1. GENERAL

Select areas of the Tyndall Stone masonry cladding show signs of distress, including cracking and displacement, both in the stone and the mortar. This section details the types of repairs to be utilized to address these areas of distress.

Identification of the areas of repair are to be established by the Contractor but under the direction of the Contract Administrator with respect to the criteria for repair.

The work of **Method A,** Mortar Joint Repointing, is included under a Fixed Price. All repointing work, to all areas, as required by the outlined criteria, will be included in the indicated Fixed Price. Access to all stone areas will be included in the indicated Fixed Price.

The work of **Methods B** to **H** will be included in Unit Price and/or Fixed Price Items as indicated elsewhere in the Specifications and Drawings.

1.1 Description of Repair Methods

.1 **Method A**: Mortar Joint Repointing:

Repoint existing Tyndall stone masonry joints throughout all four faces of the building, including walls above lower roofs. Work must include the removal of all caulking applied over the joints followed by installation of the specified joint mortar.

a) Visually inspecting for obvious signs of deteriorated masonry;
b) Testing of joints, not visually unsound, to identify unsound joints, and
c) Raking and repointing unsound joints.

.2 **Method B**: Face Pinning of Stone Unit using Helifix anchors

.3 **Method C**: Stone Dutchman repairs: Type 1 utilizing existing stone segment; Type 2 utilizing new stone segment.

.4 **Method D**: Structural Pinning using Anchor Pins and Epoxy Grout.

.5 **Method E**: Stone Patching with Repair Mortar

.6 **Method F**: Epoxy Injection of Cracks

.7 **Method G:** Rebuild localized areas of brick masonry

.8 **Method H:** Lintel and Sill Repairs

2. PRODUCTS

2.1 Materials

.1 Mortar materials: to Section 04 11 50 – Masonry Mortar.

.2 Stainless steel threaded rod to ASTM F593.

.3 Anchor bolt epoxy resin to be Sikadur Injection Gel, in side-by-side cartridge.

.4 Anchors used to reinforce existing brick to be Helifix stainless steel wall ties, manufactured and supplied by Blok-Lox Ltd., 30 Millwork Drive, Weston, ON, Ph: (416) 749-1010.

.5 Stone anchors for stone stabilization to be Hilti HY20 Type 304 stainless steel anchors c/w stainless steel sieve.

3. EXECUTION

3.1 General

.1 Perform work in accordance with CAN3-A371(latest).

.2 Use manual raking tools to remove deteriorated mortar from masonry joints. Do not use power tools unless authorized by Contract Administrator.

.3 Tool and compact using jointing tool to force mortar into joint.

.4 Finish joints to match existing joints, except where specified otherwise.

.5 Use suitable approved jointing tool to form compacted slightly concave tooled joints on exterior joints.

.6 Use calking gun to inject mortar for fine gauged masonry areas where mortar joints are too narrow for tool penetration.

.7 Comply with manufacturer's written specifications and recommendations for surface preparation, mixing, application, and curing of mortars.

.8 When temperature is 4^{o}C or less, suspend work until temperature is anticipated to remain above 4^{o}C, unless provisions are in place to protect the mortar from freezing.

3.2 Method A: Mortar Joint Repointing

.1 Repoint masonry on all four faces of the building. Price to include removal of all caulking placed over mortar joints followed by installation of joint mortar.

.2 Procedure of testing: inspect joints visually for obvious signs of deteriorated masonry. As a general rule, mortar may be satisfactory if the pointing is firm, intact and not eroded more than ½" from the face of the masonry. To judge which joints may need repointing, use the following criteria:

I) **Open Joints:** the mortar is deeply eroded (more than one half inch from the face of the masonry), or the mortar has fallen out, or,
II) **Cracked Joints:** cracks, hairline width or larger, have formed in the mortar, or,

III) **Separated Joints:** the mortar and masonry no longer adhere, resulting in a gap or crack between the two, or the mortar is sitting loosely in the joint, or,

IV) **Unsound Joints:** joint is found to contain voids or weak areas as revealed by hammer-sounding, by raking with an appropriate tool or other approved method to determine score resistance, surface unsoundness or delamination.

