

**Part 1            General**

**1.1                WORK COVERED BY CONTRACT DOCUMENTS**

- .1            Work of this Contract comprises localized structural concrete and steel decking repairs and localized roofing replacement at the Winnipeg Transit Garage, located at 1520 Main Street and further identified as the Work.

**1.2                CONTRACT METHOD**

- .1            Construct Work under a Purchase Order issued by City of Winnipeg.

**1.3                REFERENCES AND CODES**

- .1            Perform Work in accordance with the National Building Code of Canada (NBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2            Meet or exceed requirements of contract documents, specifications, as specified standards, codes and referenced documents, latest editions.

**1.4                WORK SEQUENCE**

- .1            Construct Work in stages to accommodate City of Winnipeg's continued use of adjacent areas and premises during construction.
- .2            Co-ordinate Progress Schedule and co-ordinate with City of Winnipeg Occupancy during construction.
- .3            Construct Work in stages to provide for continuous facility usage. Do not close off usage of facilities until use of one stage of Work will provide alternate usage.
  - .1            The Contractor will be restricted to work in two (2) bus lanes at a given time. Prior to work starting in a new lane, all work in previous lane, including any required cleaning and demobilization must be completed, and the lane must be turned over to the City of Winnipeg for usage.
- .1            Work on multiple items may occur simultaneously to meet schedule. Work to be prioritized in the general conformance with the following:
  - .1            Structural repairs deemed necessary by the Contract Administrator, including and repairs of reinforced concrete and steel deck.
  - .2            Roofing repairs at locations of concrete and steel deck structural repairs.
  - .3            General roofing replacement to specified extents.

**1.5                CONTRACTOR USE OF PREMISES**

- .1            Limit use of premises for Work, for storage, and for access, to allow:
  - .1            City of Winnipeg occupancy.
  - .2            Work by other contractors.

- .2 Co-ordinate use of premises under direction of Contract Administrator.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

**1.6 CITY OF WINNIPEG OCCUPANCY**

- .1 City of Winnipeg will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with City of Winnipeg in scheduling operations to minimize conflict and to facilitate City of Winnipeg usage.

**1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations, occupants, and normal use of premises. Arrange with Contract Administrator to facilitate execution of work.

**1.8 EXISTING SERVICES**

- .1 Notify, City of Winnipeg and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves connecting to existing services, give City of Winnipeg minimum 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions.
- .3 Check for embedded services in concrete prior to demolition work. Where unknown services or embedded electrical conduit are encountered, immediately advise Contract Administrator and confirm findings in writing.
- .4 Protect, relocate or maintain existing active services.

**1.9 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy of each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 Change Orders.

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- .6 Other Modifications to Contract.
- .7 Field Test Reports.
- .8 Copy of Approved Work Schedule.
- .9 Health and Safety Plan and Other Safety Related Documents including:
  - .1 Material data sheets (MSDS) on all products used in Project.
- .10 Other documents as specified.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

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**1.1 RELATED SECTIONS**

- .1 Section 01 11 00 – Summary of Work.

**1.2 ACCESS AND EGRESS**

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, in accordance with relevant municipal, provincial and other regulations.

**1.3 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Contract Administrator to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .5 Keep within limits of work and avenues of ingress and egress.

**1.4 WORKING HOURS**

- .1 Working hours will be restricted to between 7:30 a.m. and 2:30 p.m. Monday through Friday.
- .2 Working Hours outside of the established hours are to be negotiated with the City of Winnipeg on a case-by-case basis. Notwithstanding the above, all Work shall be completed in conformance with City of Winnipeg Neighbourhood Liveability By-Law No. 1/2008.
- .3 Notwithstanding the above, all Work shall be completed in conformance with the City of Winnipeg Noise Control By-Law No. 2480/79.

**1.5 SPECIAL REQUIREMENTS**

- .1 Construct Work in phases to provide for continuous City of Winnipeg usage. Do not close off public access to facilities until proper notification has been provided to both the Contract Administrator and City of Winnipeg and use of completed phases will provide alternate usage if necessary.
- .2 All work which interferes with the normal operation of the facility and/or require closures of bus lanes will have to be precisely coordinated with City of Winnipeg.
- .3 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .4 Keep within limits of work and avenues of ingress and egress.

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**1.6 BUILDING SMOKING ENVIRONMENT**

.1 Smoking is not allowed.

**Part 2 Products**

**2.1 NOT USED**

.1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

.1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 03 92 40 – Repair of Slab-Joist Systems
- .2        Section 03 93 20 – Pressure Grouting

**1.2                REFERENCES**

- .1        City of Winnipeg contract documents.

**1.3                CASH ALLOWANCES FOR TESTING, EXAMINATION**

- .1        Include in Contract Price, allowances to cover costs of site and laboratory testing and examination listed.
- .2        Tests and testing requirements, as specified shall be carried out by independent examining, testing companies, as appointed by the Contractor and acceptable to the Contract Administrator.
- .3        Obtain quotations from examining and testing companies and submit to Contract Administrator for review.
- .4        Pay all costs for specified examination, testing work performed by independent examining and testing companies, from cash allowance specified.
- .5        The invoices for work performed by the specialist examining and testing companies shall be directed to the Contractor, and forwarded with monthly request for payment. Invoices will be processed onto a Change Order periodically to formalize an expenditure from the Cash Allowance.
- .6        Cash Allowance is for payment of examining, testing company invoices only. Contractor costs for site supervision and coordination is deemed to be part of overhead included in the Total Estimated Contract Price.
- .7        Specific testing requirements are outlined in respective technical Sections. Materials failing to meet specified requirements shall be replaced or repaired and retested as directed by Contract Administrator, with all costs involved in retesting borne by the Contractor.
- .8        Include testing/examination allowances for:
  - .1        Testing cash allowance lump sum of \$ 1,000.00.

**1.4                CASH ALLOWANCES FOR PRODUCTS, LABOUR, MATERIAL**

- .1        Include in Contract Price, allowances to cover Work specified in respective Sections or as otherwise listed below.

- .2 Work may be carried out by sub-contractors already employed on site, or by sub-contractors brought in for the Cash Allowance work.
- .3 Obtain quotations from for the work and submit to Contract Administrator for review.
- .4 Pay all costs for work performed from cash allowance specified.
- .5 The invoices for work performed shall be directed to the Contractor, and forwarded with monthly request for payment. The invoices will be processed onto a Change Order periodically to formalize an expenditure from the Cash Allowance.
- .6 Cash Allowance is for payment of invoices from companies carrying out the Work.
- .7 Include cash allowances for:
  - .1 Electrical repairs: \$ 2,000.00.

**1.5 ADJUSTMENTS OF CASH ALLOWANCES**

- .1 Contractor shall not exceed Cash Allowances without authority from Contract Administrator. Contractor will not be allowed expenses or profit on overage unless authority for over expenditure is obtained. Over expenditure of Cash Allowances may, at Contract Administrator's discretion, be deducted from sums of money due Contractor, should Contractor exceed allowance without authority from the Contract Administrator.
- .2 Adjustments to the Cash Allowances will be made by a written Change Order, signed by the City of Winnipeg, or as amendments to the Contract at the time of final payment, on the basis of submitted net cost invoices.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS SPECIFIED ELSEWHERE**

- .1            Particular requirements for inspection and testing to be carried out by testing laboratory designated by Contract Administrator are specified under various sections.

**1.2                APPOINTMENT AND PAYMENT**

- .1            Examination and testing shall be carried out by independent testing laboratory appointed by the Contract Administrator and acceptable to the Contractor.
- .2            Contractor will pay for services of testing laboratory from cash allowances specified except as follows:
  - .1            Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2            Inspection and testing performed exclusively for Contractor's convenience.
  - .3            Mill tests and certificates of compliance.
- .3            Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Contract Administrator to verify acceptability of corrected work.

**1.3                CONTRACTOR'S RESPONSIBILITIES**

- .1            Provide labour, equipment and facilities to:
  - .1            Provide access to Work for inspection and testing.
  - .2            Facilitate inspections and tests.
  - .3            Make good Work disturbed by inspection and test.
  - .4            Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2            Notify testing agency sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3            Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4            Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Contract Administrator.

**Part 2            Products**

**2.1                NOT USED**

- .1            Not Used.

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**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                PRECONSTRUCTION MEETING**

- .1        Within 5 working days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2        Senior representatives of City of Winnipeg, Contract Administrator, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3        Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4        Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5        Agenda to include:
  - .1        Appointment of official representative of participants in the Work.
  - .2        Schedule of Work: in accordance with Section 01 32 16 - Construction Progress Schedule.
  - .3        Submission of shop drawings, concrete mix statements, samples. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4        Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
  - .5        Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
  - .6        Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .7        Delivery schedule of specified materials.
  - .8        Appointment of inspection and testing agencies or firms.
  - .9        Insurances, transcript of policies.

**1.2                PROGRESS MEETINGS**

- .1        During course of Work schedule progress meetings at biweekly intervals.
- .2        Contractor, major Subcontractors involved in Work, Contract Administrator and City of Winnipeg's representative are to be in attendance.
- .3        Contract Administrator will be responsible for recording minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 working days after meeting.
- .4        Agenda to include the following:
  - .1        Review, approval of minutes of previous meeting.
  - .2        Review of Work progress since previous meeting.
  - .3        Field observations, problems, conflicts.
  - .4        Problems which impede construction schedule.

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- .5 Review of off-site fabrication delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for affect on construction schedule and on completion date.
- .12 Other business.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1      City of Winnipeg Bid Opportunity 700-2017, Purchase Order and associated contract documents.
- .2      Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .3      Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1      Material Safety Data Sheets (MSDS).
- .4      Province of Manitoba
  - .1      The Workers Compensation Act RSM 1987 - Updated 2006.
  - .2      Manitoba Regulation 217/2006 – Workplace Safety and Health Regulation.

**1.2                SUBMITTALS**

- .1      Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit copies of incident and accident reports.
- .3      Submit WHMIS MSDS - Material Safety Data Sheets on all products used in conjunction with the Work.
- .4      W.H.I.M.I.S. Training: Provide copies of valid certification/training for all employees (regular or temporary) including all subcontractors.
  - .1      All individuals involved in the application of any product shall meet all WHMIS/provincial standards safety/protection requirements at all times.
- .5      Upon request submit Letter of Good Standing or C.O.R. Certificate.

**1.3                GENERAL REQUIREMENTS**

- .1      Contractors to comply with requirements of City of Winnipeg Bid Opportunity 700-2017.

**1.4                RESPONSIBILITY**

- .1      Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2      Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

**1.5                PERSONAL PROTECTIVE EQUIPMENT (PPE)**

- .1      All employees (regular or temporary) of contractor and subcontractors shall wear PPE in accordance with Manitoba Regulation 217/2006.

- .2 Fall Protection: Provide fall protection in accordance with Manitoba Regulation 217/2006.

## 1.6 EMBEDDED ELECTRICAL CONDUIT

- .1 When the presence of embedded electrical conduits are known:
  - .1 Prior to demolition ensure circuits feeding conduit within repair areas are disconnected, de-energized, or abandon.
  - .2 Coordinate shutdowns with City of Winnipeg.
- .2 When the presence of embedded electrical conduits is unknown or are known but locations cannot be determined:
  - .1 Prior to demolition of concrete repairs, scan existing concrete structures for embedded electrical conduit.
  - .2 Ensure circuits feeding conduit within repair areas are disconnected, de-energized, or abandon.
  - .3 Coordinate shutdowns with City of Winnipeg.
  - .4 Costs of scanning to be paid for via the testing cash allowance.

## 1.7 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction, governing codes, regulations and bylaws.

## 1.8 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

## Part 2 Products

### 2.1 NOT USED

- .1 Not used.

## Part 3 Execution

### 3.1 NOT USED

- .1 Not used.

END OF SECTION

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 01 21 00 – Allowances.

**1.2                REFERENCES**

- .1            City of Winnipeg Bid Opportunity 700-2017, Purchase Order and associated contract documents.

**1.3                CONTRACTOR QUALIFICATIONS**

- .1            Minimum of 10 years' experience in the repair and restoration of concrete structures.
- .2            Provide minimum 5 examples of local projects demonstrating successful performance concrete repairs of similar size and complexity to specified Work within the last 3 years.
- .3            Provide minimum 3 references exhibiting successful performance concrete repairs within the last 3 years.
- .4            Site Superintendent to have a minimum of 5 years' experience exhibiting successful performance in concrete restoration projects. Provide references upon request.
- .5            Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.

**1.4                INSPECTION**

- .1            Allow Contract Administrator access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2            Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions, or law of Place of Work.
- .3            If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4            Contract Administrator will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

**1.5                INDEPENDENT INSPECTION AGENCIES**

- .1            Independent Inspection/Testing Agencies will be engaged for purpose of inspecting and/or testing portions of Work. Cost of such services will be paid by the Contractor via the testing cash allowance.
- .2            Allocated costs: to Section 01 21 00 - Allowances.

- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no cost to City of Winnipeg. Pay costs for retesting and reinspection.

**1.6 ACCESS TO WORK**

- .1 Allow inspection/testing agencies access to Work.
- .2 Co-operate to provide reasonable facilities for such access.

