W" INDICATES 200 AMP PHASE AND WIRE. "200A 3P" INDICATES 3 POLE MAIN LUGS AND BUS RATED 120/208V FOR 200A. 3Ø, 4W MLO

MAIN CIRCUIT BREAKER PANELBOARD. "PANEL" INDICATES PANEL PANEL DESIGNATION. "120/208" INDICATES PANEL OPERATING VOLTAGE. "3Ø, 4W" 200 AMP INDICATES PHASE AND WIRE. "200A 3P" INDICATES 3 POLE MAIN LUGS AND 120/208V BUS RATED FOR 200A. 3Ø, 4W MCB

FUSED SWITCH. TOP NUMBER INDICATES SWITCH RATING IN AMPERES. BOTTOM NUMBER INDICATES FUSE RATING IN AMPERES.

MOTOR WITH HORSEPOWER INDICATED.

THERMAL MAGNETIC CIRCUIT BREAKER. TOP NUMBER INDICATES TRIP RATING IN AMPERES. BOTTOM NUMBER INDICATES FRAME RATING IN AMPERES. "80% RATED" INDICATES BREAKER RATING. "LSIG" INDICATES BREAKER WITH 80% RATED ADJUSTABLE LONG TIME, SHORT TIME, INSTANTANEOUS, AND GROUND FAULT TRIP SETTINGS. "SS" INDICATES SOLID STATE, 3-POLE, U.O.N.

FEEDER CIRCUIT.

BUS BAR.

30KVA

208/120

K13

TRANSFORMER. PRIMARY VOLTAGE, SECONDARY VOLTAGE, RATING IN KVA AS INDICATED, K FACTOR AS INDICATED

GROUND. 100Å NON-FUSED DISCONNECT SWITCH. NUMBER INDICATES RATING IN AMPERES **ENCLOSURE OUTLINE**

CABLE/CONDUIT NUMBER

AUTOMATIC TRANSFER SWITCH

SWITCHBOARD

MAIN CIRCUIT BREAKER

MAIN DISTRIBUTION FRAME

ABBREVIATIONS:

A.F	AMPERE FUSE	MFR.	MANUFACTURER
A.F.C.	ABOVE FINISHED COUNTER	MOCP	MAXIMUM OVERCURRENT PROTECTION
A.F.F.	ABOVE FINISHED FLOOR	MTS.	MANUAL TRANSFER SWITCH
A.F.G.	ABOVE FINISHED GRADE	MUTOA	MULTI-USER TELECOMMUNICATIONS
BE	BURIED ELECTRIC		OUTLET ASSEMBLY
B.F.G.	BELOW FINISH GRADE	NEC	NATIONAL ELECTRICAL CODE
BFO	BURIED FIBER OPTIC	NL	NON-SWITCHED NIGHT LIGHT
ВТ	BURIED TELEPHONE	NTRL.	NEUTRAL
C.	CONDUIT	NTS	NOT TO SCALE
CAT	CATEGORY	OCP	OVERCURRENT PROTECTIVE DEVICE
DED.	DEDICATED	OL.	OVERLOADS
DFA	DROP FROM ABOVE	Р	POLE
DIV.	DIVISION	POTS	PLAIN OLD TELEPHONE SYSTEM
D.S	DISCONNECT SWITCH	Ø	PHASE
E.T.R.	EXISTING TO REMAIN	RCPT.	RECEPTACLE
E	EXISTING	RECEPT.	RECEPTACLE
EC	ELECTRICAL CONTRACTOR	RM.	ROOM
(F)	FUTURE	SE	SERVICE ENTRANCE
FAAP	FIRE ALARM ANNUNCIATOR PANEL	SP.	SPARE
FACP	FIRE ALARM CONTROL PANEL	SPEC	SPECIFICATIONS
G.	GROUND	SS	SOLID STATE (ELECTRONIC) BREAKER
GFI	GROUND FAULT INTERRUPT	SSOL	SOLID STATE OVERLOADS
GRND	GROUND	ST	SAFETY TYPE
H.O.A.	HAND OFF AUTOMATIC	SW.	SWITCH
H.L.O.A.	HIGH LOW OFF AUTOMATIC	T.B.I.	TO BE INSTALLED
HNDLR	HANDLER	TBR	TO BE REMOVED
IDF	INTERMEDIATE DISTRIBUTION FRAME	TWSH.	TWISTED SHIELDED
LSIG	LONG TIME, SHORT TIME, INSTANTANEOUS, GROUND	TYP.	TYPICAL
1.70		U.O.N.	UNLESS OTHERWISE NOTED
LTG.	LIGHTING	V.F.D.	VARIABLE FREQUENCY DRIVE
MC	MECHANICAL CONTRACTOR	W	WATT
MCA	MINIMUM CIRCUIT AMPACITY	WG	WIRE GUARD

WIRELESS ACCESS POINT

WEATHERPROOF

GENERAL NOTES:

A. DRAWINGS ARE DIAGRAMMATIC. ALL DIMENSIONS SHOWN ARE APPROXIMATE. ALL LOCATIONS SHALL BE FIELD VERIFIED.

B. ALL WORK SHALL BE IN CONFORMANCE WITH THE NATIONAL ELECTRICAL CODE LATEST EDITION ADOPTED BY MICHIGAN, THE MICHIGAN ELECTRICAL CODE AMENDMENTS, LOCAL/MUNICIPAL CODES, AND THE AUTHORITY HAVING JURISDICTION.

C. ALL CONNECTIONS TO EQUIPMENT SUBJECT TO MOVEMENT OR VIBRATION SHALL BE LIQUID TIGHT FLEXIBLE METAL CONDUIT, NOT LESS THAN 12" IN LENGTH, NOR GREATER THAN 36" IN LENGTH.

D. ALL PENETRATIONS THROUGH FIRE RATED WALLS SHALL BE SEALED WITH THE APPROPRIATE FIRE STOPPING MATERIAL TO MAINTAIN WALL FIRE RATING. SEE ARCHITECTURAL DRAWING #A-051 FOR FIRE RATED WALL LOCATIONS.

E. SEE MECHANICAL AND PLUMBING SCHEDULES FOR MECHANICAL EQUIPMENT RATINGS AND SIZES.

F. ALL POWER AND LIGHTING CIRCUITS SHALL BE MINIMUM (2)#12, AND (1) #12 G, IN 3/4" CONDUIT UNLESS OTHERWISE NOTED. ALL BRANCH CIRCUIT WITH 20A AND BELOW BREAKER(S) SHALL USE THE FOLLOWING MINIMUM CABLE SIZE TO ACCOMMODATE VOLTAGE DROP UNLESS OTHER WISE NOTED: LESS THAN 85'-0": #12 AWG; 85'-0" TO 140'-0": #10 AWG; 140'-0" TO 225'-0": #8 AWG.

G. ALL CONTROL WIRING SHALL BE NOT LESS THAN (2) #14, (1) #14G, 3/4"C, UON.

H. ALL CABLES INSTALLED IN AIR HANDLING PLENUMS SHALL BE PLENUM RATED

I. HOME RUNS SHALL NOT BE COMBINED IN A RACEWAY UNLESS SHOWN ON THE CONTRACT DRAWINGS. SINGLE PHASE BRANCH CIRCUIT HOME RUNS MAY BE COMBINED AT THE CONTRACTOR'S DISCRETION NOT GREATER THAN (3) PHASE CONDUCTORS, (3) NEUTRAL CONDUCTORS, AND REQUIRED GROUNDING CONDUCTOR(S), CONTRACTOR MUST INCREASE WIRE SIZE AND DERATE CONDUCTOR CAPACITY ACCORDING TO NEC.