.3 Raking joints:

.1 Rake unsound joints free of deteriorated and loose mortar, dirt and other undesirable material. Joints should be raked to a minimum depth of 2 to 2.5 times the vertical joint height, but at no point less than 1".
.2 Clean out voids and cavities encountered during raking. Remove mortar cleanly from masonry, leaving square corners and a flat surface at back of cut.
.3 Clean by compressed air, surfaces of joints without damaging texture of exposed joints.
.4 Flush open joints and voids; clean with low pressure water and if not free draining blow clean with compressed air.
.5 Leave no standing water.
.6 Before filling joints, any masonry that is loose should be reset. Any pieces that are chipped off while removing old mortar shall be repaired at the contractor's cost.

.4 Repointing

.1 Masonry to be repointed shall be damp but not wet. Do not allow free standing water.
.2 Mortar joints are to be filled in successive layers. Deeper joints shall be filled first compacting new mortar in several layers until back of joint is flat. Several layers (maximum ½" each) will be needed to fill the joint flush with the surface of the masonry. Allow each layer to reach thumbprint hardness before the next is applied.
.3 Keep masonry damp while pointing is being performed.
.4 Do no pointing in freezing weather unless provisions are in place to protect mortar.

.5 Replacement

.1 Clean units by washing with water and natural fibre brush before laying.
.2 Dampen surfaces and apply mortar.
.3 Lay unit after mortar in courses below has hardened sufficiently to support weight.
.4 Set unit on water soaked softwood wedges to support it in proper alignment until mortar has set. Remove wedges when dry, do not break off.
.5 Remove mortar dropping from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.

.6 Tooling

.1 Do not finish joint by using trowel to smooth out mortar.
.2 Finish joint with slicker narrow enough to be placed inside the joint. Pull the slicker across surface of mortar to compress it.
.3 Proper timing of the tooling operation is essential. If mortar is tooled when it is too soft, the colour will be too light and hairline cracks may occur; if mortar

is too hard, dark streaks may result and good closure between mortar and stone may be difficult to achieve.

.4 Do not feather edge mortar. Joints shall be finished with a slight concave joint profile unless noted otherwise.

.7 Mock-ups

.1 Provide mock-ups in accordance with 01 45 00 Quality control.

.2 Repointing mock-ups are required at the following locations:

.1 South face brick repointing: provide mock-up size of 50 square feet. Allow to stand minimum 7 days prior to continuing repointing work to allow assessment of colour change for cured mortar.

.2 Typical face tyndall stone repointing: provide mockup size of 100 square feet. Allow to stand minimum 7 days prior to continuing repointing work to allow assessment of colour change for cured mortar.

3.3 Method B: Face Pinning of Stone Unit using Helifix anchors

.1 A ¼" diameter entry hole shall be predrilled through the existing mortar joint and drilled into the stone and back-up material at an angle of 45 degrees. This drill procedure shall be carried out by means of a high speed electric hammer drill (3 Jaw Chuck Type)

.2 The 5/16" Helifix 304 stainless steel anchor shall then be driven into position with a Helifix DryFix power tool mounted on an SDS Type concrete hammer drill and recessed a maximum of 0.5 inches below the surface. The masonry shall then be patched with mortar to match the substrate to mask the anchor location.

.3 Contractor to obtain all relevant drill bits and setting tools from manufacturer and install anchors in accordance with manufacturer's specification requirements.

.4 Install anchors to cross existing crack, minimum one from each side.

3.4 Method C: Stone Dutchman repairs

.1 Remove fractured area, carefully in order to prevent fracturing of sound substrate. Saw-cut to depth required to remove damaged stone unit. Where freeze-thaw deterioration has induced multiple fractures, sawcut a minimum one inch beyond deteriorated area.

.2 Dutchman Repair Type 1: Where possible, re-use existing stone piece.