**1.7 PROCEDURES**

- .1 Notify appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

**1.8 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of the Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, City of Winnipeg will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Contract Administrator.

**1.9 REPORTS**

- .1 Submit copies of inspection and test reports to City of Winnipeg and Contract Administrator.
- .2 Provide copies to subcontractor of work being inspected or tested.
- .3 Provide copies of concrete test results to Concrete Supplier.

**1.10 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Contract Administrator and may be authorized as recoverable.

**1.11 MOCK-UPS**

- .1 Upon request of Contract Administrator, prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Contract Administrator and as specified in specific Section.
- .3 Prepare mock-ups for Contract Administrator's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Mock-ups may remain as part of Work.
- .6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

**1.12 MILL TESTS**

- .1 Submit mill test certificates as requested by Contract Administrator.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                INSTALLATION AND REMOVAL**

- .1    Provide temporary utilities controls in order to execute work expeditiously.
- .2    Remove from site all such work after use.

**1.2                WATER SUPPLY**

- .1    The City of Winnipeg will make available, for the extent that it is available, a supply of potable water for construction use at no charge to the Contractor
- .2    Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .3    The Contractor shall provide all necessary hoses, lines, connections, and other ancillary hardware which may be required.
- .4    The services are to be returned to their original condition at the temporary locations, or left in an altered condition only as approved by the City of Winnipeg.

**1.3                TEMPORARY HEATING AND VENTILATION**

- .1    Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2    Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted.
- .3    Provide temporary heat and ventilation in enclosed areas as required to:
  - .1    Facilitate progress of Work.
  - .2    Protect Work and products against dampness and cold.
  - .3    Prevent moisture condensation on surfaces.
  - .4    Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5    Provide adequate ventilation to meet health regulations for safe working environment.
- .4    Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5    Ventilating:
  - .1    Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
  - .2    Provide filtered local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3    Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, may not be adequate for heating. Pay costs for maintaining temporary heat if existing heat source is not adequate. Be responsible for damage to heating system if use is permitted.
- .7 City of Winnipeg will pay utility charges when temporary heat source is existing building equipment.
- .8 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
  - .1 Conform with applicable codes and standards.
  - .2 Enforce safe practices.
  - .3 Prevent abuse of services.
  - .4 Prevent damage to finishes.
  - .5 Vent direct-fired combustion units to outside.
- .9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

**1.4 TEMPORARY POWER AND LIGHT**

- .1 The City of Winnipeg will make available, for the extent and capacity that it is locally available, access to electrical power during construction for temporary lighting and operating of power tools.
- .2 Connect to existing power supply in accordance with Canadian Electrical Code.
- .3 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.
- .4 Temporary power for equipment requiring in excess of that available on-site is responsibility of the Contractor.
- .5 Provide and maintain temporary lighting throughout project.

**1.5 TEMPORARY COMMUNICATION FACILITIES**

- .1 Provide and pay for cellular telephone for site superintendent and use of Contract Administrator

**1.6 TEMPORARY COMMUNICATION FACILITIES**

- .1 Provide and pay for cellular telephone for site superintendent and use of Contract Administrator

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**1.7 FIRE PROTECTION**

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**1.1 REFERENCES**

- .1 City of Winnipeg Bid Opportunity 700-2017, Purchase Order and associated contract documents.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA O121-08, Douglas Fir Plywood.

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

**1.3 SCAFFOLDING**

- .1 Scaffolding shall be design and erected in accordance with Manitoba Regulation 217/2006 and CAN/CSA S269.2.
  - .1 Where Manitoba Regulation 217/2006 requires scaffolds to be designed by a professional Contract Administrator. Submit shop drawings bearing the seal of professional Contract Administrator registered in the Province of Manitoba.

**1.4 SITE STORAGE/LOADING**

- .1 Confine work and operations of employees to Contract Documents and as directed by facility manager. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

**1.5 CONSTRUCTION PARKING**

- .1 The Contractor will be provided with two (2) stalls at the facility parking lot, Maintain such areas for duration of Contract and make good damage resulting from Contractors' use.

**1.6 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

**1.7 SANITARY FACILITIES**

- .1 The Contractor may use on-site facilities for the duration of the project. The facilities must be maintained in a neat condition or use will be revoked.

**1.8 POLLUTION CONTROL**

- .1 The use of gas or diesel powered equipment within facility interior is strictly prohibited.
- .2 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures and/or other control methods. If necessary, arrange for shutdown of air handling units which have air intakes in the vicinity of the work. Dust can trigger fire alarm smoke detectors and can plug ducts and filters. Dust and suspended particles can damage air-cooled mechanical and electrical equipment. If necessary, arrange for shutdown of this equipment. Contractor shall be responsible for all damages. Prior to start of work, identify locations of air intakes and air-cooled mechanical and electrical equipment within and adjacent to the area of work.
- .3 Control noxious and hazardous gases. Prevent hazardous accumulations. Control emission from equipment and plant to local authority's emission requirements.
- .4 On exterior, cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

**1.9 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                INSTALLATION AND REMOVAL**

- .1        Provide temporary controls in order to execute Work expeditiously.
- .2        Remove from site all such work after use.

**1.2                HOARDING**

- .1        The Contractor must barricade off the area under construction to prevent the general public from improper access to the construction area. Suitable barricades and protection systems include:
  - .1        Stanchions with a minimum of three (3) horizontal bands of fluorescent warning tape and/or snow fencing around perimeter of work area. Spacing of stanchions not to exceed 10'.
  - .2        Barricade areas below through-slab repairs prior to commencement of demolition.
- .2        Repair surface coatings and/or finishes which are damaged by temporary hoardings and barricades.
- .3        Provide adequate signage, fencing, etc. to inform the public of the work being undertaken.

**1.3                WEATHER ENCLOSURES**

- .1        Provide weather tight closures to unfinished and curing concrete and masonry construction, and openings in floors and roofs.
- .2        Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

**1.4                DUST TIGHT SCREENS**

- .1        The facility operations are very sensitive to dust. Provide dust tight screens and enclosures to localize dust generating activities, and for protection of workers, finished areas of Work and facility operations.
- .2        Maintain and relocate protection until such work is complete.

**1.5                FIRE ROUTES**

- .1        Maintain access to property including overhead clearances for use by emergency response vehicles.

**1.6                PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1        Protect surrounding private and public property from damage during performance of Work.
- .2        Be responsible for damage incurred.

**1.7 PROTECTION OF BUILDING FINISHES**

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Be responsible for damage incurred due to lack of or improper protection.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-2008, Stipulated Price Contract.
- .2 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.
- .4 If there is question as to whether products or systems are in conformance with applicable standards, Contract Administrator reserves right to have such products or systems tested to prove or disprove conformance.
- .5 The Cost for such testing will be borne by the Contractor or Supplier.

**1.2                QUALITY**

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

**1.3                AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- .2 In event of failure to notify Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### **1.5 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.

#### **1.6 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator will establish course of action. Where conflicts exist, the more stringent instruction will be enforced.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

**1.7 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.

**1.8 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

**1.9 REMEDIAL WORK**

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

**1.10 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Contract Administrator.

**1.11 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

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**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1            City of Winnipeg Bid Opportunity 700-2017, Purchase Order and associated contract documents.

**1.2                PROJECT CLEANLINESS**

- .1            Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by City of Winnipeg or other Contractors.
- .2            Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.
- .3            Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4            Provide on-site containers for collection of waste materials and debris.
- .5            Dispose of waste materials and debris off site.
- .6            Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .7            Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8            Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9            Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10           Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

**1.3                FINAL CLEANING**

- .1            When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2            Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3            Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4            Remove waste products and debris other than that caused by City of Winnipeg or other Contractors.

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- .5 Remove waste materials from site at regularly scheduled times. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove stains, spots, marks and dirt from existing surfaces, fixtures, and finishes within the work area or affected by the affected by the Work.
- .8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .9 Remove dirt and other disfiguration from exterior surfaces.
- .10 Sweep and power wash clean all work areas.
- .11 Remove construction debris from drain and pits.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 92 40 – Repair of Slab-Joist Systems
- .3 Section 03 93 20 – Pressure Grouting

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-O86-14, Engineering Design in Wood.
  - .3 CSA O121-08, Douglas Fir Plywood.
  - .4 CSA O151-09, Canadian Softwood Plywood.
  - .5 CSA O153-M1980(R2008), Poplar Plywood.
  - .6 CAN/CSA-O325-07, Construction Sheathing.
  - .7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
  - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
  - .9 CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada

**1.3 MEASUREMENT PROCEDURES**

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

**1.4 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series, and CSA-O153.
  - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Pan forms: removable steel or reinforced plastic to match existing profiles.
- .3 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .4 Form liner:
  - .1 Plywood: high density overlay, medium density overlay, Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151, Poplar to CSA O153.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .6 Falsework materials: to CSA-S269.1.

**Part 3 Execution**

**3.1 FABRICATION AND ERECTION**

- .1 Fabricate and erect falsework in accordance with CSA S269.1.
- .2 Refer to drawings for concrete members requiring architectural exposed finishes.
- .3 Do not place shores and mud sills on frozen ground.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .6 Align form joints and make watertight. Keep form joints to minimum.
- .7 Use 1-inch (25 mm) chamfer strips on external corners and/or 1 inch (25 mm) fillets at interior corners, joints, unless specified otherwise.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

- .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .9 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .10 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

### 3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 Structural slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.
  - .2 Through-slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.]
  - .3 Vertical grouting repairs: Three (3) or the time it takes to reach 20 MPa, whichever is greater.
  - .4 Miscellaneous curbs, pads, etc.: One (1) day.
- .2 Remove formwork when concrete has reached 70 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction at not more than 8' apart.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        This section also covers general conformance standards for all supplemental reinforcing steel instructed to be installed on site, dependant on extent of steel reinforcing corrosion identified.

**1.2                RELATED SECTIONS**

- .1        Section 03 20 00 – Concrete Reinforcing.
- .2        Section 03 92 11 – Top Surface Repairs with Rapid Setting Mortar.
- .3        Section 03 92 40 – Repair of Slab-Joist Systems.
- .4        Section 03 93 20 – Pressure Grouting Repairs

**1.3                REFERENCES**

- .1        ASTM International
  - .1        ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .2        ASTM A1064 / A1064M - 17, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  - .3        ASTM A775/A775M-17, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .2        CSA International
  - .1        CSA-A23.1/23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2        CAN/CSA-A23.3-14, Design of Concrete Structures.
  - .3        CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
  - .4        CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5        CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .6        CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3        Reinforcing Steel Institute of Canada (RSIC)
- .4        RSIC-2004, Reinforcing Steel Manual of Standard Practice.

**1.4                MEASUREMENT PROCEDURES**

- .1        Measure reinforcing steel in pounds of steel incorporated into Work, computed from theoretical unit mass specified in [CSA-G30.18] for lengths and sizes of bars as indicated or authorized in writing by Contract Administrator.

- .1 These unit prices will only cover supplemental reinforcing steel in concrete repair areas or as designated by the Contract Administrator. All other reinforcing steel costs must be included in the fixed price portions of the work to which they correspond.
- .2 Dowels will be measured individually and will include dowel drilling, cleaning, preparation, epoxy supply and placement, and bar insertion, but excluding steel costs which will be covered by the rate per pound unit prices. The Contract Administrator and the Contractor will count and agree upon the numbers and lengths of bars as well as the number of bar embedments. These agreed upon number will form the basis for payment.

## 1.5 SUBMITTALS

- .1 Submit mill test results in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

## Part 2 Products

### 2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.
- .1 hairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .2 Mechanical splices: subject to approval of Contract Administrator.
- .3 Plain round bars: to CSA-G40.20/G40.21.

### 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Contract Administrator's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

### **2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
- .2 Upon request inform Contract Administrator of proposed source of material to be supplied.

## **Part 3 Execution**

### **3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

### **3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

### **3.3 DOWELING PROCEDURES**

- .1 For bars that are indicated as being dowelled, drill in and grout bars into slab as follows:
  - .1 10M bars, 6 inches
  - .2 15M bars, 8 inches
  - .3 20M bars, 12 inches
- .2 Use only approved adhesive to manufacturer's instructions. Acceptable product or approved equal in accordance with Bid Opportunity Clause B7:
  - .1 Hilti HIT-HY-200 by Hilti Canada.
  - .2 Sikad AnchorFix-3001 by Sika Canada Inc.
- .3 Clean hole thoroughly prior to application of adhesive. Use injection or caulking gun to ensure that the adhesive fills the bottom of the hole prior to embedment of bar.

### **3.4 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        The care that is exercised during the removal and preparation phases of concrete repairs can be the most important factor in determining the longevity of the repair, regardless of the material or technique used. This Section covers the removal of deteriorated concrete and surface preparation for the repair of deteriorated concrete resulting from reinforcing steel corrosion and is applicable to horizontal, vertical, and overhead repairs.
  
- .2        All delaminated or deteriorated concrete must be removed down to sound concrete. The reinforcing may have to be exposed at these locations by removing additional concrete, if there is any sign of corrosion. All concrete and exposed reinforcing shall be cleaned of all corrosion by mechanical means.

**1.2                RELATED SECTIONS**

- .1        Section 03 20 00 – Concrete Reinforcing.
  