J. EACH SINGLE PHASE BRANCH CIRCUIT CONDUCTOR SHALL HAVE A DEDICATED NEUTRAL BACK TO THE PANELBOARD.

K. SUPPORTING WIRE FOR THE SUSPENDED CEILING GRID SHALL NOT BE USED AS RACEWAY SUPPORT.

L. DISCONNECT SWITCH RATINGS SHALL BE AS INDICATED ON THE DRAWINGS.

M. MAJOR FEEDERS FROM THE SWITCHBOARD TO PANELBOARDS, TRANSFORMERS, MOTORS AND OTHER LARGE EQUIPMENT ARE NOT SHOWN ON THE FLOOR PLAN DRAWINGS. THESE FEEDERS ARE INCLUDED WITHIN THE SCOPE OF THE ELECTRICAL WORK AND ARE SHOWN ON THE ONE-LINE DIAGRAMS.

a. AVOID INSTALLING POWER RECEPTACLES OR DATA OUTLETS LOCATED BACK

b. WHERE OUTLETS ARE REQUIRED TO BE LOCATED BACK TO BACK CONTRACTOR SHALL PROVIDE SOUNDPROOFING MATERIAL BETWEEN JUNCTION BOXES.

U. THE WORD "PROVIDE" IS TO BE DEFINED AS "FURNISH AND INSTALL."

V. ALL ELECTRICAL DEVICES IN RECREATION ROOMS TO BE PROVIDED WITH WIREGUARD UNLESS INSTALLED IN CUSTOM BOX.

W. COORDINATE VIDEO VISITATION POWER REQUIREMENTS WITH OWNER'S VIDEO VISITATION VENDOR BEFORE ROUGH-IN. FURNISH AND INSTALL POWER AS REQUIRED. PROVIDE DEVICES, BOXES, RACEWAYS, CABLING, SUPPORTS, DISCONNECTS, STARTERS, ETC AS REQUIRED.

X. THE TRADE CONTRACTOR SHALL COORDINATE LOCATIONS OF ALL PENETRATIONS WITH STRUCTURAL DRAWING REQUIREMENTS. ADDITIONALLY, THE TRADE CONTRACTOR SHALL COORDINATE ALL PENETRATIONS REQUIRED THROUGH PRECAST CONCRETE UNITS WITH THE PRECAST CONCRETE MANUFACTURER TO PRODUCE A SHOP DRAWING SUBMITTAL NOTING ALL PENETRATIONS AND THEIR SIZES. TRADE CONTRACTOR AND PRECAST MANUFACTURER SHALL PROVIDE DOCUMENTATION WITH SHOP DRAWING SUBMITTAL INDICATING THAT ALL TRADES HAVE SIGNED OFF ON ALL AFOREMENTIONED COORDINATION.

Y. ALL DEVICES SURFACE MOUNTED ON BOTTOM OF PRECAST SHALL BE SUPPLIED FROM ABOVE. NO EXPOSED CONDUITS OR WIREMOLD SHALL BE USED ON BOTTOM

Z. ADJUST DEVICE BOX MOUNTING HEIGHT TO TOP OR BOTTOM OF BLOCK COURSING AS NEEDED SO BOXES DO NOT CROSS A MORTAR JOINT.

AA. SECURITY CAULKING/SEALANT SHALL BE INSTALLED IN CREVICES IN ALL DETENTION SPACES (I.E. AROUND DEVICE PLATES, LIGHTING FIXTURES, ETC.). REFER TO SPECIFICATION 079200 FOR DETAILED REQUIREMENTS.

AB. TORX HEAD SCREWS WITH A CENTER PIN SHALL BE INSTALLED IN ALL DETENTION SPACES (I.E. DEVICE FACEPLATES, LIGHTING FIXTURE ACCESS PLATES, ETC.). REFER TO SPECIFICATION 050553 FOR DETAILED REQUIREMENTS

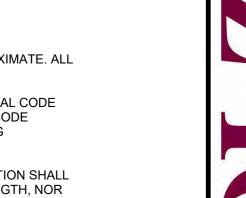
AC. CONDUITS SHALL NOT BE ROUTED IN OR THROUGH THE PRECAST HOLLOWCORE CEILING. COORDINATE WITH PRECAST VENDOR TO DETERMINE DROP-IN ANCHOR LOCATIONS FOR MOUNTING OF RACEWAYS OR OTHER ELECTRICAL ITEMS UNDERNEATH THE PRECAST HOLLOWCORE CEILING. REFER TO DRAWING S-500, DETAIL #7.

AD. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATED WALLS AND CEILINGS. INSTALL FIRESTOP AT PENETRATIONS. INSTALL FIRE RATED PUTTY AROUND BOXES INSTALLED IN FIRE RATED WALLS AND OFFSET BACK TO BACK BOXES. REFER TO SPECIFICATION SECTION <u>078443</u> "JOINT FIRESTOPPING" FOR DETAILS FIRESTOP REQUIREMENTS.