.3 Dutchman Repair Type 2: Where existing stone segment can not be salvaged, supply new replacement Tyndall stone segment.

.4 Drill 3/8" diameter holes, a minimum of three inches into substrate. Not less than two dowels will be used but allow for four dowels for every square foot of exposed face.

.5 Blow out holes, install SikaDur injection gel into base of holes and install 6 mm stainless steel dowels. Ensure dowels project a minimum of three inches into the Dutchman. Where the repair section is less than three inches, have dowel project to within ½" of exterior face.

.6 Upon sufficient cure, butter faces of both stone with Sikadur epoxy, join stones and clamp for 24 hours. Reinstate repaired units and repoint perimeter with specified mortar.

3.5 Method D: Structural Pinning Using Anchor Pins and Epoxy Grout

.1 Determine with Contract Administrator stone units requiring structural pinning to back-up.

.2 Drill or core a 2" diameter hole, extending not more than 5/8" into the stone face. Retain plug.

.3 Drill a 7/8" hole, centred on the larger hole, extending 6" into sound substrate. Blow out hole with compressed air.

.4 Insert screen tube into hole.

.5 Inject hole with Hilti injection gel using a tube extension on the injection gun. With plate washer and nut in place on end of threaded Type 304 Stainless Steel rod, insert rod through stone and into resin in back-up. Ensure plate washer is in tight contact with stone. Ensure that end of rod is a minimum of ¼" below the outside face of the stone.

.6 Rout plug to match profile of nut and install plug in hole.

3.6 Method E: Stone Patching with Repair Mortar

.1 Where stone fractures are shallow, or small original piece is missing, follow the steps outlined below under the direction of the Contract Administrator.

.2 Patch spalled areas with approved repair mortar according to manufacturer's instructions, except as modified herein.

.3 At areas to receive patches, remove all loose mortar and masonry. Cut away an additional ½" of substrate to ensure that surface to be patched is solid and stable. Sound masonry with hammer or chain to verify its integrity. Remove any sealant residue.

.4 Where existing cramp anchors, threaded rod anchors, or dowels have been cut and pieces remain embedded in the substrate; anchor pieces that are free of rust, are solidly embedded, and do not project beyond the surface of the masonry unit may remain. Anchor pieces that are rusted, loose or that project beyond the edges of the masonry unit shall be removed. Method of anchor removal must be approved by the Contract Administrator. Repair damage to substrate resulting from anchor removal.

.5 Cut the edges of the repair area to provide a minimum depth of 1/8". Do not overcut corners of patch; stop short of corner and chip out remainder by hand without damaging surrounding masonry. Feathered edges in patch area are not permitted.

Supply and install stainless steel dowels. Clean surface to receive patch with 1200 p.s.i. pressure water wash.

.6 Moisten the substrate using clean water. Jahn mortar should be applied to a glistening wet surface with no pooling water. If the surface is allowed to dry out before applying M70, this step must be repeated.

.7 Apply mortar using a trowel in a series of lifts with no waiting periods or scratch coat necessary between layers, up to a total maximum thickness of 3". For patches thicker than 3", apply mortar in two layers, allowing the first to cure before applying the second. If cement skin forms, scrape approximately 1/16" of mortar off, then dampen first layer before application of second layer. Use light pressure during applications. Work mortar firmly into surface of masonry and under and around all mechanical anchors.

.8 Build up patching material so that it is slightly above the adjacent masonry surface. Allow 15-30 minutes to set lightly, then scrape off excess using a straight edge. Do not press down or float the patch. Where patch occurs at a panel edge or corner, form mortar to match the profile of the surrounding masonry. In all cases, finish patch so that it is indistinguishable from surrounding adjacent masonry.

To ensure colour uniformity, wait until the appropriate time has lapsed and the material being removed is the consistency of dry sand.

.9 To obtain a smooth finish, extra water can be used in the mix and the finished patch can be floated or trowelled to leave a smooth finish.