- .2        Section 03 92 40 – Repair of Slab-Joist Systems.
  
- .3        Section 03 93 20 – Pressure Grouting

**1.3                REFERENCES**

- .1        American Concrete Institute (ACI)
  - .1        ACI 546-04, Concrete Repair Guide.
  - .2        ACI RAP-5, Surface Repair Using Form-and-Pump Techniques.
  - .3        ACI RAP-7, Spall Repair of Horizontal Concrete Surfaces.
  - .4        ACI RAP-6, Vertical and Overhead Spall Repair by Hand Application.
  
- .2        Canadian Standards Association (CSA)
  - .1        CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.
  
- .3        International Concrete Repair Institute (ICRI)
  - .1        ICRI concrete Repair Terminology (2010 Edition).
  - .2        ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
  - .3        ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).
  - .4        ICRI Guideline No. 310.1R–2008, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion (formerly No. 03730).
  - .5        ICRI Guideline No. 310.2R–2, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

#### 1.4 MEASUREMENT PROCEDURES

- .1 Refer to applicable Sections for measurement procedures for each type of repair.

#### 1.5 DEFINITIONS

- .1 Delamination: A separation along a plane parallel to a surface as in the separation of a coating from a substrate or the layers of a coating from each other, or in the case of a concrete slab, a horizontal splitting, cracking, or separation of a slab in a plane roughly parallel to, and generally near, the upper surface.
- .2 Laitance: A weak layer of cement and aggregate fines on a concrete surface that is usually caused by an overwet mixture, overworking the mixture or excessive finishing, underwater concrete placement, or combinations thereof.
- .3 Sounding: A technique to evaluate the condition of hardened concrete by striking the surface with a hammer; sound concrete will exhibit a clear ringing sound, whereas dull or hollow sounds indicate delaminated areas.
- .4 Spall: A fragment, usually in the shape of a flake, detached from a larger mass by a blow, by the action of weather, by pressure, or by expansion within the larger mass; a small spall involves a roughly circular depression not greater than 120 mm in depth and 150 mm in any dimension; a large spall, may be roughly circular or oval or in some cases elongated, is more than 20 mm in depth and 150 mm in greatest dimension
- .5 Substrate: The layer immediately under a layer of different material to which it is typically bonded; an existing concrete surface that receives an overlay, partial-depth repair, protective coating, or some other maintenance or repair procedure.
- .6 Surface Preparation: The process whereby a method or combination of methods is used to remove deteriorated or contaminated concrete and roughen and clean a substrate to enhance bond of a repair material or protective coating.
- .7 Surface Profile: The topographic contour of the exposed surface of a material or substrate.

#### 1.6 QUALITY ASSURANCE

- .1 Contractor Qualifications:
  - .1 Minimum of 10 years' experience in the repair and restoration of concrete structures.
  - .2 Provide minimum 5 examples of local projects demonstrating successful performance concrete repairs of similar size and complexity to specified Work within the last 3 years.
  - .3 Provide minimum 3 references exhibiting successful performance concrete repairs within the last 3 years.
  - .4 Site Superintendent to have a minimum of 5 years' experience exhibiting successful performance in concrete restoration projects. Provide references upon request.
  - .5 Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.

- .2 Field Mock-ups:
  - .1 Complete a field mock-up for each type of repair as requested by the Contract Administrator. Locations to be site determined.
  - .2 Field mock-up shall be a minimum of 4 sq.ft. and incorporate all aspects of the concrete surface preparation described in this Section. Trial repairs areas shall be chosen to include exposure of embedded reinforcing steel.
  - .3 Field mock-up areas shall be used as a standard against which subsequent work shall be judged.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Electric or pneumatic chipping hammers are to be used for demolition within the following limits:
  - .1 Initial bulk removal of delaminated concrete above corroded reinforcing steel: maximum 30 lb. electric or pneumatic chipping hammers.
  - .2 Final removal and undercutting of reinforcing steel: maximum 15 lb. electric chipping hammers.
  - .3 Bulk removal of full depth repairs: electric or pneumatic jack hammers with weight ratings above 30 lbs. may be used upon approval by Contract Administrator.
  - .4 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .2 Sandblast equipment shall consist of:
  - .1 Air compressor of sufficient capacity to drive the equipment and blast media selected.
  - .2 Blast media hopper (meters the media into the air stream passing through the hose and nozzle).
  - .3 Moisture and oil separators to insure clean, dry air supply.
  - .4 Blast nozzle and hose.
  - .5 Materials. The blast medium consistent with equipment, site conditions, and capable of obtaining specified surface profile.
- .3 High pressure waterblast: capable of maintaining a sustained pressure of not less than 4,000 psi.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 The location number and extent of repairs shown on Drawings are indicative only. Repairs areas will be identified on-site by the Contract Administrator in the presence of and with the assistance of the Contractor. The approximately periphery of the repair will be marked on the surface of the member and the location and extent recorded on drawings

- .2 Allow time in the Schedule for survey and inspection work carried out by the Contract Administrator ahead of repairs. Provide sufficient safe access to enable review of all areas designated for repairs.
- .3 The Contractor shall make available as required throughout the Contract labour to carry out the following under the direction of Contract Administrator:
  - .1 Identification of repairs.
  - .2 Sample chipping and/or drilling.
  - .3 Operators for access equipment.
- .4 The Contractor shall make available as required throughout the Contract equipment for the use of the Contract Administrator:
  - .1 Marking paint and chalk.
  - .2 Hammer and chain for sounding surveys.
  - .3 Tape measure.

### **3.2 PREPARATION**

- .1 All necessary measures shall be taken to provide protection to the general public, occupants of the building.
- .2 Remove or protect all surface attachments (e.g. signs, notices, electrical fittings) from the areas to be repaired or from positions that obstruct access or which may be damaged from Work.
- .3 Carefully store items removed during the course of the works. Reinstall when restoration work is complete.
- .4 The Contractor shall make good or rectify any damage caused as a result of insufficient protection.
- .5 Provide temporary access required to facilitate Work.

### **3.3 CONCRETE DELAMINATION REMOVAL**

- .1 Refer also to Figure 1 in this Section.
- .2 Remove all loose and or delaminated concrete above corroded reinforcing steel.
- .3 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.
- .4 Use chipping to extend concrete removal along reinforcing bars and ensure bars are completely free of corrosion and well bonded to the surrounding concrete. Notify Contract Administrator of increases in areas.
- .5 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused more than 1/3 the periphery of a bar to be exposed for a distance of 6 inches (150 mm) or more, the concrete adjacent to the bar shall be

removed by maximum 15 lb. electric chipping hammers to provide sufficient clearance between the reinforcement and concrete.

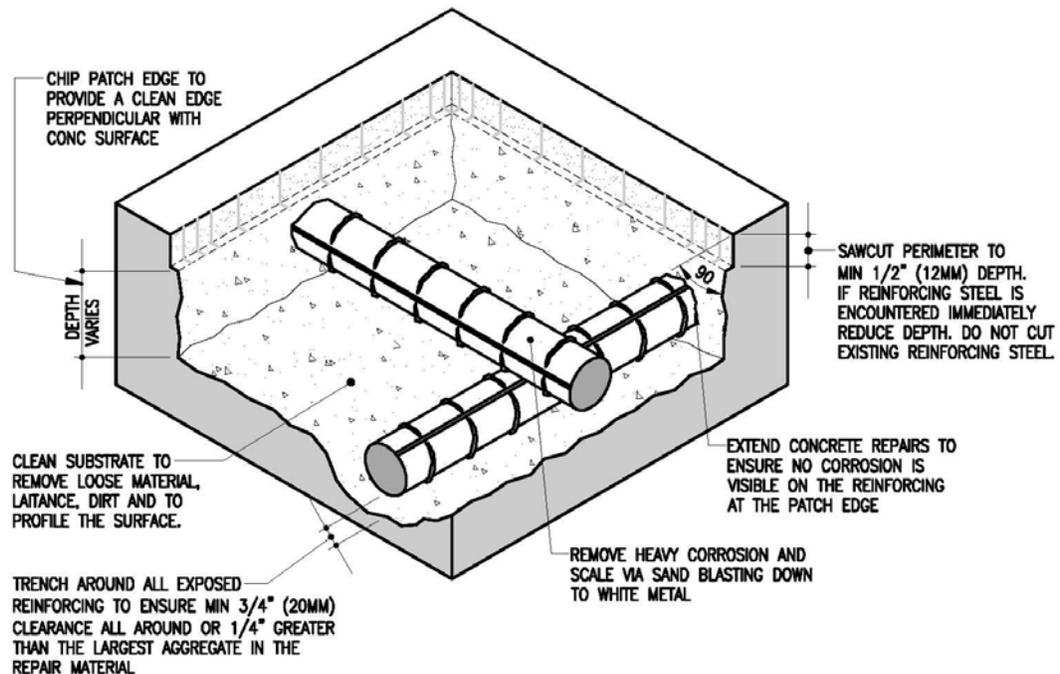
- .1 Provide a minimum 3/4 inches (20 mm) clearance, or 1/4 inch (6 mm) larger than the largest aggregate in the repair material, whichever is greater.
- .6 If non-corroded reinforcing steel is exposed, do not damage the bar's bond to the surrounding concrete. If bond between the bar and concrete is destroyed, exposing the bar will be required.
- .7 The perimeter of the areas marked as delaminated are to be saw cut to a depth of 1/2 inch (12 mm). Feather edging is not permitted. If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly.
- .8 Ensure sawcut encompasses the boundaries of corrosion that have been established.
- .9 Ensure the entire area within the saw cut is removed to a depth consistent with the type of repair and repair material specified in other Sections.
- .10 Chip patch edges to provide a clean vertical edge along the patch perimeter to the required minimum depth.
- .11 Conduct soundings to determine if any further unsound or delaminated concrete is present, which must be removed.
- .12 After all delaminated, unsound, or loose material is removed, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be completed in the presence of the Contractor and if any further Work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

### **3.4 SURFACE PREPARATION OF CONCRETE AND REINFORCING STEEL**

- .1 Refer also to Figure 1 in this Section.
- .2 Within 24 hours prior to infilling, sandblast or high-pressure waterblast at a minimum 4,000 psi the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-3 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.
- .3 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .4 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust for the full circumference of the bar.
- .5 Secure any reinforcement which is loose by tying to other secured bars or by other methods approved by Contract Administrator.

- .6 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .7 Maintain substrate in a clean condition using polyethylene film until the patch material is ready to be placed.
- .8 After all surface preparation is complete the Contractor shall request an inspection from the Contract Administrator to review the existing reinforcing steel. The purpose of this inspection is to provide assurance that all heavy corrosion and scale is removed from the bar. At that time, the Contract Administrator will review the condition of the reinforcing steel and determine if the addition of supplemental reinforcing steel will be required. At locations identified by the Contract Administrator, provide supplemental reinforcing steel to Section 03 20 00.
- .9 Maintain substrate in a saturated condition for a period of not less than 4 hours prior to infilling. Do not allow the concrete surface to dry. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.

Figure 1: Surface Preparation for Concrete Delamination Repair



### 3.5 FIELD QUALITY CONTROL

- .1 Coordinate site work and inspections with Contract Administrator. Provide minimum 24 hours notice prior to each phase of the work.
- .2 Contract Administrator inspection to be completed at the following times:
  - .1 Prior to demolition to identify and quantify repair locations and types.
  - .2 Following initial demolition to confirm all loose, deteriorated, or unsound concrete has been removed from the substrate.

- .3 Following concrete substrate preparation to review concrete surface profile and condition of reinforcing steel.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        The top surface of slabs and beams exhibiting extensive spalling and/or delamination are to be repaired by mechanical removal of the deteriorated concrete and infilling with rapid-setting repair mortar.
- .2        All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10.

**1.2                RELATED SECTIONS**

- .1        Section 03 10 00 – Concrete Forming and Accessories.
- .2        Section 03 20 00 – Concrete Reinforcing.
- .3        Section 07 92 10 – Joint Sealant

**1.3                REFERENCES**

- .1        American Concrete Institute (ACI)
  - .1        ACI 309R-05, Guide for the Consolidation of Concrete.
  - .2        ACI 546R-14, Concrete Repair Guide.
  - .3        ACI RAP-7, Spall Repair of Horizontal Concrete Surfaces.
- .2        Canadian Standards Association (CSA)
  - .1        CSA-A3000-13, Cementitious materials compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .2        CSA-A3001-14, Cementitious Materials for Use in Concrete.
  - .3        CSA-A23.1/A23.1-14, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
  - .4        CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.
- .3        American Society for Testing and Materials (ASTM)
  - .1        ASTM C260/C260M-10a, Specification for Air-Entraining Admixtures for Concrete.
  - .2        ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3        ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
- .4        International Concrete Repair Institute
  - .1        ICRI concrete Repair Terminology (2010 Edition).
  - .2        ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.

- .3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).