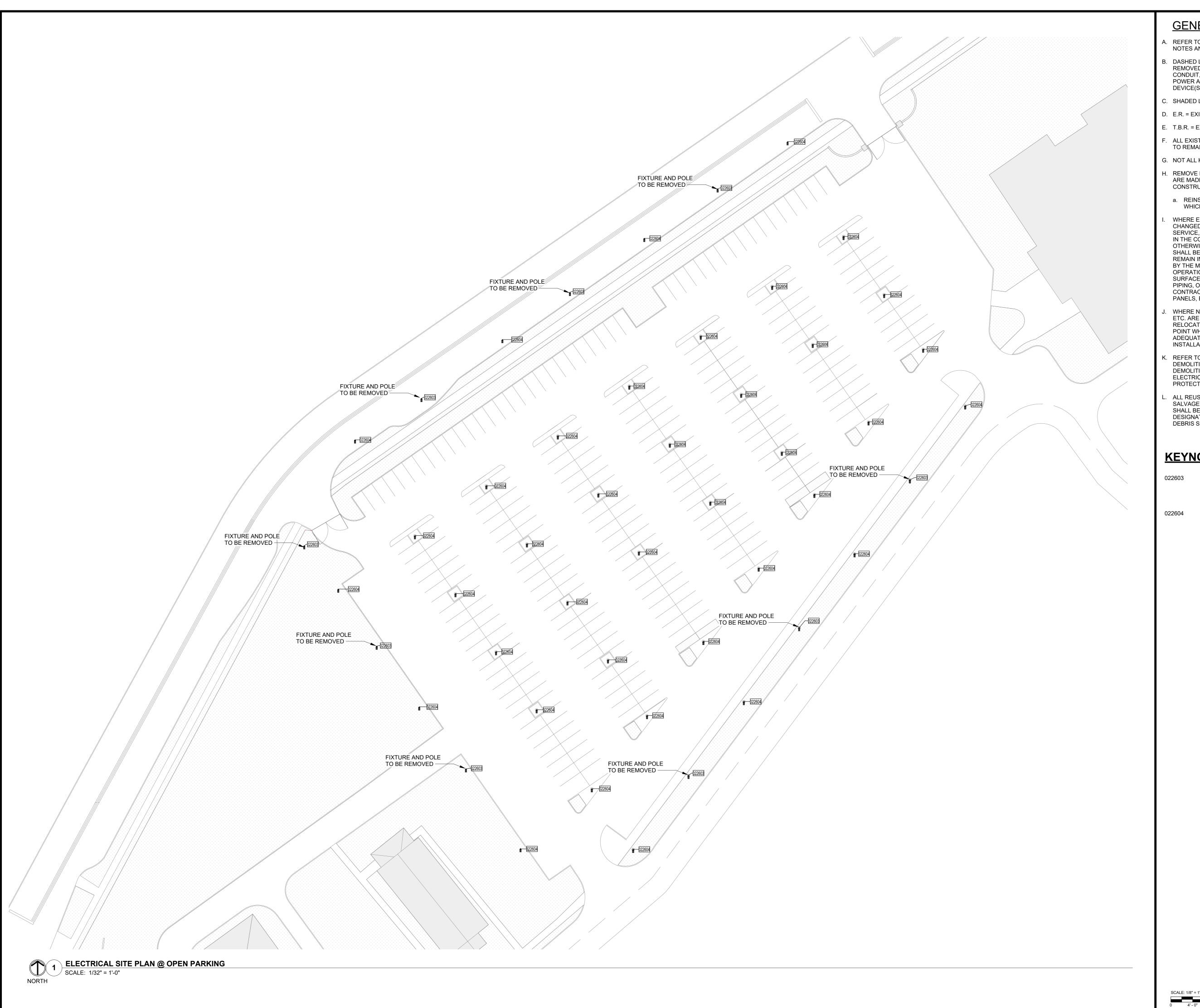
4

RTS

N. ALL FIRE ALARM CABLING SHALL BE RED, PLENUM RATED, AND INSTALLED IN FACTORY PAINTED "RED" CONDUIT. ALL ASSOCIATED JUNCTION/PULL BOXES SHALL BE FACTORY PAINTED "RED". O. HVAC CONTROL WIRING FURNISHED AND INSTALLED BY OTHERS. PROVIDE POWER TO EACH TEMPERATURE CONTROL PANEL AS SHOWN. P. INDOOR CONTROL EQUIPMENT ENCLOSURES SHALL BE NEMA 1 RATED U.O.N. ALL EXTERIOR ENCLOSURES SHALL BE NEMA 3R UNLESS OTHERWISE NOTED. ALL ENCLOSURES LOCATED IN KITCHEN SHALL BE NEMA 4X STAINLESS STEEL UNLESS OTHERWISE NOTED. Q. ALL CONDUITS CROSSING EXPANSION JOINTS SHALL BE INSTALLED WITH EXPANSION FITTINGS, UNLESS THE CONDUIT IS BELOW SLAB IN THE COMPACTED GRANULAR FILL. EXPANSION FITTINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE NEC AND MANUFACTURER'S WRITTEN RECOMMENDATIONS. REFER TO STRUCTURAL DRAWINGS FOR EXPANSION JOINT LOCATIONS. R. THE CONTRACTOR SHALL COORDINATE RECEPTACLE HEIGHTS AND LOCATIONS WITH THE CASEWORK SHOP DRAWINGS TO DETERMINE EXACT LOCATIONS AND HEIGHTS FOR OUTLET INSTALLATION. S. CONTROL WIRING FOR HVAC EQUIPMENT FURNISHED AND INSTALLED BY OTHERS. PROVIDE POWER AS INDICATED ON PLANS. T. TO REDUCE NOISE BETWEEN WALLS, CONTRACTOR SHALL:







GENERAL NOTES:

- REFER TO SHEETS G1.1 AND E0.1 FOR ADDITIONAL GENERAL NOTES AND INFORMATION.
- B. DASHED LINES INDICATE EXISTING ELECTRICAL EQUIPMENT TO BE REMOVED. REMOVE ASSOCIATED ELECTRICAL ITEMS (E.G. CABLE, CONDUIT, SUPPORTS, DISCONNECTS, ETC.) COMPLETE BACK TO POWER AND/OR SIGNAL SOURCE OR TO NEAREST REMAINING DEVICE(S) U.O.N.
 - C. SHADED LINES INDICATE EXISTING ELECTRICAL ITEMS TO REMAIN.
 - D. E.R. = EXISTING DEVICE TO REMAIN.
- E. T.B.R. = EXISTING DEVICE TO BE REMOVED.
- F. ALL EXISTING LIGHTING, POWER, SYSTEMS DEVICES / EQUIPMENT TO REMAIN UNLESS OTHERWISE NOTED.
- G. NOT ALL KEYNOTES ARE USED ON EVERY SHEET.
- H. REMOVE EXISTING SYSTEMS, MATERIALS, AND EQUIPMENT WHICH ARE MADE OBSOLETE OR WHICH INTERFERE WITH THE CONSTRUCTION OF THE PROJECT.
- a. REINSTALL ANY SUCH SYSTEMS, MATERIALS, AND EQUIPMENT WHICH ARE REQUIRED TO COMPLETE THE PROJECT.

WHERE EXISTING EQUIPMENT OR MATERIALS ARE REMOVED OR CHANGED, ALL BRANCH CONDUITS, WHICH NO LONGER ARE IN SERVICE, SHALL BE REMOVED AS DIRECTED BY THE ARCHITECT. IF IN THE COURSE OF THE WORK, OUTLETS ARE COVERED UP OR OTHERWISE RENDERED INACCESSIBLE, ALL WIRING TO SAME SHALL BE REMOVED TO THE SOURCE. IF A CIRCUIT THAT MUST REMAIN IN SERVICE IS INTERRUPTED, IT SHALL BE RECONNECTED BY THE MOST INCONSPICUOUS MEANS SO AS TO REMAIN OPERATIONAL, WITH SAME CAPACITY AS BEFORE. ALL BUILDING SURFACES DAMAGED, AND OPENING LEFT BY REMOVAL OF BOXES, PIPING, OR THEIR EQUIPMENT SHALL BE REPAIRED BY THE CONTRACTOR. ALL HOLES LEFT IN JUNCTION BOXES, SWITCHES, PANELS, ETC. SHALL BE CLOSED.

- WHERE NEW OPENINGS ARE CUT AND CONCEALED CONDUITS, ETC. ARE ENCOUNTERED, THEY SHALL BE REMOVED OR RELOCATED AS REQUIRED. CONDUIT SHALL BE REMOVED TO THE POINT WHERE THE FINISH SURFACES CAN BE PATCHED ADEQUATELY SO THAT NO EVIDENCE OF THE FORMER INSTALLATION REMAINS.
- REFER TO ARCHITECTURAL DRAWINGS WHICH SHOW THE TOTAL DEMOLITION IN SPECIFIC AREAS. E.C. SHALL COORDINATE IN THIS DEMOLITION TO ENSURE THAT POWER IS OFF AND THAT ELECTRICAL EQUIPMENT THAT MUST REMAIN IS PROPERLY
- ALL REUSABLE DEVICES, FIXTURES, AND EQUIPMENT SHALL BE SALVAGED, SHALL BECOME THE PROPERTY OF THE OWNER, AND SHALL BE STORED BY THE CONTRACTOR IN A ROOM TO BE DESIGNATED BY THE OWNER. ALL OTHER REMOVED ITEMS AND DEBRIS SHALL BE CLEARED FROM THE PREMISES DAILY.