.10 Lightly mist the patch with water to wet the entire surface of the finished patch approximately 30 minutes to 1 hour after completion of hot sunny days, and approximately 2 hours on cool cloudy days. Time will vary with temperature and humidity. Mist at least once a day, but as often as possible on the two days following patch installation. Install patch on days when area will be available for misting during the next two consecutive days. If this is not possible, cover patch with plastic, taped in place, and begin misting as soon as possible.

.11 Mock-ups

.1 Provide mock-ups in accordance with 01 45 00 Quality control.

.2 Provide mock-up size of 5.0 square feet. Allow to stand minimum 7 days prior to continuing patching work to allow assessment of colour change for cured patching material.

3.6 Method F: Epoxy Injection of Cracks

.1 At cracks in stone designated for injection, the contractor shall drill a hole corresponding to the port diameter, inserted to a depth of one-half of the thickness of the stone. Blow out holes and install ports.

.2 Blow out holes with oil free compressed air and apply 2" wide masking tape to length of crack. Firmly press tape into crack. Slit tape carefully at port locations.

.3 Gently hammer injection port into crack at drilled hole locations. Use grease-free modelling clay to seal interface of port and stone. Insert injection valve into port and inject with Capweld 673 Resin at very low pressure, about 5 psi using a pressure pot.

.4 Commence at lowest port and continue upward along crack. Carefully follow path of resin, using a flashlight and magnifying glass if required. Allow resin to come to the surface. Do not allow resin to overflow face of crack.

.5 Upon sufficient cure, remove tape and ports. Grind off any residual resin which has stained the surface and patch port holes with stone patching mortar.

3.7 Method G: Rebuild Localized Areas of Brick Masonry

.1 For extent determined by on-site review with Engineer, rebuild localized areas of brick masonry.

.2 Remove existing brick, up to 2 wythes deep into wall construction and rebuild wall to restore original configuration and soundness.

.3 Rebuild using existing brick removed from indicated repair location under Unit Price.

.4 Where existing brick is in poor condition or has been previously dislodged from the wall, the Contractor is to provide suitable replacement brick salvaged from another source off-site. The supply of the replacement brick is to be paid for under a separate unit price.

.5 Provide samples of replacement brick units in accordance with 01 33 00 Submittals.

3.8 Method H: Lintel and Sill Repairs

.1 At locations determined by on-site review with Contract Administrator, repair lintels and sills.

.2 Shore lintel or sill prior to commencing work.

.3 Drill 3 ½" diameter core in underside of lintel/sill at a 45 degree angle, one core each side of crack towards crack. Salvage cores for re-installation.

.4 Drill 13/16" diameter hole 5" beyond crack from each side.

.5 Install stainless steel Hilti rod in HY150 adhesive.

.6 Reinstall plug upon completion.

4.0 FIXED/UNIT PRICE

4.1 Method A: Mortar Joint Repointing The Contractor shall provide a fixed price to repoint all of the stone mortar joints throughout all faces and elevations of the building. The fixed price is to include all labour, materials, access and supervision required to complete the work as described in the specifications and drawings.

4.2 **Method B: Face Pinning of Stone Unit using Helifix Anchors** The Contractor shall provide a unit price to supply and install Helifix anchors into the masonry, at locations determined on-site by the Contract Administrator. The price shall be per Helifix anchor and shall apply to general areas of Helifix installation for stabilization of areas of the stone cladding and also apply to specific areas of face pinning across cracks as shown on the drawings.

The unit price work shall be completed at areas identified on-site by the Contract Administrator and shall include all labour, material, access, equipment, supervision and incidentals. The areas of repair must be measured and agreed to between the Contract Administrator and Contractor, prior to proceeding. This measurement shall form the basis of payment. If the Contractor repairs additional areas without consultation and approval from the Contract Administrator, they shall not be paid for the additional areas. Should the number of units differ at all from the amount estimated, there shall be no change in the unit price.