#### 1.4 MEASUREMENT PROCEDURES

- .1 The repair areas will be identified by the Contract Administrator on-site by a sounding survey which will be completed in the presence of, and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work. These measurements will form the basis of payment for the area.
- .2 The following unit prices have been requested which will be covered under this Section:
  - .1 Through-slab removal and replacement: Applicable to full depth removal and replacement of the slab pan including removal of concrete from the top surface of adjacent joists equivalent to the slab depth and installation of supplemental steel dowels as shown on Drawings (unit price per square foot):
    - .1 Minimum payment for repair areas will be 1 square foot.
  - .2 Through-joist removal and replacement of concrete joists performed together with through-slab removal and replacement (unit price per linear foot):
    - .1 Minimum payment for repair areas will be 1 linear foot of joist.
  - .3 Joist only pressure grouting repairs: Refer to Section 03 93 20 – Pressure Grouting.
- .3 The Contractor is to note that if the area of the repair is increased over that originally measured without consultation with the Contract Administrator, then the Contractor will not be paid for the increased area.
- .4 Unit prices must include all supervision, labour and materials, and equipment.

#### 1.5 QUALITY ASSURANCE

- .1 Contractor Qualifications:
  - .1 Minimum of 10 years' experience in the repair and restoration of concrete structures.
  - .2 Provide minimum 5 examples of local projects demonstrating successful performance concrete repairs of similar size and complexity to specified Work within the last 3 years.
  - .3 Provide minimum 3 references exhibiting successful performance concrete repairs within the last 3 years.
  - .4 Site Superintendent to have a minimum of 5 years' experience exhibiting successful performance in concrete restoration projects. Provide references upon request.
  - .5 Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.
- .2 Field Mock-up:
  - .1 Upon request, install field mock-up at Project site or pre-selected area of building or location approved by Contract Administrator. Install material in accordance with this Section.
  - .2 Field mock-up will be standard for judging workmanship on remainder of Project.

- .3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

## 1.6 PROJECT CONDITIONS

- .1 Environmental Requirements:
  - .1 Ensure that substrate temperature is minimum of 10°C and remains above 10°C for entire curing period. Ensure that frost or frozen surfaces are thawed and dry.
  - .2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.
  - .3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

## 1.7 ABBREVIATIONS

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
  - .1 Type GU or GUb - General use cement.
  - .2 Type CI - with CaO content ranging from 8 to 20%.
- .2 SCM – Supplemental cementing materials.
- .3 SSD - Saturated surface dry.
- .4 WRA – Water reducing agent.

## 1.8 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed manufacturer's recommendations.
  - .1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2. Deviations to be submitted for review by Contract Administrator.

## Part 2 Products

### 2.1 MATERIALS

- .1 Rapid Setting Repair Mortar: One-component, shrinkage-compensated, cement-based mortar with extended working time for repairing horizontal concrete surfaces.
  - .1 Provide mortar material complying with the following requirements:
    - .1 Compliance: ASTM C928.
    - .2 Compressive Strength, ASTM C109, 2-inch (51-mm) cubes:
      - .1 3 Hours: 3,000 psi (21 MPa).
      - .2 1 Day: 6,000 psi (41 MPa).
      - .3 28 Days: 8,000 psi (55 MPa).
    - .3 Compressive Strength, ASTM C39, 3-inch by 6-inch (76-mm by 152-mm) cylinders:

- .1 28 Days: 7,400 psi (51 MPa).
- .4 Set Time, ASTM C191, 72 degrees F (22 degrees C):
  - .1 Initial: 50 minutes.
  - .2 Final: 80 minutes.
- .5 Splitting Tensile Strength, ASTM C496:
  - .1 1 Day: 400 psi (3 MPa).
  - .2 28 Days: 450 psi (3 MPa).
- .6 Freeze-Thaw Resistance, ASTM C666, Procedure A, at 300 cycles:
  - .1 100 percent relative dynamic modulus.
- .7 Scaling Resistance, ASTM C672, at 25 cycles:
  - .1 Zero rating; no scaling.
- .8 Length Change, ASTM C928:
  - .1 Drying Shrinkage: Minus 0.05 percent.
  - .2 Wetting Expansion: Plus 0.03 percent.
- .9 Rapid Chloride Permeability, ASTM C1202:
  - .1 Less than 300 Coulombs.
- .10 Coefficient of Thermal Expansion, CRD C39:
  - .1  $6.8 \times 10^{-6}$  in/in/degree F ( $12.6 \times 10^{-6}$  cm/cm/degree C).
- .2 Acceptable Product:
  - .1 MasterEmaco T 1061 formerly (10-61 Rapid Mortar) by BASF Building Systems.
- .2 Bonding Slurry:
  - .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of [0.40] in accordance with CSA-A23.1 and as follows:
    - .1 1.0 kg Type GU to CSA A3001.
    - .2 1.0 kg SSD concrete sand to CSA A23.1.
    - .3 0.40 kg Water to CSA A23.1.
    - .4 MRWRA or HRWRA to ASTM C494/C494M as required and approved by Contract Administrator.
    - .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labeled, indicating material type, calibrated weight of material, and calibrated volume. The Contract Administrator reserves the right to randomly check batch weights.
    - .6 Shovel batching is strictly prohibited.
  - .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

## 2.2 ACCESSORIES

- .1 Aggregate Extension: extend mortar material with washed, graded, 3/8 inch (10 mm), low-absorption, saturated surface-dry aggregate at mortar manufacturers recommended rates.
  - .1 For repair areas 2 – 4" (50 – 100 mm) in depth, the minimum recommended addition is 15 – 25 lbs (6.8 – 11.4 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb (22.7 kg) bag.
  - .2 For areas greater than 4" (100 mm) in depth, the minimum recommended addition is 25 – 50 lbs (11.4 – 22.7 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb bag.
  - .3 The maximum aggregate extension is 50 lbs (22.7 kg) of pea gravel per bag.
- .2 Evaporation retardant: MasterKure ER 50 formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
- .3 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
  - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m<sup>2</sup>/L.
  - .2 MasterKure CC 160 WB formerly (Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.
- .2 Surface Preparation:
  - .1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.
- .4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .5 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .6 Forming:
  - .1 Unless otherwise indicated provide plywood formwork to match existing profiles.
  - .2 Install chamfers at outside corners and filets at inside corners in accordance with Section 03 10 00 or to match existing profiles.
  - .3 Design formwork to accommodate the mass and pressure of the repair material and construction live loads.

- .4 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms during placement and curing.
- .5 Construct forms to fit tightly against existing concrete surfaces. Seal around edge of formwork with sealant to prevent leakage during grouting.
- .6 Anchors shall be completely removable. All anchor holes shall be patched with same grout mixed to dry pack consistency. Completely fill all anchor holes.
- .7 A minimum of 30 mm concrete cover over the primary reinforcing steel will be required, thus, an adjustment of the formwork such as a notch may be required to ensure sufficient cover.
- .8 Use form-release agent to facilitate removal of forms from cast material.
- .9 Test formwork for leaks. Any areas of leakage are to be sealed prior to placement of repair material. Re-test as required.

### 3.2 INFILLING PROCEDURES

- .1 Obtain Contract Administrator's approval before placing repair material. Provide minimum 24 hours notice.
- .2 Prior to placing concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in cold weather. Special provisions for hot and cold weather concrete placement shall be in accordance with CSA A23.1 unless specifically noted otherwise.
- .3 Maintain the substrate in a saturated surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .4 Mixing of rapid-setting mortar:
  - .1 Mix materials in accordance with manufacturer's instructions.
  - .2 Ensure repair mortar is thoroughly mixed.
  - .3 Do not use free-fall mixers.
  - .4 Never mix partial bags.
- .5 Transport and place concrete by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.
- .6 Bonding Slurry Application:
  - .1 Apply the specified bonding slurry to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove standing water by vacuuming.
  - .2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the concrete.
  - .3 Place repair material while the bonding slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bond slurry dries prior to placement of the repair material, removal of the dried slurry will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.
- .7 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.

- .8 Immediately place repair material, into the prepared patch area from one side to the other. Work the repair material firmly into the bottom and sides of the patch, and underneath reinforcing steel, to assure good bond.
- .9 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.
- .10 The addition of water to increase slump is strictly prohibited. The use of a high range water reducing agent (HRWRA) may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections. Site addition HRWRA will be the responsibility of the concrete supplier.
- .11 The concrete must be internally vibrated by means of standard immersion "pencil" vibrators meeting the requirements of ACI 309R. Pencil vibrators must be used in all delamination and through slab repair areas.
- .12 Vibrate repair material to ensure proper consolidation.
- .13 Continuously consolidate and finish to matching elevations, ensuring patch thickness and required elevations are maintained.
- .14 Ensure reinforcement, floor drains, inserts, etc. are not disturbed during concrete placement.

### **3.3 FINISHING**

- .1 Following consolidation and screeding, the surface shall be immediately floated to close and smooth the surface to required finish.
- .2 Apply evaporation retardant at manufacturers recommended coverage rate immediately following final finishing. Do not apply evaporation retardant during any finishing operation nor should it be worked into the surface.
- .3 Protect freshly placed concrete from exposure to dust, debris and precipitation.

### **3.4 CURING**

- .1 Concrete repairs to be cured for a minimum of 3 days at 10°C.
- .2 Immediately after final finishing, apply evaporation retardant to prevent drying shrinkage until the concrete has enough strength to support the placement of the wet burlap.
- .3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" and be securely held in place without marring the concrete surface.
- .5 Wet curing with burlap and water must be maintained throughout entire curing period.

- .6 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.
- .7 Leave formwork in place until repair mortar reaches compressive strength of 20 MPa or minimum 3 days for surfaces to be painted.

### 3.5 JOINTS

- .1 Tool in or "Soff-Cut" joints at locations match existing. Upon minimum 28-day cure, re cut joints to match existing but not less than 1/4" wide x 1/4" deep, prepare surface, prime, install bond breaker or backing rod, and continuous bead of sealant. Refer to Section 07 92 10.

### 3.6 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 2 10 - Allowances.
- .3 Not less than one test per 50 square feet of patching material placed and not less than one test for each day of placement.
- .4 Direct pull-out tensile tests to determine bond strength will be completed throughout the course of the work but not less than the following:
  - .1 Two (2) tests will be completed within the first phase of repairs.
  - .2 Not less than one (1) bond test will be completed in each phase.
  - .3 The Contract Administrator reserves the right to take additional bond tests if concrete or bonding system is suspect.
  - .4 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section.
- .5 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

### 3.7 DEFECTIVE CONCRETE

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Slab soffit areas, beams, columns and walls exhibiting extensive spalling and/or delamination in which patching would be uneconomical are to be repaired by mechanical removal of the deteriorated concrete and replacement with a pumpable grout.
- .2 All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10.

**1.2 RELATED SECTIONS**

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repairs.

**1.3 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 ACI 546-14, Concrete Repair Guide.
  - .2 ACI RAP-5, Surface Repair Using Form-and-Pump Techniques.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM C109/C109M-16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. (50-mm) Cube Specimens).
  - .2 ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 Canadian Standards Association (CSA)
  - .1 CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.
- .4 International Concrete Repair Institute (ICRI)
  - .1 ICRI concrete Repair Terminology (2010 Edition).
  - .2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
  - .3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).

**1.4 MEASUREMENT PROCEDURES**

- .1 The areas of repair will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work.
- .2 Unit prices must include all supervision, labour and materials, and equipment.

- .3 Beam, Column: The unit price submitted will apply to removal depths of up to 3 inches and at no point less than 1 inch in depth. A second unit price must also be submitted which will apply to removal depths of up to a 6 inches depth and at no point less than 3 inches in depth.
  - .1 The minimum area of payment will be one (1) square foot.
- .1 Concrete joist removal and replacement (unit price per linear foot):
  - .1 Minimum payment for repair areas will be one (1) linear foot of full depth of concrete joist.
  - .2 The Contractor is to note that if the area of the repair is increased over that originally measured without consultation with the Contract Administrator, then the Contractor will not be paid for the increased area.

## 1.5 QUALITY ASSURANCE

- .1 Contractor Qualifications:
  - .1 Minimum of 10 years' experience in the repair and restoration of concrete structures.
  - .2 Provide minimum 5 examples of local projects demonstrating successful performance concrete repairs of similar size and complexity to specified Work within the last 3 years.
  - .3 Provide minimum 3 references exhibiting successful performance concrete repairs within the last 3 years.
  - .4 Site Superintendent to have a minimum of 5 years' experience exhibiting successful performance in concrete restoration projects. Provide references upon request.
  - .5 Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.
- .2 Field Mock-up:
  - .1 Install field mock-up at Project site or pre-selected area of building or location approved by Contract Administrator. Install material in accordance with this Section.
  - .2 Field mock-up will be standard for judging workmanship on remainder of Project.
  - .3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Comply with Section 01 61 00.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .4 Keep materials in manufacturer's original, unopened containers and packaging until installation.

- .5 Protect materials during storage, handling, and application to prevent contamination or damage.