KEYNOTES

LIGHTING FIXTURE, POLE, AND POLE BASE TO BE REMOVED. REPLACE WITH HANDHOLE, REWORK CONDUIT AND RECONNECT CONDUCTORS TO MAINTAIN CONTINUITY OF CIRCUIT.

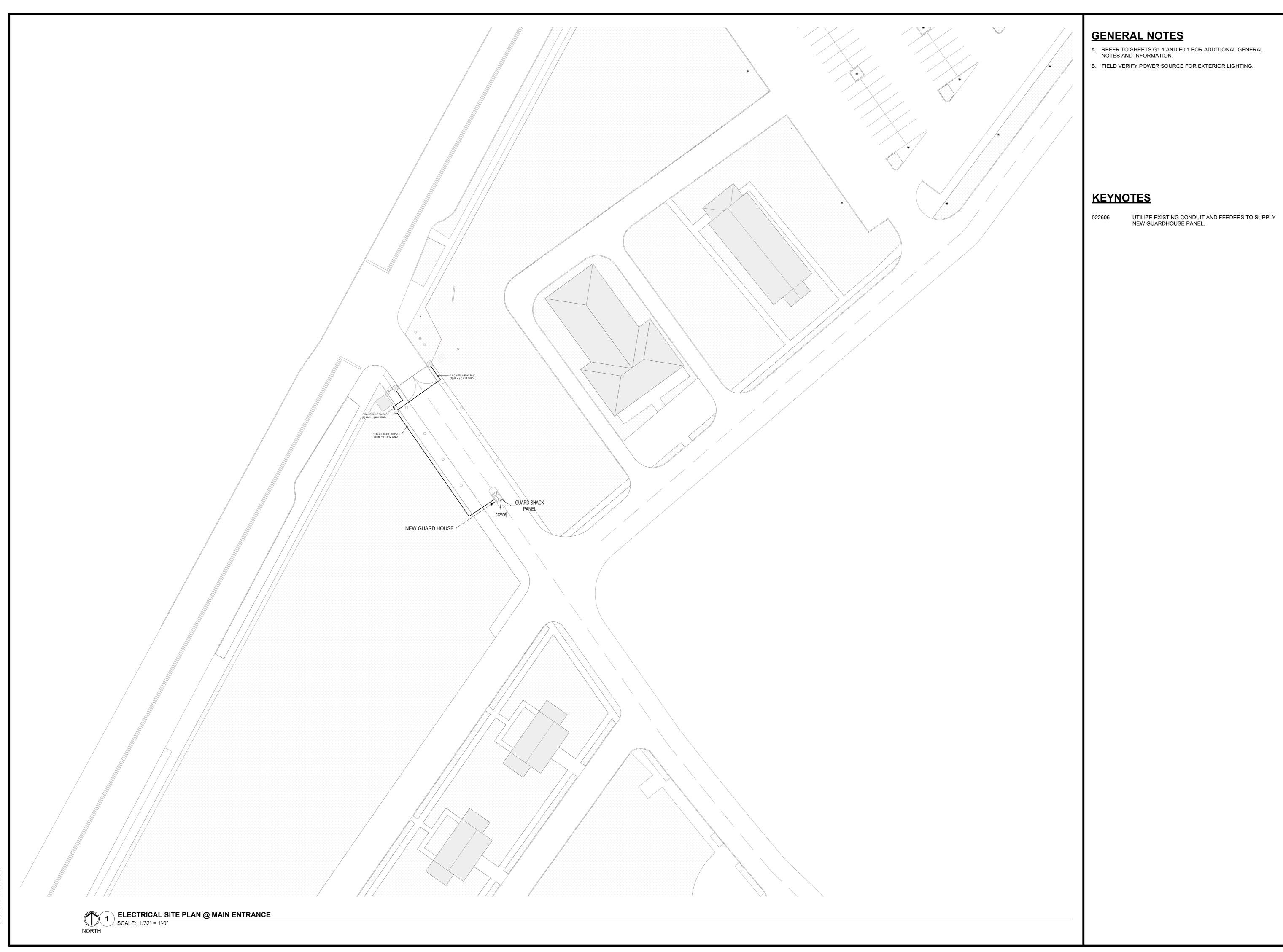
REMOVE FIXTURE, POLE, AND POLE BASE IN PREPARATION FOR NEW DIRECT BURY LIGHT POLE IN SAME PLACE. MAINTAIN WIRING FOR NEW POLE. REWORK EXISTING CONDUIT AS REQUIRED FOR NEW POLE.

GENERAL NOTES

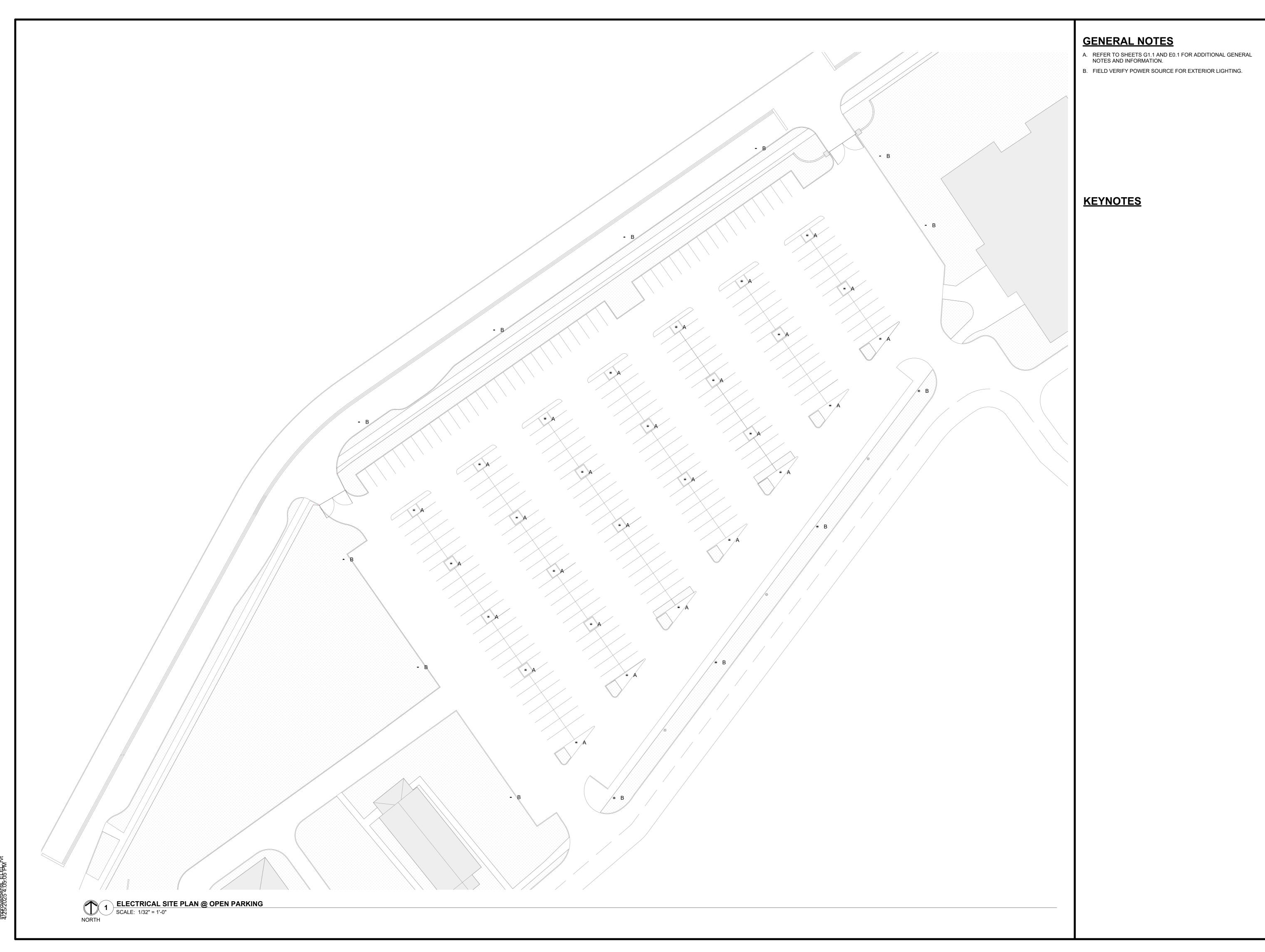
- A. REFER TO SHEETS G1.1 AND E0.1 FOR ADDITIONAL GENERAL NOTES AND INFORMATION.
- B. FIELD VERIFY POWER SOURCE FOR EXTERIOR LIGHTING.