4.3 **Method C: Stone Dutchman Repairs** The Contractor shall provide a unit price to repair fractured stone areas as directed by the Contract Administrator on site. The unit price work shall be completed at areas identified on-site by the Contract Administrator and shall include all labour, material, access, equipment, supervision and incidentals. The areas of repair must be measured and agreed to between the Contract Administrator and Contractor, prior to proceeding. This measurement shall form the basis of payment. If the Contractor repairs additional areas without consultation and approval from the Contract Administrator, they shall not be paid for the additional areas.

The unit price for each Type of Dutchman repair shall be per cubic foot of volume of Dutchman stone piece assuming prismatic stone with flat faces. Minimum payment is for 0.5 cu. ft. Additional sculpting of new stone to achieve more extensive exterior face detailing, where required, to be under a unit price per hour of labour to sculpt stone.

4.4 **Method D: Structural Pinning Using Anchor Pins and Epoxy Grout** The Contractor shall provide a unit price to supply and install the Hilti HY 150 anchors, completed with face patching as directed by the Contract Administrator on site and shown on the drawings. The unit price work shall be completed at areas identified on-site by the Contract Administrator and shall include all labour, material, access, equipment, supervision and incidentals. The areas of repair must be measured and agreed to between the Contract Administrator and Contractor, prior to proceeding. This measurement shall form the basis of payment. If the Contractor repairs additional areas without consultation and approval from the Contract Administrator, they shall not be paid for the additional areas.

The unit of measurement shall be per repair location, assuming 2 Hilti anchors per location.

4.5 **Method E: Stone Patching with Repair Mortar** The Contractor shall provide a unit price to repair fractured stone using the stone patching mortar as directed by the Contract Administrator on site. The unit price shall be completed at areas identified on-site by the Owner and/or Contract Administrator and shall include all labour, material, access, equipment, supervision and incidentals. The areas of repair must be measured and agreed to between the Contract Administrator and Contractor, prior to proceeding. This measurement shall form the basis of payment. If the Contractor repairs additional areas without consultation and approval from the Contract Administrator, they shall not be paid for the additional areas.

The unit of measurement will be 1.0 square foot face area of patch, with one price for patches up to 3” thick, and one price for patches up to 5” thick.

4.6 **Method F: Epoxy Injection of Cracks** The Contractor shall provide a unit price to epoxy inject cracks in the stone as directed by the Contract Administrator on site and shown on the drawings. The unit price work shall be completed at areas identified on-site by the Contract Administrator and shall include all labour, material, access, equipment, supervision and incidentals. The areas of repair must be measured and agreed to between the Contract Administrator and Contractor, prior to proceeding. This measurement shall form the basis of payment. If the Contractor repairs additional areas without consultation and approval from the Contract Administrator, they shall not be paid for the additional areas. The minimum length of measurement shall be 1.0 lin. ft.

4.7 **Method G: Rebuild Localized Area of Brick Masonry** The Contractor shall provide a unit price to remove and re-install brick units as directed by the Contract Administrator and as described herein. The unit price work shall be completed at areas identified on-site by the Contract Administrator and shall include all labour, material, access, equipment, supervision and incidentals. The areas of repair must be measured and agreed to between the Contract Administrator and Contractor, prior to proceeding. This measurement shall form the basis of payment. The minimum area of repair shall be 1.0 square foot.

A separate unit price shall be provided for replacement brick units if existing units cannot be salvaged. Replacement brick units shall be selected to match as closely as possible existing brick and are subject to acceptance by the Contract Administrator. Unit price shall be per brick unit.

4.8 **Method H: Lintel and Sill Repairs** The Contractor shall provide a unit price to supply and install the Hilti anchors, complete with removal and re-installation of core plugs as directed by the Contract Administrator on site and shown on the drawings. The unit price work shall be completed at areas identified on-site by the Contract Administrator and shall include all labour, material, access, equipment, supervision and incidentals. The areas of repair must be measured and agreed to between the Contract Administrator and Contractor, prior to proceeding. This measurement shall form the basis of payment. If the Contractor repairs additional areas without consultation and approval from the Contract Administrator, they shall not be paid for the additional areas.

The unit of measurement shall be per repair location.

END OF SECTION