## 1.7 PROJECT CONDITIONS

- .1 Environmental Requirements:
  - .1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.
  - .2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.
  - .3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

## Part 2 Products

### 2.1 MATERIALS

- .1 One-component, shrinkage-compensated, micro concrete consisting of cement, graded aggregate, shrinkage-compensating agents, and additives complying with the following performance requirements:
  - .1 Compressive Strength, ASTM C109:
    - .1 1 day: minimum 17.0 MPa.
    - .2 7 days: minimum 34.5 MPa.
    - .3 28 days: minimum 41.0 MPa.
  - .2 Slant Shear Bond Strength, ASTM C 882:
    - .1 1 Day: minimum 5.0 MPa.
    - .2 7 Days: minimum 10.0 MPa.
    - .3 28 days: minimum 16.0 MPa.
  - .3 Drying Shrinkage, ASTM C157, Unmodified, 1-inch (25-mm) prisms:
    - .1 28 Days: less than 350 µstrain.
  - .4 Drying Shrinkage, ASTM C157, Modified, 3-inch (76-mm) prisms, air cured at 73 degrees F (23 degrees C), 50 percent relative humidity:
    - .1 7 Days: less than 225 µstrain.
    - .2 28 Days: less than 500 µstrain.
  - .5 Coefficient of Thermal Expansion, ASTM C531:
    - .1 28 days:  $10 \pm 0.1 \times 10^{-6}$  cm/cm per degree C.
  - .6 Freeze/Thaw Resistance, ASTM C666 at 300 cycles:
    - .1 minimum 96% relative dynamic modulus.
  - .7 Splitting Tensile Strength, ASTM C496:
    - .1 28 days: minimum 4.0 MPa.
  - .8 Rapid Chloride Permeability, ASTM C1202:
    - .1 Less than 1,000 Coulombs
- .2 Acceptable product is:

- .1 MasterEmaco S 440 MC, formerly (LA Repair Mortar) by BASF Building Systems or approved equal in accordance with Bid Opportunity clause B7.

## 2.2 EQUIPMENT

- .1 Pumping equipment: Mono-type, piston/ball valve, or hydraulic/swing valve pumps capable of pumping specified grout. Pumping equipment must have adequate controls to regulate flow rates and pressures

## 2.3 ACCESSORIES

- .1 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
  - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m<sup>2</sup>/L;
  - .2 MasterKure CC 160 WB, (formerly Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L;
  - .3 Or an approved substitute in accordance with Bid Opportunity Section B7.
- .2 Sealants: to Section 07 91 20.

## 2.4 FINISHES

- .1 Materials
  - .1 Paint materials for each coating formulae to be products of a single manufacturer.
  - .2 Provide specified, approved paint, finish materials.
  - .3 Provide linseed oils, shellacs, turpentine, etc. of pure grade, highest quality.
- .2 Acceptable Products
  - .1 Specified manufacturer: Sherwin Williams.
  - .2 Acceptable manufacturers, using equal quality, performance products subject to Contract Administrator approval:
    - .1 Pratt & Lambert Inc.
    - .2 Glidden Paint Co.
    - .3 Or an approved substitute in accordance with Bid Opportunity Section B7.
- .3 Acceptable Systems
  - .1 Surface preparation: in accordance with manufacturer's recommendations.
  - .2 Acceptable materials: S-W Duration Exterior Latex Acrylic Satin Coating.
  - .3 Or an approved substitute in accordance with Bid Opportunity Section B7
- .4 Colour by: to match existing.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.

- .2 Surface Preparation:
  - .1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.
- .4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .5 Forming:
  - .1 Unless otherwise indicated provide plywood formwork to match existing profiles.
  - .2 Install chamfers at outside corners and filets at inside corners in accordance with Section 03 10 00 or to match existing profiles.
  - .3 Design formwork to accommodate the mass and pressure of the repair material but not less than 14 psi (100 kPa).
  - .4 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms during pressure grouting.
  - .5 Construct forms to fit tightly against existing concrete surfaces. Seal around edge of formwork with sealant to prevent leakage during grouting.
  - .6 Anchors shall be completely removable. All anchor holes shall be patched with same grout utilized for the repairs but mixed to dry pack consistency. Completely fill all anchor holes.
  - .7 A minimum of 30 mm concrete cover over the primary reinforcing steel will be required, thus, an adjustment of the formwork such as a notch may be required to ensure sufficient cover.
  - .8 Provide drainage outlets in formwork for presoaking and, if beneath a soffit, provide air venting. Provide suitable access points to pump mixed repair mortar into place.
  - .9 Space ports for pump line attached in a grid pattern.
  - .10 Use form-release agent to facilitate removal of forms from cast material.
  - .11 Within two (2) hours immediately prior to grouting, pressure test formwork to determine watertightness. Completely fill formwork with clean water and let stand for not less than 15 minutes. Any areas of leakage are to be sealed prior to grouting. Re-test as required.

### **3.2 INFILLING PROCEDURES**

- .1 Obtain Contract Administrator approval before placing repair material. Provide minimum 24 hours notice.
- .2 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .3 Mixing:
  - .1 Mix materials in accordance with manufacturer's instructions.
  - .2 Ensure repair mortar is thoroughly mixed.

- .3 Do not use free-fall mixers.
- .4 Never mix partial bags.
- .4 Within 15 minutes of mixing, pump the grout into the prepared form. Work in a manner to avoid air entrapment with a variable pressure pump.
- .5 Start pumping at one corner for horizontal surfaces, or at the lowest point for vertical surfaces, continue filling in a manner that prevents air entrapment.
- .6 Continue pumping until material flows from adjacent ports and all air is expelled. After all air is expelled, temporarily stop pumping, close off port, and begin pumping from next port that has seen material flow. Repeat sequence until the cavity is completely filled.
- .7 Monitor pump-line pressure to prevent excessive back-pressure when pumping long distances.
- .8 Vibrate the form while pumping, as required, to achieve flow and compaction. Flowable grout must be confined in either the horizontal or vertical direction, leaving a minimum of exposed surface.

### 3.3 CURING

- .1 Concrete repairs to be cured for a minimum of 3 days at 10°C. Provide supplemental heat and hoarding as required throughout curing period.
- .2 Leave formwork in place until repair mortar reaches compressive strength of 20 MPa or minimum 3 days for surfaces to be painted.

### 3.4 FINISHING

- .1 After stripping of formwork, any spaces not filled should be trimmed, cleaned, and dry-packed with grout to the desired profile. Do not proceed with repairs without Contract Administrator's written approval.
- .2 Prepare surface and paint to match existing.

### 3.5 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 2 10 - Allowances.
- .3 Not less than one test per 50 square feet of patching material placed and not less than one test for each day of placement.
  - .1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.
- .4 Direct pull-out tensile tests to determine bond strength will be completed throughout the course of the work but not less than the following:

- .1 Two (2) tests will be completed within the first phase of repairs.
- .2 Not less than one (1) bond test will be completed in each phase.
- .3 The Contract Administrator reserves the right to take additional bond tests if concrete or bonding system is suspect.
- .4 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section or Section 03 93 10.
- .5 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

**3.6 DEFECTIVE CONCRETE**

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .3 ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
  - .4 ASTM C1177/C1177-13 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA O80 Series-08 (R2012), Wood Preservatives
  - .2 CSA O121-08, Douglas Fir Plywood.
  - .3 CSA O141-05, Softwood Lumber.
  - .4 CSA O151-09, Canadian Softwood Plywood.
  - .5 CAN/CSA-O325.0-92 (R2003), Construction Sheathing.
- .3 Underwriters Laboratories' of Canada (ULC).
  - .1 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre for Buildings.
- .4 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber.

**1.2 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 FRAMING AND STRUCTURAL MATERIALS**

- .1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Framing and board lumber: in accordance with NBC, except as indicated or specified otherwise.
- .3 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers all to be pressure treated:
  - .1 S2S is acceptable for interior protected areas.
  - .2 Board sizes: "Standard" or better grade.
  - .3 Dimension sizes: "Standard" light framing or better grade.
  - .4 Post and timbers sizes: "Standard" or better grade.
- .4 Douglas fir plywood (DFP): to CSA O121, standard construction.

**2.2 PANEL MATERIALS**

- .1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.

**2.3 ACCESSORIES**

- .1 Sealants: Dow Corning 795 silicone, or an approved substitute in accordance with Bid Opportunity Section B7. Colour to match adjacent finish or as selected and approved by The City.
- .2 General purpose adhesive: to CSA O112 Series.
- .3 Nails, spikes and staples: to CSA B111.
- .4 Bolts: 12.5 mm (1/2") diameter unless indicated otherwise, complete with nuts and washers.
- .5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
- .6 Sprayed polyurethane foam to meet the requirements of ULC S705.1.
  - .1 Acceptable product: Enerfoam by Dow Chemical Company, or an approved substitute in accordance with Bid Opportunity Section B7.
- .7 Batt and blanket mineral fibre insulation to CAN/ULC S702.
- .8 Gypsum board sheathing: paperless, mold and moisture resistant gypsum cover board combining reinforcing glass mat fully embedded into a specially formulated fire and moisture resistive, non-combustible core.

- .1 Thickness: as indicated on drawings.
- .2 Thickness: to suite wall cavity and as indicated on drawings.
  - .1 Acceptable product: Roxul ComfortBatt as manufactured by Roxul INC, or an approved substitute in accordance with Bid Opportunity Section B7.

#### **2.4 FASTENER FINISHES**

- .1 Hot-dipped galvanizing: use galvanized fasteners for exterior work, interior highly humid areas and pressure-preservative treated lumber.
- .2 Stainless steel: use stainless steel where indicated on drawings.

#### **2.5 WOOD PRESERVATIVE**

- .1 Preservative Coating: in accordance with manufacturer's recommendations for surface conditions:
  - .1 CCA or other water-born salt, free of petroleum solvents and oils, applied by pressure treatment in accordance with CSA O80

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 PREPARATION**

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

#### **3.3 MATERIAL USAGE**

- .1 Use pressure-treated wood and treat material when used in the following application:
  - .1 Wood, fascia backing, blocking, curbs, sleepers on roof deck.
  - .2 Wood in direct contact with concrete.
  - .3 Wood furring on outside surface of exterior masonry and concrete walls.
  - .4 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.
- .2 Plywood sheathing:

- .1 Douglas fir plywood (DFP) sheathing grade, square edge, thickness as indicated on drawings.
- .3 Interior face of parapets and exterior face of curb wall sheathing:
  - .1 Gypsum board sheathing, square edge, thickness as indicated on drawings.

### **3.4 INSTALLATION**

- .1 Install members true to line, levels and elevations, square and plumb.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.
- .4 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .5 Install furring and blocking as required to space-out and support facings, fascia, soffit, siding, and other work as required.
- .6 Install furring to support siding applied vertically, where there is no blocking and where sheathing is not suitable for direct nailing.
  - .1 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .7 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .8 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .9 Install sleepers as indicated.
- .10 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .11 Countersink bolts where necessary to provide clearance for other work.
- .12 Patch, finish, re-finish interior finishes removed, cut, broken or damaged resulting from the Work.

### **3.5 CLEANING**

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by rough carpentry installation.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1    Section 06 10 00 – Rough Carpentry
- .2    Section 07 62 00 – Sheet Metal Flashing and Trim

**1.2            REFERENCES**

- .1    Canadian Roofing Contractors Association (CRCA)
  - .1    CRCA Roofing Specifications Manual.
- .2    Canadian Standards Association (CSA International)
  - .1    CSA A123.21-14, Standard test method for the dynamic wind uplift resistance of membrane-roofing systems.

**1.3            MEASUREMENT PROCEDURES**

- .1    No measurement will be made under this section. The Contractor shall include in the appropriate fixed price component all labour, materials, supervision, and equipment as required to complete the work required under this Section and as shown on the Drawings.

**1.4            ADMINISTRATIVE REQUIREMENTS**

- .1    Convene pre-installation meeting one week prior to beginning Work, with roofing contractor's representative, the Contract Administrator and The City to:
  - .1    Verify project requirements.
  - .2    Review installation and substrate conditions.
  - .3    Co-ordination with other building sub trades.
  - .4    Review manufacturer's installation instructions and warranty requirements.

**1.5            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2    Product Data:
  - .1    Provide two (2) copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
- .3    Manufacturer's Certificate: certify that products and system design meet or exceed specified requirements of CSA A 123.21-14, Standard Test Method for Dynamic Wind Uplift Resistance of Membrane-Roofing Systems. Provide Certification from the manufacturer that the adhesive and/or mechanical anchors utilized in the design and installation exceed the following design live wind loads:
  - .1    1.3 kPa for the field of the roof.
  - .2    1.5 kPa for the edge of the roof.
  - .3    2.8 kPa for the corners of the roof.
- .4    Note; Load presented have wind load factors applied
- .5    Provide shop drawings:

- .1 Indicate flashing, control joints, tapered insulation, pre-manufactured fittings, roof drains, and details.
- .2 Provide layout for tapered insulation. Provide details of sloped insulation. Insulation to provide as a minimum the slopes indicated on the drawings. At no point less than 1% to drains or scuppers. Submit on a shop drawing locating and identifying all sloped insulation blocks.
- .6 Closeout Submittals:
  - .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
  - .2 Submit operation and maintenance data for incorporation into manual, including manufacturer's recommended cleaning instructions for metal components.
  - .3 Submit manufacturer's and contractor's warranty documentation.

#### **1.6 QUALITY ASSURANCE**

- .1 Roofing contractors and sub-contractors must, when tendering or performing work, possess a roofing contractor operating license.
- .2 Roofing contractors and sub-contractors must also be currently registered with and approved by the product manufacturer.
- .3 Only qualified, certified installers employed by a company with the appropriate equipment may execute the roofing work.
- .4 Roofing contractors must be members in good standing of RCAM and provide the Contract Administrator with a certificate to this effect before beginning any roof work.
- .5 Contractor may switch roofing foreman through project only upon written permission of the Contract Administrator and only after suitable overlap to facilitate transfer of knowledge.