KEYNOTES

DESIGNED. Designer	APPRV'D: Approver	DATE: MONTH XX XXXX	PROJECT NUMBER	1641-674700	-	
				ELECI KICAL SII E PLAN		
		<i>-</i>	-			AL



GHIB FORT WAYNE LIGHTING & SITE IMPROVEMENTS ELECTRICAL SITE PLAN ENLARGED

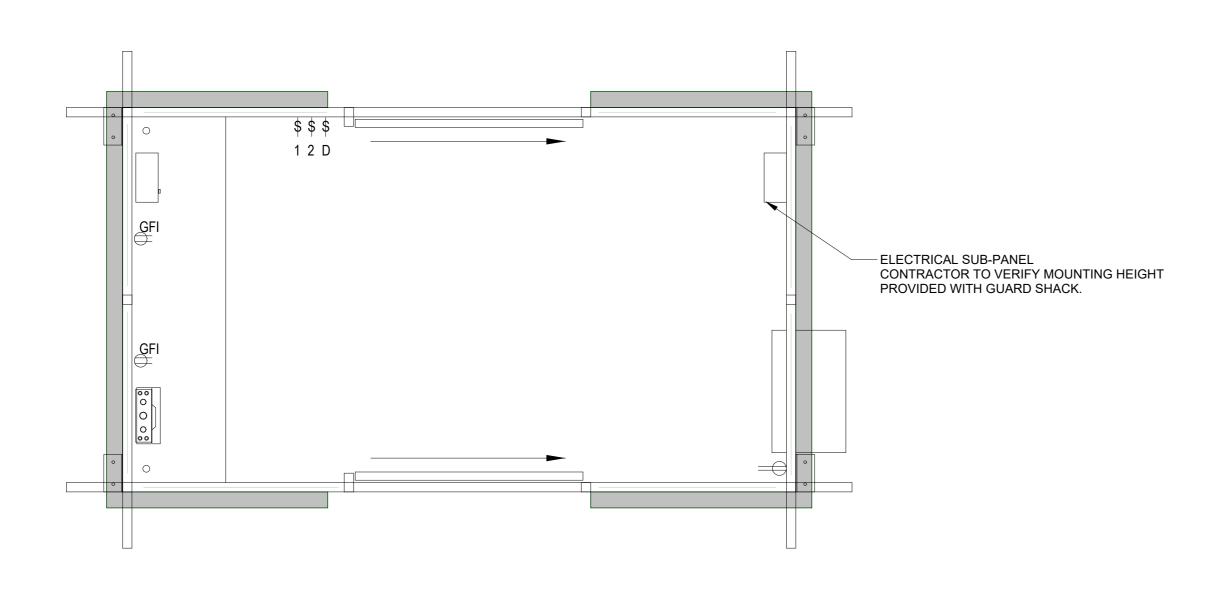


Autodesk Docs://1641-6470-00 GHIB Site Improvements/1641-6470-0

E12

ELECTRICAL SITE PLAN ENLARGED @ OPEN PARKING

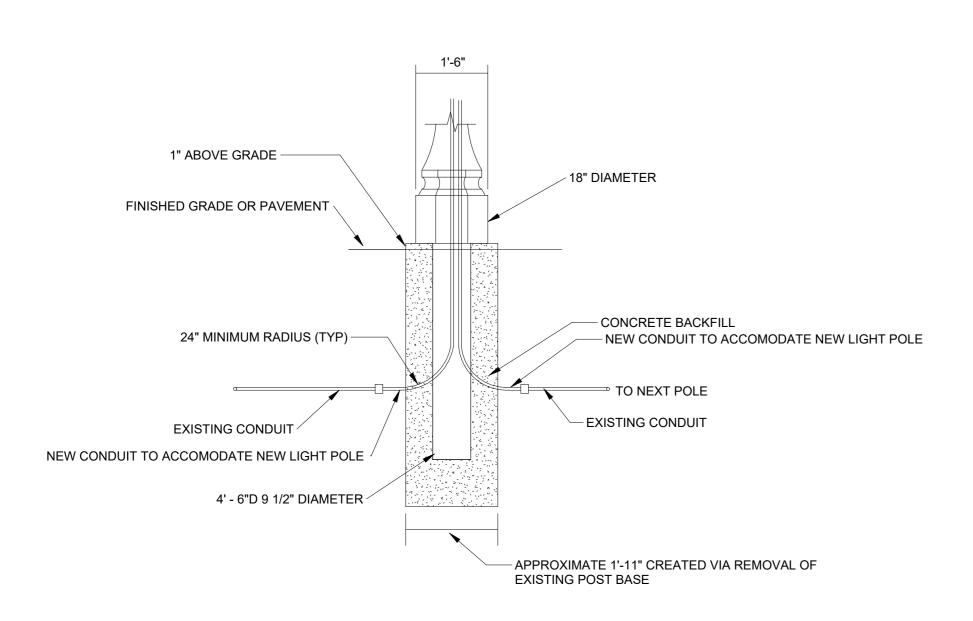
GHIB FORT WAYNE LIGHTING & SITE IMPROVEMENTS



NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS. GUARD SHACK FURNISHED WITH ELECTRICAL DEVICES BY VENDOR.

1 GUARD HOUSE ELECTRICAL PLAN
SCALE: 1" = 1'-0"

GHIB FORT WAYNE LIGHTING & SITE IMPROVEMENTS GUARD HOUSE ELECTRICAL PLAN 3 <u>П</u>



NORTH

LIGHT POLE CONCRETE FOUNDATION DETAIL

SCALE: 1/2" = 1'-0"

GENERAL NOTES

- A. REFER TO SHEETS G1.1 AND E0.1 FOR ADDITIONAL GENERAL NOTES AND INFORMATION.
- B. FIELD VERIFY POWER SOURCE FOR EXTERIOR LIGHTING.



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	LIGHTING FIXTURE SCHEDULE								
TYPE	LAMP	WATTAGE	VOLTS	DESCRIPTION	MANUFACTURER 1	TYPE COMMENTS			
A	LED	97 W	MVOLT	POLE MOUNTED ARCHITECTURAL AREA LIGHT, DIECAST ALUMINUM HOUSING, ACRYLIC LENS	EVOLVE #EPAM 01 12 A 40 1H A	MOUNT ON WALL WITH BOTTOM AT +12'-0" AFG UNLESS OTHERWISE NOTED.			
В	LED	97 W	MVOLT	POLE MOUNTED ARCHITECTURAL AREA LIGHT, DIECAST ALUMINUM HOUSING, ACRYLIC LENS	EVOLVE #EPAM 01 12 B 40 1H A	MOUNT ON WALL WITH BOTTOM AT +12'-0" AFG UNLESS OTHERWISE NOTED.			

NOTE: CONTRACTOR TO VERIFY VOLTAGE OF EXISTING LIGHT POLE CIRCUIT

Branch Panel: GUARD SHA Location: Supply From: Mounting: Surface Enclosure: 1				Volts: 120/240 Single Phases: 1 Wires: 3				A.I.C. Rating: 10kA Mains Type: MLO Mains Rating: 125 A MCB Rating: 0 A		
Notes:										
СКТ	Circuit Description	Trip	Poles	A	В	Poles	Trip	Circuit Des	scription	СКТ
1	·	•							•	2
3										4
5										6
7 9										8 10
11										12
			otal Load:	0 VA	0 VA		<u> </u>			12
		. •	tal Amps:	0 A	0 A					
Legend:							.			
_egend: _oad Classific	ation	Connec	ted Load	Demand Fac		imated Demar	nd	Panel	Totals	
	ation	Connec	ted Load	Demand Fac		imated Demar	nd			
	ation	Connec	ted Load	Demand Fac		imated Demar	nd	Panel Total Conn. Load: Total Est. Demand:	0 VA	
	ation	Connec	ted Load	Demand Fac		imated Demar	nd	Total Conn. Load:	0 VA 0 VA	
	ation	Connec	ted Load	Demand Fac		imated Demar		Total Conn. Load: Total Est. Demand:	0 VA 0 VA 0 A	

GENERAL NOTES

- A. REFER TO SHEETS G1.1 AND E0.1 FOR ADDITIONAL GENERAL NOTES AND INFORMATION.
- B. FIELD VERIFY POWER SOURCE FOR EXTERIOR LIGHTING.



DESIGNED: Designer	APPRV'D: Approver	DATE: MONTH XX, XXXX	PROJECT NUMBER	1641-674700	-	
NJ9-2101	ĺ			SCHEDOLES		



EPAM Americana LED Post Top Lighting

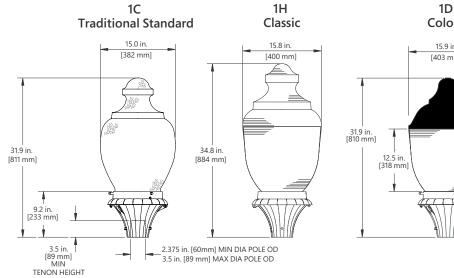
CUSTOMER NAME	
PROJECT NAME	
DATE	TYPE
CATALOG NUMBER	

1M

FINIAL



GLOBE



Colony W/ Crown & Ribs 15.9 in. [403 mm] 12.5 in. [318 mm] 31.9 in. [810 mm]

Weight

< 20 lbs (9.07 kgs)

Effective Projected Area

• 1.4 sq ft max (0.13 sq M max)

Available Finials if ordered separately

MATERIAL DESCRIPTION	COLOR*	MATERIAL
FNLBL-ACN	BLACK	126817
FNLBL-BLS	BLACK	126819
FNLBL-FDL	BLACK	126812
FNLBL-OAK	BLACK	170102
FNLBL-SIL	BLACK	126816
FNLBL-SPK	BLACK	126818

^{*}Contact Factory for different finial colors

Suggested Mounting Height

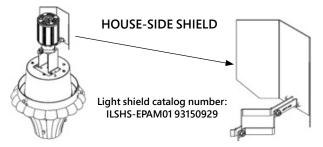
• 8-16 ft. (2.5-5 M)

Mounting

Post top mounting for 2.375 in. (60mm) MIN – 3.5 in. (89mm) MAX diameter by 3.5-inch MIN vertical tenon secured with three square head set screws

Accessories

SAP NUMBER	PART NUMBER	DESCRIPTION
93029237	PED-MV-LED-7	ANSI C136.41 Dimming PE, 120-277V
28299	PEC0TL	Standard 120-277V
73251	SCCL-PECTL	Shorting Cap





CUSTOMER NAME		
PROJECT NAME		
DATE	TYPE	
	· · · · -	
CATALOG NUMBER _		

EPAM Americana

LED Post Top Lighting

The **Evolve**® LED Americana Post Top offers energy efficiency and quality of light in a classic, Acorn look and style.

Construction

Housing:	Diecast aluminum housing.			
Lens:	Acrylic or Polycarbonate Globe			
Paint:	Corrosion resistant polyester powder paint, minimum 2.0 mil thickness Standard = Black, Dark Bronze RAL & custom colors available			
Weight:	< 20 lbs (9.07 kgs)			

Optical System

Lumens:	1,900 – 12,600
Distribution:	Symmetric Asymmetric
Efficacy:	74-155 LPW
CCT:	3000K, 4000K
CRI:	≥70

Electrical

Input Voltage:	120-277V
Input Frequency:	50/60Hz
Power Factor:	≥ 90% at rated watts*
Total Harmonic Distortion:	≤ 20% at rated watts

^{*}PF > 0.88 for 1C and 1H globes at 02 Lumen Output above 240V

Surge Protection*

Standard	Optional		
10kV/5kA	Secondary 10kV/5kA (R Option) Secondary 20kV/10kA (T Option)		
*Per ANSI C136.2-2015			
	Warrantv		

5 Year (Standard) 10 Year (Optional)

Luminaire Ambient Temperature Factor (LATF)

Ambient Temp (°C)	Initial Flux Factor	Ambient Temp (°C)	Initial Flux Factor
10	1.02	30	0.99
20	1.01	40	0.98
25	1.00	50	0.97

Operating Temperature

Globe	Min Ambient	Max Ambient	Lumen
	Temp (°C)	Temp (°C)	Output
1C & 1H	-40°	50°	02 to 10
	-40°	40°	12
1D	-40°	50°	02 to 08
	-40°	45°	10
1M	-40°	50°	02 to 06
	-40°	45°	07

Ratings

Vibration:	1.5G per ANSI C136.41-2010
LM-79:	Testing in accordance with IES Standards
Environmental:	Complies with the material restrictions of RoHS

Controls

Dimming:	Standard - 0-10V			
	Optional - DALI (Option U)			
Sensors:	Photo Electric Sensors (PE) available			

Applications

- Local Roadways
- Antique Streetscapes
- Parks and Pathways
- University and Business Campuses











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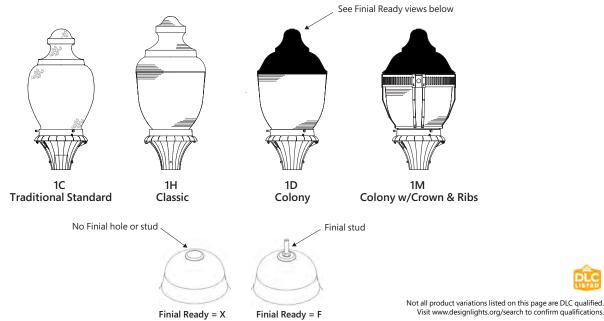
CUSTOMER NAME		
PROJECT NAME		
DATE	TYPF	
CATALOG NUMBER		