#### **1.7 FIRE PROTECTION**

- .1 Prior to the start of work, conduct a site inspection to establish safe working practices and make sure that all procedures and proposed changes are approved to minimize the risk of fires.
- .2 Respect safety measures described in the Product Manufacturers' Specifications Manual as well as local association recommendations, and The City's requirements.
- .3 At the end of each workday, use a heat detector gun to spot any smouldering or concealed fire. Job planning must be organized to ensure workers are still on location at least **TWO** hour after torch application.
- .4 Never apply the torch directly to old and wood surfaces.
- .5 Throughout roofing installation, maintain a clean site and have at least one ULC-approved ABC fire extinguisher, charged and in perfect operating condition, within 6 metres of each roofing torch. Respect all safety measures described in technical data sheets. Torches must never be placed near combustible or flammable products, nor used where the flame is not visible or cannot be easily controlled.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .2 The materials are to remain in their original packaging, displaying the manufacturer's name, product name, weight, and reference standards, as well as all other indications or references considered standard.

- .3 Storage and Handling Requirements:
  - .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
  - .2 Provide and maintain dry, off-ground weatherproof storage.
  - .3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
  - .4 Avoid material overloads which may affect the structural integrity of specific roof areas.
  - .5 Remove only in quantities required for same day use.
  - .6 Place plywood runways over completed Work to enable movement of material and other traffic.
  - .7 Store sealants at +5 degrees C minimum.
  - .8 Store insulation protected from daylight, weather and deleterious materials.

## 1.9 FIELD CONDITIONS

- .1 Ambient Conditions
  - .1 Do not install roofing when temperature remains below the manufacturer's minimum recommended temperature.
  - .2 Minimum temperature for solvent-based adhesive is -5 degrees C.
- .2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

## 1.10 WARRANTY

- .1 The product manufacturer will issue a written and signed document in The City's name, certifying that the roofing membranes are free of manufacturing defects for a period of ten (10) years, starting from the date of acceptance. This warranty will cover the removal and replacement of defective roof membrane products, including labour. The warranty must remain a full warranty for the duration of the period specified. No letter amending the manufacturer's standard warranty will be accepted and the warranty certificate must reflect these requirements.
- .2 The contractor will provide a written and signed document to The City certifying that the work executed will remain in place and free of leakage or other waterproofing defect for a period of five (5) years from the date of acceptance.

## Part 2 Products

### 2.1 PERFORMANCE CRITERIA

- .1 Compatibility between components of roofing system is essential. All waterproofing materials are to be provided by the same manufacturer. Provide written declaration to Contract Administrator stating that materials and components, as assembled in system, meet this requirement.
- .2 Roofing System: to CSA A123.21 for wind uplift resistance.
- .3 Acceptable Roof System and Manufacturer:
  - .1 Colvent System by Soprema Canada Inc,

- .2 Armourvent System by IKO Industries,
- .3 Or approved equal in accordance with Bid Opportunity Clause B7.

## 2.2 PRIMER

- .1 Primer for self-adhesive membranes:
  - .1 Composed of SBS synthetic rubber, volatile solvents, adhesive enhancing resins and volatile solvent used to prime porous substrates and non-porous substrates such as wood, concrete or metal to enhance the adhesion of self-adhered membranes at temperatures above -10°C
  - .2 Polymeric emulsion finish designed to improve adherence of self-adhesive waterproofing membranes when solvent-based primer is not recommended.
- .2 Primer for thermofusible membranes:
  - .1 Bitumen, fast-evaporating solvents and adhesive enhancing additives. It is required to prime most surfaces in order to improve the adhesion of heat welded waterproof membranes.
  - .2 Stabilised bituminous emulsion (water based) primer.

## 2.3 AIR VAPOUR BARRIER MEMBRANE

- .1 Self-adhered air/vapour barrier membrane:
  - .1 Description: Self-adhered membrane with SBS modified bitumen and a tri-laminated woven polyethylene facer. The underface is covered with silicone release film.
- .2 Self-adhered continuity (transition) membrane:
  - .1 Description: Self-adhered transition membrane with SBS modified bitumen and a tri-laminated woven polyethylene facer. The underside is covered with silicone film.

## 2.4 INSULATION

- .1 Polyisocyanurate Insulation:
  - .1 Closed-cell polyisocyanurate foam core Type 2 integrally laminated between two heavy coated-glass facers. These facers shall be saturated with a coating that provides a smooth, consistent surface, free of loose fibres. Insulation thickness and layers as indicated on project drawings.
- .2 Polyisocyanurate Insulation:
  - .1 Closed-cell polyisocyanurate foam core Type 3 integrally laminated between two heavy coated-glass facers. These facers shall be saturated with a coating that provides a smooth, consistent surface, free of loose fibres. Insulation thickness and layers as indicated on project drawings.

## 2.5 MEMBRANE ROOFING SYSTEM

- .1 Semi-Adhered System:
  - .1 Base sheet: a semi-independent, self-adhered base sheet membrane composed of SBS modified bitumen and glass mat reinforcement. The top surface is covered with a thermofusible plastic film and the underside is covered with a release protection film. The surface must be marked with three (3) chalk lines to facilitate roll alignment.

- |    |   |             |      |
|----|---|-------------|------|
| .1 | Properties:   | MD          | XD   |
| .1 | Strain energy (kN/m)  | 1.8         | 1.2  |
| .2 | Breaking strength (N/ cm)   | 12          | 16.3 |
| .3 | Ultimate elongation (%)   | 15          | 15   |
| .4 | Cold bending at -30°C   | No cracking |      |
| .5 | Softening point   | ≥ 90°C      |      |
| .6 | Static puncture (N)   | 160         |      |
| .2 | Prefabricated membrane to comply with CAN/CGSB 37.56-M (9th draft). |             |      |
- .2 Base Sheet Membrane for Flashing and Upstands:
- .1 Description: Description: Roofing membrane composed of SBS modified bitumen and a non-woven polyester reinforcement. The top surface is covered with a thermofusible plastic film and the underside is covered with a release protection film. The surface must be marked with three (3) chalk lines to ensure proper roll alignment.
- .2 In conformance with: CGSB 37.56-M (9<sup>th</sup> Draft).
- |    |                                |               |      |
|----|--------------------------------|---------------|------|
| .3 | Properties:                    | MD            | XD   |
| .1 | Strain energy (kN/m)           | 9             | 7    |
| .2 | Breaking strength (kN/m)       | 17            | 12.5 |
| .3 | Ultimate elongation (%)        | 60            | 65   |
| .4 | Tear resistance (N)            | 60            |      |
| .5 | Static puncture resistance (N) | 400           |      |
| .6 | Dimensional stability (%)      | -0.4          | 0.3  |
| .7 | Plastic flow (°C)              | ≥ 105         |      |
| .8 | Cold bending at -30 °C         | No cracking   |      |
| .9 | Lap joint strength (kN/m)      | Pass > 4 kN/m |      |
- .3 Cap Sheet: a heat-welded membrane composed of SBS modified bitumen with a non-woven polyester reinforcement and elastomeric bitumen. The cap sheet underface is covered with a thermofusible plastic film and the top face is protected by coloured granules.
- |    |  |             |      |
|----|--|-------------|------|
| .1 | Properties:  | MD          | XD   |
| .1 | Strain energy (kN/m)   | 7.8         | 7.2  |
| .2 | Breaking strength (N/ cm)  | 15          | 13.5 |
| .3 | Ultimate elongation (%)  | 60          | 65   |
| .4 | Cold bending at -30°C  | No cracking |      |
| .5 | Softening point  | ≥ 110°C     |      |
| .6 | Static puncture (N)  | 560         |      |
| .2 | Prefabricated membrane to comply with CAN/CGSB 37.56-M (9th draft).                        |             |      |
| .1 | Acceptable product: Cap sheet membrane – SBS Modified Bitumen granulated cap 250 Membrane. |             |      |
| .2 | Colour: as selected by The City from manufactures standard colour range.                   |             |      |
- .4 Cap Sheet Membrane for Flashing and Upstands

- .1 Membrane composed of SBS modified bitumen with a non-woven polyester reinforcement and elastomeric bitumen. The cap sheet underface is covered with a thermofusible plastic film and the top face is protected by coloured granules.
- .2 Prefabricated membrane to comply with CAN/CGSB 37.56-M (9th draft).
- .3 Colour: to match field cap sheet membrane.

## 2.6 ACCESSORY MEMBRANES

- .1 Cover Strip
  - .1 Description: Membrane strip 12" made of SBS modified bitumen and composite elastomeric bitumen reinforcement. Both faces are covered with a plastic thermofusible film. The strip ensures water-tightness in the end laps.

## 2.7 FLAME-STOP MEMBRANE

- .1 Self-adhered membrane composed of a reinforced glass mat and SBS modified bitumen designed to prevent flames from penetrating into empty spaces and openings while installing heat-welded membranes.

## 2.8 ADHESIVES

- .1 Insulation adhesive:
  - .1 Description: A highly elastomeric, two components urethane, one step, all purpose, foam able adhesive that contains no V.O.C. and sets in minutes.

## 2.9 FASTENERS

- .1 Perimeter Fastener:
  - .1 #14 Phillips pre-assembled hot-dipped galvanized mechanical fasteners made case-hardened carbon steel that comply with FMR approval standards, complete with 2" diameter barbed stress plates that comply with the CSA B35.3.

## 2.10 SEALERS

- .1 Waterproofing mastic:
  - .1 Aluminized SBS mastic applied to finished membrane edges at perimeter metal edges, vent pipes and penetration pockets.
- .2 Pitch pocket filler:
  - .1 Pitch pocket system made of pre-cast curb components, including pourable sealant and structural adhesive/sealant.
- .3 Sealing product:
  - .1 Bitumen/polyurethane waterproofing mono-component resin and polyester reinforcement.

## 2.11 ROOF DRAINS

- .1 Spun aluminum drain:
  - .1 Two piece membrane clamping system and cast aluminum high rise strainer, 18" diameter and 4" flange surface adhesion.
    - .1 Acceptable product: Menzies Metal Products or approved equal in accordance with Bid Opportunity Clause B7.

**2.12 STACK FLASHING**

- .1 Aluminum pre-manufactured insulated stack flashing consisting of a metal flashing sleeve with integral flange, matching removable cap, pre-molded urethane insulation liner and EPDM Base Seal.

**Part 3 Execution**

**3.1 QUALITY OF WORK**

- .1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual and CRCA Roofing Specification Manual, particularly for fire safety precautions.
- .2 Do not install roofing materials during rain or snowfall.

**3.2 SURFACE EXAMINATION**

- .1 Examine substrate surface in accordance with manufacturer's written instructions.
- .2 Confirm existing substrate surfaces are acceptable to manufacturer's written instructions to accept Work of this section.
- .3 Contractor to profile level all existing surfaces receiving new roofing systems to ensure positive drainage will be achieved.
- .4 Notify Contract Administrator in writing of discrepancies. Commencement of the Work or any parts thereof constitute acceptance of substrate conditions.

**3.3 PREPARATION**

- .1 Protection:
  - .1 Protect adjacent surfaces and building finished from damage resulting from Work of this section.
  - .2 Protect finished work to avoid damage during roof installation and material transportation. Install protective boardwalks over installed roofing materials to enable passage of people and products. Assume full responsibility for any damage.
  - .3 Protect installation from moisture for minimum 48 hours after completion of each portion of Work.
  - .4 Ensure site protection below deck is provided at all times. Any contamination from construction processes and/or precipitation must not be permitted to penetrate the areas below the roof deck. Complete environmental separation must be maintained at all times.
- .2 Surface preparation:
  - .1 Ensure environmental and site conditions are suitable as directed by manufacturer for installation of system.
  - .2 Remove all existing roofing materials, included membrane residual on existing roof deck. All loose and/or protruding materials to be removed down to existing roof deck with methods suitable to the contractor. As necessary the contractor is to provide the applicable site protection measures.
  - .3 Prepare surfaces in accordance with manufacturer's written instructions.

### 3.4 APPLICATION OF PRIMER

- .1 Apply primer to wood, metal, concrete, masonry, gypsum board and cementitious board roofing substrates at a rate recommended by manufacturer. All surfaces to be primed must be free of rust, dust or any residue that may hinder adherence. Cover primed surfaces with roofing membrane as recommend by manufacturer.

### 3.5 INSTALLATION OF AIR VAPOUR BARRIER MEMBRANE

- .1 Primer must be dry prior installation of the vapour barrier membrane.
- .2 Beginning at the bottom of the slope, without adhering the membrane, unroll onto the substrate for alignment. Do not immediately remove the silicone release sheet.
- .3 Align the roll parallel to the corrugations of the steel deck. Make sure the membrane overlaps are supported along their entire length.
- .4 Peel back one end of the silicone release sheet and adhere this part of the membrane to the substrate. Peel back the remaining release sheet at a 45° angle to avoid wrinkles in the membrane.
- .5 Overlap adjacent membranes by 75 mm (3 in). Overlap end laps by 150 mm (6 in). Stagger end laps by at least 300 mm (12 in).
- .6 When the vapour barrier is installed directly on the steel deck, place a thin sheet of metal under the end lap of the vapour barrier.