Ordering Information

EPAM 01

PROD. ID	GEN	VOLTAGE	LUMEN OUTPUT ⁴	DISTRIBUTION	ССТ	CONTROLS	GLOBE	GLOBE MATERIAL	FINIAL READY	FINIAL	COLOR	OPTIONS
E = Evolve	01	0 = 120-277V ³	02	A = Symmetric	30 = 3000K	1 = None	1C = Traditional Standard	A = Acrylic	F = Finial Ready ²	A = Silhouette	BLCK = Black	F = Fusing
P = Post Top		1 = 120V	04	B = Asymmetric ¹⁰	40 = 4000K	A = ANSI C136.41 7-Pin Receptacle (in Base)	1H = Classic	P = Polycarbonate ⁶	X = No Finial Hole or Stud ¹	B = Acorn	DKBZ = Dark Bronze	R = Secondary 10kV/5kA SPD
AM = Americana		2 = 208V	06			D = ANSI C136.41 7-Pin Receptacle (in Base) w/ Shorting Cap	1D = Colony	F = Frosted Acrylic ^{6, 7}		C = Fleur-De-Lis	XXXX = RAL Color	T = Secondary Elevated Surge (20kV/10kA)
		3 = 240V	08			E = ANSI C136.41 7-Pin Receptacle (in Base) w/ non-Dimming PE	1M = Colony w/ Crown & Ribs			E = Blossom		U = DALI Programmable
		4 = 277V	10							F = Spike		V1 = Field Adjustable Module ⁵
			12							G = Oak		XXX = Special Options
										X = None		

- 1 If globe finial is not desired, choose FINIAL READY = X and FINIAL = X. If FINIAL READY = X, a finial cannot be added later
- $^{\rm 2}~$ A Finial is not required to complete order and can be added later
- ³ Not Available with Fusing
- ⁴ Globe Choice affects total lumen output. See Spec Table for additional information.
- ⁵ Not available with DALI "U" option
- ⁶ Only available with 1C Globe
- ⁷ Only available without Finial (Finial Ready = X)
- ⁸ Lumen offering 07 is only available with the 1M Globe
- $^{9}\,\,$ Review the Spec Tables for combination of Lumen Output, Distribution, Globe and Globe Material
- $^{\rm 10}\,$ Not available with 1C Globe







CUSTOMER NAME	
PROJECT NAME	
DATE	TYPE
CATALOG NUMBER	

LUMEN OUTPUT	DIST. CODE	GLOBE	GLOBE MATERIAL	TYPICAL INITIAL LUMENS		TYPICAL SYSTEM WATTAGE	BUG RATINGS		TM-21-11 LXX (≥10k) @ HOURS		
				4000K	3000K	120-277V	4000K	3000K	25,000 HR	50,000 HR	60,000 HR
02			A Acrylic	2300	2200	16	B1-U4-G2	B1-U4-G2	L96	L95	L94
04				4500	4400	29	B1-U5-G3	B1-U5-G3	L96	L95	L94
06	А	1C		6600	6400	44	B2-U5-G3	B2-U5-G3	L95	L93	L92
08	Symmetric	Traditional Standard		8500	8200	59	B2-U5-G4	B2-U5-G3	L94	L91	L90
10				10600	10300	77	B3-U5-G4	B3-U5-G4	L92	L88	L86
12				12600	12200	97	B3-U5-G5	B3-U5-G4	L87	L78	L75
02				2200	2100	16	B1-U4-G2	B1-U4-G2	L96	L95	L94
04		1C Traditional Standard	P Polycarbonate	4300	4200	29	B1-U5-G3	B1-U5-G3	L96	L95	L94
06	А			6300	6100	44	B2-U5-G3	B2-U5-G3	L95	L93	L92
08	Symmetric			8200	7900	59	B2-U5-G4	B2-U5-G4	L94	L91	L90
10				10200	9900	77	B3-U5-G4	B3-U5-G4	L92	L88	L86
12				12100	11700	97	B3-U5-G5	B3-U5-G4	L87	L78	L75
02		1H Classic	A Acrylic	2200	2200	16	B1-U4-G1	B1-U4-G1	L96	L95	L94
04				4500	4300	29	B2-U5-G2	B2-U5-G2	L96	L95	L94
06	А			6500	6300	44	B2-U5-G2	B2-U5-G2	L95	L93	L92
08	Symmetric			8400	8200	59	B3-U5-G2	B3-U5-G2	L94	L91	L90
10				10500	10200	77	B3-U5-G3	B3-U5-G3	L92	L88	L86
12				12400	12100	97	B3-U5-G3	B3-U5-G3	L87	L78	L75
02			A Acrylic	2200	2100	16	B1-U4-G1	B1-U4-G1	L96	L95	L94
04	B Asymmetric			4400	4300	29	B1-U5-G2	B1-U5-G2	L96	L95	L94
06		1H		6400	6200	44	B1-U5-G3	B1-U5-G3	L95	L93	L92
08		Classic		8300	8000	59	B2-U5-G3	B2-U5-G3	L94	L91	L90
10				10300	10000	77	B2-U5-G3	B2-U5-G3	L92	L88	L86
12				12300	11900	97	B2-U5-G3	B2-U5-G3	L87	L78	L75

For additional information on EPAM IES files, please refer to LED.com



Not all product variations listed on this page are DLC qualified. Visit www.designlights.org/search to confirm qualifications.





CUSTOMER NAME	
PROJECT NAME	
DATE	TYPE
CATALOG NUMBER	

LUMEN OUTPUT	DIST. CODE	GLOBE	GLOBE MATERIAL	TYPICAL INITIAL LUMENS		TYPICAL SYSTEM WATTAGE	BUG RATINGS		TM-21-11 LXX (≥10k) @ HOURS		
				4000K	3000K	120-277V	4000K	3000K	25,000 HR	50,000 HR	60,000 HR
02			A Acrylic	2800	2700	23	B2-U3-G1	B2-U3-G1	L96	L94	L93
04				4600	4500	37	B2-U3-G2	B2-U3-G2	L96	L94	L93
06	A Symmetric	1D Colony*		6100	5900	50	B3-U4-G2	B3-U4-G2	L94	L91	L90
08				7800	7600	66	B3-U4-G3	B3-U4-G3	L92	L88	L87
10				9500	9200	86	B3-U5-G3	B3-U4-G3	L87	L79	L76
02		1D Colony*	A Acrylic	2800	2700	23	B1-U3-G2	B1-U3-G2	L96	L94	L93
04				4600	4500	37	B2-U3-G3	B2-U3-G3	L96	L94	L93
06	B Asymmetric			6100	5900	50	B2-U4-G3	B2-U4-G3	L94	L91	L90
08]			7800	7600	66	B2-U4-G3	B2-U4-G3	L92	L88	L87
10				9500	9200	86	B3-U4-G3	B3-U4-G3	L87	L79	L76
02				1900	1900	23	B1-U3-G1	B1-U3-G1	L96	L94	L93
04	A	1M Colony w/	A	4200	4100	50	B2-U3-G1	B1-U3-G2	L94	L91	L90
06	Symmetric	Crown & Ribs	Acrylic	6100	5900	77	B3-U3-G2	B2-U3-G2	L90	L84	L81
07				6600	6400	86	B3-U3-G2	B3-U3-G2	L87	L79	L76
02			A Acrylic	1900	1900	23	B1-U3-G1	B1-U3-G1	L96	L94	L93
04	B Asymmetric	1M Colony w/		4200	4100	50	B1-U3-G2	B1-U3-G2	L94	L91	L90
06		Crown & Ribs		6100	5900	77	B2-U3-G3	B2-U3-G2	L90	L84	L81
07				6600	6400	86	B2-U3-G3	B2-U3-G3	L87	L79	L76

For additional information on EPAM IES files, please refer to LED.com



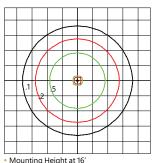


CUSTOMER NAME PROJECT NAME ___ DATE _ ____ TYPE CATALOG NUMBER

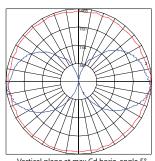
EPAM

Symmetric

12,600 Lumens 4000K EPAM01_12A40-1CA___.IES



- Mounting Height at 16
- Initial Footcandle at Grade

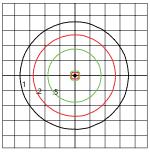


- Vertical plane at max Cd horiz. angle 5°
- Horizontal cone at max Cd vert. angle 87°

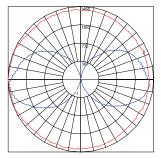
EPAM

Symmetric

12,100 Lumens 4000K EPAM01_12A40-1CP___.IES



- Mounting Height at 16'
- Initial Footcandle at Grade

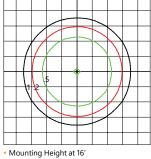


- Vertical plane at max Cd horiz. angle 180°
- Horizontal cone at max Cd vert. angle84°

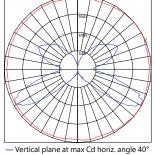
EPAM

Symmetric

12,400 Lumens 4000K EPAM01_12A40-1HA___.IES



- Initial Footcandle at Grade

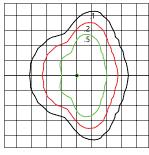


- Horizontal cone at max Cd vert. angle 64°

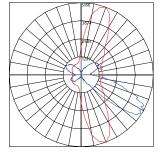
EPAM

Asymmetric

12,300 Lumens 4000K EPAM01 12B40-1HB .IES



- Mounting Height at 16'
- Initial Footcandle at Grade



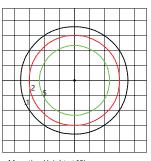
- Vertical plane at max Cd horiz. angle 70°
- Horizontal cone at max Cd vert. angle 61°



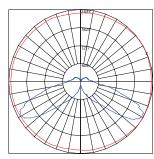
CUSTOMER NAME PROJECT NAME ___ DATE _ TYPE CATALOG NUMBER

EPAM Symmetric

9,500 Lumens 4000K EPAM01_10A40-1DA___.IES



- Mounting Height at 16'
- · Initial Footcandle at Grade

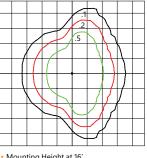


- Vertical plane at max Cd horiz. angle 61°
- Horizontal cone at max Cd vert. angle 35°

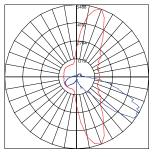
EPAM

Asymmetric

9,500 Lumens 4000K EPAM01 10B40-1DB .IES



- Mounting Height at 16'
- Initial Footcandle at Grade

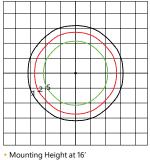


- Vertical plane at max Cd horiz. angle 70°
- Horizontal cone at max Cd vert. angle 61°

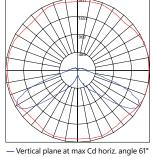
EPAM

Symmetric

6,600 Lumens 4000K EPAM01_07A40-1MA___.IES



- Initial Footcandle at Grade

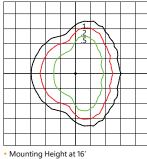


- Horizontal cone at max Cd vert. angle 20°

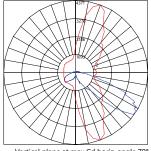
EPAM

Asymmetric

6,600 Lumens 4000K EPAM01_07B40-1MB___.IES



- Initial Footcandle at Grade

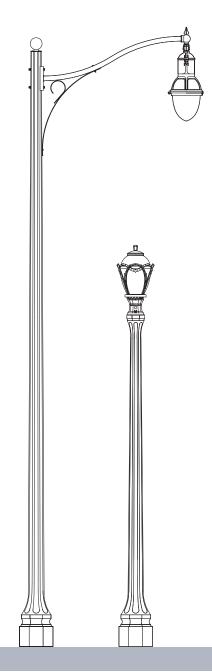


- Vertical plane at max Cd horiz. angle 70°
- Horizontal cone at max Cd vert. angle 57°



THE TALISMAN

With roots firmly established in the 20's and 30's the Talisman is an elegant version of several classic originals. In essence it is an 8 fluted version of the octagonal Belmont with the same graceful lines and proportions; the perfect choice to satisfy the tastes of many. It is available in heights from 5' to 32.5' as well as a lighted and nonlighted bollard.

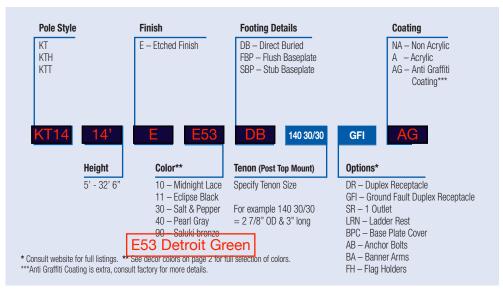


Specification Details*

Description		Catalog Number	"A" Pole Height Above Grade	"D" Tip Dimension	"E" Flare	"B" Direct Burial Length & "F" Dia.		Pole Weight Base Plate
Talisman Flared Top	11'	KT105	11'	9"	18"	4' 6" x 9 1/2"	1200 lbs	1000 lbs
Talisman Non Flared Top	12'	KT12	12' 0"	5 1/2"	18"	4' 6" x 9 1/2"	1300 lbs	1100 lbs
Talisman Flared Top	14'	KT14	13' 11"	9"	18"	4' 6" x 9 1/2"	1370 lbs	1170 lbs
Talisman Non Flared Top	20'	KTH20	20'0"	5 3/4"	18"	5' 0" x 9 1/2"	1600 lbs	1400 lbs
Talisman Non Flared Top	25'	KTH25	25' 0"	5 3/8"	18"	5' 0" x 9 1/2"	1800 lbs	1600 lbs
Talisman Non Flared Top	20'	KTT20	20'0"	7 3/8"	21"	5' 0" x 12"	2270 lbs	2000 lbs
Talisman Non Flared Top	25'	KTT25	25' 0"	6 1/2"	21"	5' 0" x 12"	2470 lbs	2200 lbs
Talisman Non Flared Top	30'	KTT30	30'0"	5 7/8"	21"	5' 0" x 12"	2630 lbs	2360 lbs
Talisman Non Flared Top	33'	KTT32.5	32' 6"	5 1/2"	21"	6' 0" x 12"	2720 lbs	2450 lbs

^{*} Bollard specification details can be found on our website

How to Catalog for Talisman Concrete Pole



Footing Details