### 3.6 INSTALLATION OF INSULATION

- .1 Tapered insulation:
  - .1 Adhere insulation to air vapour barrier panel or to adjoining board using specified adhesive.
  - .2 Apply adhesive in 19mm (3/4") continuous parallel ribbons at 305mm (12") on center (each layer). Refer manufacturer's written instructions for spacing at perimeters and corners.
  - .3 Install tapered insulation as first insulation layer, in accordance with shop drawings. Stagger joints between layers 150mm (6") minimum.
  - .4 Follow the other installation instructions as listed below.
- .2 Insulation:
  - .1 Adhere insulation to tapered insulation, air vapour barrier panel and to adjoining board using specified adhesive.
  - .2 Apply adhesive in 19mm (3/4") continuous parallel ribbons at 305mm (12") on center (each layer). Refer manufacturer's written instructions for spacing at perimeters and corners.
  - .3 Use largest insulation sheets as possible, place boards in parallel rows with ends staggered, and in firm contact with one another.
  - .4 All vertical joints between level boards and sloped modules for the two rows of insulation board to be staggered. Minimum 150mm (6").
  - .5 Use a weighted roller to ensure continuous contact between insulation, adhesive and air/vapour barrier panel.
  - .6 At gaps in the insulation, cut and adhere segments of rigid insulation as required to ensure full continuity in thermal barrier.
  - .7 If localized mechanical anchors are required to secure insulation due to surface irregularities, they shall be included in the fixed price of the roof installation and the

fasteners shall be hot-dipped galvanized No. 14 screws. Dip screws in liquid membrane prior to insertion to provide air seal.

- .8 Install only as much insulation as can be covered in the same day.

### **3.7 INSTALLATION OF FLAME-STOP MEMBRANES**

- .1 Adhere the membrane directly onto an approved substrate by peeling back the silicone release film. Membrane tape is designed to prevent flames from penetrating into empty spaces and openings while installing heat-welded membranes.
- .2 Unroll the flame-stop membrane onto the insulation without adhering, being careful to overlap adjacent strips to ensure that the flame will not come in contact with the insulation.

### **3.8 INSTALLATION OF SELF-ADHERED BASE SHEET**

- .1 Beginning at the drains and perpendicular to the slope, install the base sheet membrane without adhering in parallel strips.
- .1 Each strip should overlap the preceding strip by 75mm. along the side joint (use the blue line to facilitate alignment) and by 25mm at the ends. Base sheet membrane joints can be aligned (no staggering) to facilitate the installation of the reinforcing band.
- .2 Let the membrane relax at least 15 minutes before installing it, burn the plastic film in a zig-zag fashion using a propane torch to relax it. In cold weather, use the second method.
- .3 Peel back the silicone release paper to adhere the membrane to the substrate. Use a weighted roller to apply even pressure and to ensure good adherence.
- .4 Remove the paper protecting the selvedge then heat the side joints. Seal the joints using a trowel. A bead of molten bitumen should appear along the joint to ensure a perfect seal.
- .5 Seal the end joints by welding a 12" wide protection band centred on the joint.
- .6 Avoid creating wrinkles, blisters, and fishmouths.
- .7 The base sheet membrane should end over the cant strip or at the edge of the substrate.

### **3.9 BASE SHEET FLASHING INSTALLATION (SELF ADHERED)**

- .1 Apply base sheet flashing only after primer coat is dry.
- .2 Before applying membranes, always remove the plastic film on the section to be covered if there is an overlap (inside and outside corners and field surface). For sanded base sheet membranes, apply primer to the area to be covered at the foot of the parapets.
- .3 Position the pre-cut membrane piece. Peel back 4" to 6" of the silicone release paper to hold the membrane in place at the top of the parapet.
- .4 Then, gradually peel back the remaining silicone release paper, pressing down on the membrane with an aluminum applicator to ensure good adhesion. Use the aluminum applicator to ensure a perfect transition between the upstand and the field surface. Smooth the entire membrane surface with a roller for full adhesion.
- .5 Cut off corners at end laps to be covered by the next roll.
- .6 Install a reinforcing gusset in all inside and outside corners.
- .7 Always seal overlaps at the end of the workday.

**3.10 INSTALLATION OF REINFORCEMENTS**

- .1 Install reinforcements specified for various roof surfaces according to the following instructions and illustrations found in manufacturer's technical data.

**3.11 CAP SHEET INSTALLATION (TORCH-APPLIED MEMBRANE)**

- .1 Once base sheet is applied and no defects are apparent, proceed with cap sheet installation.
- .2 Begin with double-selvage starter roll. If starter roll is not used, side laps covered in granules must be degranulated by embedding side laps in torch-heated bitumen over a 4" width.
- .3 Unroll cap sheet at drain. Carefully align first side lap (parallel to roof edge).
- .4 Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls.
- .5 Avoid overheating.
- .6 Make sure joints between the two layers are staggered by at least 12".
- .7 Overlap cap sheet side laps by 4" and end laps by 6". Cut off corners at end laps to be covered by next roll. All overlap surfaces must be degranulated.
- .8 Complete perfect welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam (it may be necessary to slow down in certain cases).
- .9 Application to be free of blisters, fishmouths and wrinkles.
- .10 Once cap sheet is installed, carefully check all overlapped joints.
- .11 During installation, take care to avoid excessive bitumen bleed-out at joints.

**3.12 INSTALLATION OF CAP SHEETS ON UPSTANDS AND PARAPETS (HEAT-WELDED)**

- .1 This cap sheet must be installed in one-metre-wide strips. The side joints must overlap by 4" and must be staggered by at least 4" with respect to the joints of the cap sheet on the field surface, to avoid areas of excessive membrane thickness. The overlaps on the field surface must be 2" wider than those of the base sheet membrane on the upstands and parapets. At end laps, angle-cut the corners that will be covered by the following roll.
- .2 Use a chalk line to draw a straight line on the field surface 6" from the upstands and parapets.
- .3 Use a propane torch and round-nose trowel to embed the surface granules in the layer of hot bitumen starting from the chalk line on the field surface to the bottom edge of the upstand or parapet as well as on the granulated vertical surfaces that are to be overlapped.
- .4 This cap sheet will be heat-welded directly to the base sheet membrane, proceeding from bottom to top. This technique softens both membranes in order to obtain even, continuous weld.
- .5 During installation, be careful not to overheat the membrane or to create excessive bitumen bleeding at the joints.

**3.13 ROOF PENETRATIONS**

- .1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

**3.14 WATERPROOFING FOR VARIOUS DETAILS**

- .1 Install waterproofing membranes in conformance with various roofing details and as per manufacturer's written technical documentation.

**3.15 FIELD QUALITY CONTROL**

- .1 Field reviews:
  - .1 Field reviews of roofing application will be carried out by Contract Administrator and/or by independent inspection agency designated by the Contract Administrator.

**3.16 CLEANING**

- .1 Remove bituminous markings from finished surfaces.
- .2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
- .3 Repair or replace defaced or disfigured finishes caused by work of this section.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 07 52 00 – Modified Bituminous Membrane Roofing

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM D523-14, Standard Test Method for Specular Gloss.
  - .3 ASTM D1005-95(2013) Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers.
  - .4 ASTM D2244-14 Standard Practice for Calculation of Colour Tolerances and Colour Differences from Instrumentally Measured Colour Coordinates.
  - .5 ASTM D2247-11 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
  - .6 ASTM D2414-13a Standard Test Method for Carbon Black-Oil Absorption Number (OAN).
- .2 Canadian Roofing Contractors Association (CRCA)
  - .1 Roofing Specifications Manual.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit duplicate 1000 x 100mm (4"x4") samples of each type of sheet metal material, finishes and colours.
- .4 Quality assurance submittals:
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

**1.4 QUALITY ASSURANCE**

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative, The City and the Contract Administrator to:
  - .1 Verify project requirements.

- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Stack flashings to prevent twisting or bending out of shape.
- .3 Prevent contact of flashing materials with corrosive substances.
- .4 Damaged materials shall be replaced with new materials.
- .5 Handle and store metal flashings so that marring and scratching of the coatings do not occur.

**1.6 WARRANTY**

- .1 Warranty for flashing assembly free of the following defects: splitting seams, lifting, loosening and undue expansion for two (2) years from date of Substantial Performance.

**Part 2 Products**

**2.1 SHEET METAL MATERIALS**

- .1 Zinc coated steel sheet: thickness as shown on drawings, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

**2.2 PREFINISHED STEEL SHEET**

- .1 Prefinished steel with factory applied polyvinylidene fluoride.
  - .1 Thickness 26 gauge: as indicated on drawings and details.
  - .2 Colour selected by the City from manufacturer's standard range.
  - .3 Specular gloss: 30 units +/- in accordance with ASTM D523.
  - .4 Coating thickness: not less than 25 micrometres in accordance with ASTM D1005
  - .5 Resistance to accelerated weathering for chalk rating of 8 in accordance with ASTM D2414.
  - .6 Resistance to colour fade 5 units or less in accordance with ASTM D2244.
  - .7 Resistance to humidity after 1000 hours of exposure in accordance with ASTM D2247.

**2.3 ACCESSORIES**

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Sealants: Dow Corning 795 silicone. Colour to match adjacent finish or as selected and approved by the City.
- .3 Cleats: of the same materials as the metal designed to secure. Size shall be to suit components to be secured (min 100mm wide). Gauge shall be sufficient to retain the flashings in place
- .4 Fasteners: as indicated on drawings.

- .5 Washers: as indicated on drawings.
- .6 Touch-up paint: as recommended by prefinished material manufacturer.

## 2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated on drawings.
- .2 Form pieces in 2400 mm maximum lengths.
  - .1 Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm.
  - .1 Mitre and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

## 2.5 METAL FLASHINGS

- .1 Form flashings, copings and fascias to profiles and thicknesses indicated on drawings.
- .2 Butt end joints and provide 150mm (6") backup plates.
- .3 Each cap flashing to incorporate a 45°, 12mm hemmed drip edge, unless otherwise noted on drawings.

## 2.6 REGLETS

- .1 Form recessed and surface mounted reglets to profiles and thicknesses indicated on drawings, to be built-in concrete or masonry work in accordance with CRCA FL series details and as indicated on drawings.
  - .1 Provide slotted fixing holes and steel/plastic washer fasteners.

## Part 3 Execution

### 3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 3.2 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA FL series details and as indicated on drawings.
- .2 Use concealed fastenings except where approved before installation.
- .3 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
  - .1 Flash joints using S-lock forming tight fit over hook strips and as indicated.
- .4 Lock end joints and caulk with sealant.
- .5 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .6 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25mm (1"). Lead wedge flashing securely into joint and caulk top with sealant.

- .7 Any through wall flashing shall be installed on 10 degree slope unless noted otherwise.
- .8 Install pans, where shown around items projecting through roof membrane.

**3.3 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Leave work areas clean, free from grease, finger marks and stains.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        This section covers the installation of an elastomeric joint sealant in cleaned and routed cracks and joints in concrete. The work covered under this section consists of all labour, material, equipment, supervision and incidentals required to prepare and seal the joints and cracks as shown and detailed on the drawings, and as specified herein.

**1.2                RELATED SECTIONS**

- .1        Section 03 92 12 – Top Surface Repairs with Rapid Setting Mortar.
- .2        Section 03 92 40 – Repair of Slab-Joist System.

**1.3                REFERENCES**

- .1        American Society for Testing and Materials (ASTM):
  - .1        ASTM C719-14, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
  - .2        ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.
  - .3        ASTM C1193-16 Standard Guide for Use of Joint Sealants.
  - .4        ASTM C1330-02(2013) Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - .5        ASTM C1521-13 – Standard Practice for Evaluating Adhesion Of Installed Weatherproofing Sealant Joints.

**1.4                MEASUREMENT PROCEDURES**

- .1        Miscellaneous cracks, control joints, and construction joints designated for routing and caulking will be identified and quantified by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work.
- .2        Unit prices must include all supervision, labour and materials, and equipment. Joints/reglets to be uniform in size over the given length and conform to one of the following configurations. The following unit prices have been requested for miscellaneous joint/crack routing and caulking. The minimum unit of payment will be one (1) linear foot for various reglet sizes.
  - .1        ¼" width.
  - .2        ½" width.
  - .3        ¾" width.
  - .4        1" width.
- .3        The Contractor is to note that if they increase length of repair over that originally measured of their own accord and without consultation with the Contract Administrator, they will not be paid for the increased area.

**1.5 SUBMITTALS**

- .1 Comply with Section 01 33 00.
- .2 Product Data: Submit manufacturer's technical bulletins and MSDS on each product.
- .3 Samples: For each product exposed to view, manufacturer's standard bead consisting of strips of actual products showing full range of colors available.

**1.6 QUALITY ASSURANCE**

- .1 Contractor Qualifications:
  - .1 Minimum of 10 years experience in application of specified (or similar) products on projects of similar size and scope.
  - .2 Successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.
- .2 Field Mock-Ups:
  - .1 Perform mock-up of required sealant Work at location identified by the Contract Administrator. Perform minimum of one mock-up for each different combination of substrates to be sealed.
  - .2 Install mock-ups and test in presence of sealant manufacturer's authorized representative and Contract Administrator to assure installation procedures are consistent with warranty requirements and Specifications.
  - .3 After sealant has achieved sufficient cure the Contract Administrator will conduct adhesion pull-tests, or non-destructive testing, at discretion of the Contract Administrator. Conduct tests per ASTM C1521.
  - .4 Leave approved mock-ups in place to establish standards and guidelines for acceptable installation of sealant Work and acceptable appearance.

**1.7 DELIVERY STORAGE AND HANDLING**

- .1 Comply with Section 01 60 00.
- .2 The sealant shall be delivered to the jobsite in the manufacturer's original unopened
- .3 Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Material Safety Data Sheets for each product.
- .4 Store products in a location protected from freezing, damage, construction activity, precipitation, and direct sunlight per manufacturer's recommendations.
- .5 Handle products with appropriate precautions and care as stated on Material Safety Data Sheet.

**1.8 PROJECT CONDITIONS**

- .1 Environmental Requirements:
  - .1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.

- .2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.
- .3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

## 1.9 WARRANTY

- .1 The Contractor and/or system manufacturer shall furnish a written performance warranty covering labour and materials at the time of tender submission or approval, stating that the installed sealant will be free of defects related to workmanship or material deficiency for a minimum of five (5) years from the date of Substantial Performance. The Contractor shall co-sign the warranty and the approved warranty shall be made part of the contractual agreement. The following problems shall be specifically covered under the warranty in writing:
  - .1 Cohesive or adhesive failure of the seal.
  - .2 Abrasion or tear failure of the seal resulting from normal weathering.
  - .3 Moisture leakage through a sealed joint or crack.
  - .4 Chalking, cracking, sliding, debonding, shrinkage in the sealant.
- .2 The manufacturer to provide a 5 year material warranty. and/or Contractor shall submit a detailed warranty statement consistent with the terms of this specification at the time of tender submission for approval. The approved warranty shall be made part of the contractual agreement.

## Part 2 Products

### 2.1 MATERIALS

- .1 Type II: Two-component polyurethane joint sealant for routing and caulking of random cracks [and control joints] and miscellaneous cants below cold-applied liquid waterproofing. Multi-component, non-sag, chemically curing sealant, with consistency suitable for application by hand or pressure caulking gun, or by hand tool. The sealant when completely cured shall form an elastomeric solid capable of maintaining a weatherproof seal.
  - .1 Compliance: ASTM C920, Type M, Grade NS, Class 25, Use T, NT, M, and A.
  - .2 Acceptable products:
    - .1 Sikaflex 2C/NS by Sika Canada Inc.,
    - .2 MasterSeal NP2 by BASF Building Systems,
    - .3 Or approved equal in accordance with Bid Opportunity Clause B7.

### 2.2 ACCESSORIES

- .1 Primers, bond breakers and miscellaneous materials required to install the sealant shall be in accordance with manufacturer's recommendations, and as approved by the Contract Administrator. Use of aggregate bond breakers is prohibited.
  - .1 Primer: Use only manufacturer's approved primer.
  - .2 Closed-cell foam backing rod shall conform: to ASTM C1330.

- .3 Bond breaker tape: self-adhesive, pressure sensitive tape made from TFE-fluorocarbon (Teflon), polyethylene, or similar which will not react with or adhere to the sealant.

**Part 3 Execution**

**3.1 PROTECTION**

- .1 Protect adjacent surfaces against any damage that could result from sealant installation.

**3.2 EXAMINATION**

- .1 Inspect existing caulked joints and cracks to ensure there is no deteriorated sealant, adhesion loss or non elastomeric sealants installed in joints. Remove and replace deficient sealant at location identified by Contract Administrator.
- .2 Inspect all deck penetrations, including electrical, lighting, signage, plumbing, HVAC, fire sprinkler piping for watertight seal. Remove and replace deficient sealant at location identified by Contract Administrator.

**3.3 PREPARATION**

- .1 Substrates must be sound and free of dust, dirt, laitance, paints, oils, grease, curing compounds, or any other contaminants.
- .2 All new concrete surfaces to have minimum compressive strength of 21 MPa and be cured for minimum of 28 days or 80 percent of design strength.
- .3 Joint and crack preparation:
  - .1 Completely remove sealant from existing joints and cracks designated for repair.
  - .2 Sawcut reglet along cracks and joints identified by Contract Administrator.
  - .3 Reglet dimensions are to be site confirmed based on crack dimensions and pattern and be uniform over the given length. The depth of the reglet must be consistent with the type of backing material (ie. bond breaker tape or backing rod) and sized to produce a width to depth ratio of approximately 2:1.
  - .4 Thoroughly clean joints and reglets by grinding, sandblasting, or wire brushing to expose a sound surface free of contamination and in order to provide a clean, sound substrate for optimum seal adhesion.
  - .5 Remove loose particles present or resulting from grinding, abrading, or blast cleaning by blowing out joints with oil-free compressed air, or vacuuming prior to primer application.
  - .6 Ensure that surfaces to be sealed are sound, dry, free from dirt, water, frost, loose scale, corrosion, oil, grease, waterproofing or water-repellent treatments, or other contaminants which may adversely affect the performance of the sealing materials.
  - .7 If the substrate is suspected of being substandard, an on-site trial application is to be conducted to verify that the substrate is satisfactory. Work will not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the manufacturer. All costs associated with verification to be carried by Contractor.

- .8 Prior to installation of the sealant an inspection of both the joint and substrate is required to confirm the joint design and to ensure that the substrate is sound and acceptable for sealant application. A substrate that is unsound, cracked, or weak must be repaired prior to sealant.
- .9 Do not proceed with Work until any unsatisfactory conditions have been corrected in a manner acceptable to the Contract Administrator.

### 3.4 INSTALLATION

- .1 Primer: Unless otherwise approved by the sealant manufacturer, priming of all substrates is mandatory.
  - .1 Prime substrates as recommended by the sealant manufacturer.
  - .2 Primer to be installed prior to installation of the sealant backing.
  - .3 Allow primer to dry until all the solvent evaporates. This typically takes 15 to 120 minutes, depending on temperature and humidity.
  - .4 Prime only those surfaces that will be sealed with sealant the same day. If a previously primed surface that was performed the day before is encountered it must be re-primed.
- .2 Sealant backup: Where joint depth requires backup, pack joints continuously with closed cell backer rod meeting ASTM C1330
  - .1 Backer rod to be installed under adequate compression to hold it in-place in the joint opening and to resist the pressure applied when tooling a non-sag sealant into place. Backer rod diameter to be at least 25% greater than the joint width.
  - .2 Do not install backer rod with a sharp tool which could puncture the rod. Ensure surface skin of the backer rod is not punctured or cut during installation. A puncture in the backer rod may result in out-gassing into the uncured sealant resulting in voids or other defects in the cured sealant.
  - .3 Install backer rod without stretching.
  - .4 Under no circumstances should backer rod that is too small for the joint be doubled up or braided together to fit the opening.
- .3 Bond breaker: A bond breaker will be required in the bottom of all joints containing a rigid, non-flexible backing material to preclude three-side adhesion where movement will occur. A bond breaker is not required to prevent a sealant from adhering to a soft, flexible, sealant backing material that would not significantly restrict movement.
  - .1 Install bond breaker tape in joint to be sealed on top of back-up material to prevent adhesion of sealant to back-up material. The tape shall be installed continuously with no skips or voids in the tape application.
- .4 Mixing:
  - .1 Prepare sealants that require mixing; follow manufacturer's recommended procedures, mixing thoroughly.
  - .2 Mix only as much material as can be applied within manufacturer's recommended application time period.
  - .3 Mix in a manner to prevent inclusion of foreign materials.
- .5 Sealant installation:

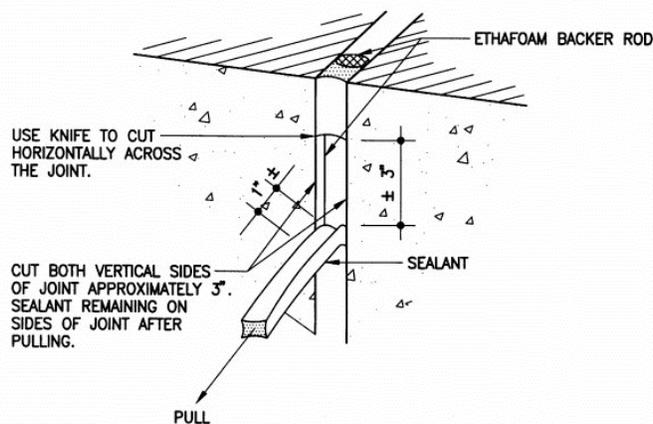
- .1 Apply sealants only within manufacturer's specified application life period. Discard sealant after application life is expired or if prescribed application period has elapsed.
- .2 Application of sealants must be completed by skilled applicators installed in accordance with manufacturer's printed directions and this Section.
- .3 Apply sealants to meet Specification and design requirements [as shown on Drawings].
- .4 Do not install sealant on wet or damp substrates. Wet or damp substrates should be allowed to dry before application of primer and/or sealant.
- .5 Do not install sealants under conditions of precipitation or temperatures below 4°C. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions in accordance with manufacturer's recommendations if application during inclement weather occurs.
- .6 All sealants have a temperature range for optimum handling which can vary considerably, and should be stored at a temperature within this range for at least 4 hours before use.
- .7 Do not use sealant that has started to set in its container, exceeded shelf life or installation times as stated by the manufacturer.
- .8 Sealant to be installed in a manner that will completely fill the cavity formed in the joint opening by the substrates and sealant backing or bond breaker.
- .9 Apply sealant by any of the common types of hand operated guns. Nozzles shall be sized and shaped to fit the intended joint opening width, which will confine the sealant to the joint and aid in building pressure to force the sealant into the cavity. Ensure that mixing and placing procedures do not entrain air within the sealant.
- .10 Immediately after applying the sealant, tool the bead. Tooling forces material into cavities and into more intimate contact with the substrate. Wet tooling will not be permitted.
- .11 Tool sealant to produce a concave shaped surface. Specifically, the sealant and concrete are to be flush at the edges but recessed at the joint centre, forming a parabolic arc. Do not re-use any material forced outside of the joint by the tooling procedure.
- .12 Sealant bead to be free of air pockets, embedded impurities, and free of ridges, wrinkles and sags.
- .13 Use anti-tack solutions only with the approval and directions of the sealant manufacturer.

### **3.5 CLEANING**

- .1 Do not clean inadvertent spills or splatters of sealant on concrete or masonry with solvent because of possible permanent staining of the substrate. Scrape, wipe or scrub such spills with dry tools or rags.
- .2 Clean bulk caulking guns, barrel and nozzle completely after every day's use.
- .3 The special precautions recommended by the manufacturer shall be rigidly followed where hazardous materials are involved.

### 3.6 FIELD ADHESION TESTING

- .1 Field adhesion testing of miscellaneous joints and cracks will be complete at the discretion of the Contract Administrator.
- .2 Field adhesion testing will be performed during the field mockup and throughout the course of the work by the Contract Administrator in the presence of and with the assistance of the Contractor and be completed throughout the course of the work. The purpose of the field adhesion testing is to help detect application problems such as improper cleaning, use of improper primer, poor primer application, or improper joint configuration.
- .3 A minimum three (3) field adhesion tests will be completed for each type of sealant used for the first 500 linear feet and two (2) tests per 500 linear feet thereafter.
- .4 The field adhesion test shall be performed as follows:
  - .1 Make a knife cut across the full width of the joint.
  - .2 Make two (2) cuts (from the cross cut) approximately 3" long, along both sides of the joint.
  - .3 Place a 1" mark on the sealant tab.
  - .4 Grasp the 3" sealant tab firmly 1" from its bonded edge and pull at a 90° angle.
  - .5 If dissimilar substrates are being sealed, check the adhesion of sealant to each substrate separately. This is accomplished by extending the vertical cut along one side of the joint, checking adhesion to the opposite side and then repeating for the other surface.



**FIGURE 1.1 HAND PULL TEST**

- .5 Field adhesion test criteria:
  - .1 Urethane Sealants: the sealant should tear cohesively within itself without bond loss.
- .6 At this time the joint will be inspected for complete fill. The joint should not have voids, and joint dimensions should match those shown on the drawings.
- .7 This testing will be completed by the Contract Administrator in the presence of and with the assistance of the Contractor and results recorded by the Contract Administrator,

retained and made available for review upon request. A sample log form has been appended with this specification.

- .8 Repair of Sealant at Field Adhesion Test Locations
  - .1 Repair the sealant pulled from the test area by applying new sealant to the test area. Assuming good adhesion was obtained, use the same application procedure to repair the area as was used originally for the joint. Care should be taken to ensure that the original sealant surfaces are clean and that the new sealant is in contact with the original sealant.
  - .2 Contractor shall carry costs associated with sealant testing and repair in their bid including but not limited to access, labour, materials, etc.

**END OF SECTION**