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WORK RESTRICTIONS

SECTION 1 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Division 1 Specification Sections, apply to this Section.

1.2 USE OF SITE

- A. **General:** The Contractor shall have full use of the site of the works, during construction period. However, the Contractor's use of site is limited only by the Employer's right to perform work or to retain other Contractors to do so.
- B. **Use of Site:** Limit work and activities to the area of the Site as defined on Drawings in areas indicated. Do not disturb areas outside the Site or in which the work is indicated.
1. Limits: Confine constructions operations to areas where work is permitted.
 2. The Employer Occupancy: Allow for the Employer occupancy of Site.
 3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to the Employer, the Engineer and their employees, other Contractors engaged in work on the Site and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.3 OCCUPANCY REQUIREMENTS

- A. **Partial Employer Occupancy:** The Employer reserves the right to occupy and to place and install equipment in completed areas of the Site, before substantial completion, provided such occupancy does not interfere with the Contractor's completion of the Works. Such placement of equipment and partial occupancy shall not, by itself, constitute completion or acceptance, or Taking-Over of any part of the Works.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT



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QUALITY ASSURANCE/ QUALITY CONTROL

SECTION 2 - QUALITY ASSURANCE/ QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Division 1 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE PROGRAM

- A. Provide and maintain an effective Quality Assurance Program that complies with Clauses 36, 37, 38 and 39 entitled "Materials, Plant and Workmanship" of the Part I, General Conditions of the Contract.

1.3 SCOPE OF PROGRAM

- A. The Contractor shall establish a Quality Assurance Program to perform sufficient inspection and tests of all items of work, including that of his suppliers and subcontractors, to insure conformance to applicable Technical Specifications and Drawings with respect to the materials, workmanship, construction, finish, functional performance, and identification.

1.4 PLAN DEFINITION

- A. **The PQAP (Project Quality Assurance Program):** This Plan is the means to ensure that construction complies with the requirements of the Contract Documents. The CQAP shall be adequate to cover all construction operations, including both on-site and off-site fabrication and installation works by subcontractors and will be keyed to the proposed Contract Schedule. The PQAP shall include as a minimum, at least three phases of inspection for all definable phases of works which are subsequently described in paragraphs 1.4.B, 1.4.C, 1.4.D.
- B. **Preparatory Inspection:** This inspection shall be performed prior to beginning any work on any activity on any definable phase of works and as shown in the Contract Schedule. It shall include a review of contract requirements; a check to assure that all materials and/or equipment have been tested, submitted, and approved by the Engineer; a check to assure that provisions have been made to provide required control testing; and plan mock-ups when appropriate; examination of work area to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment to assure that they conform to approved shop drawings or submittal data and that all materials and/or equipment are on hand. The Engineer shall be notified at least twenty four (24) hours in advance of the preparatory inspections and such inspection shall be



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made a matter of record in the Contractor's Quality Control Reports as required by paragraph 3.3.

- C. **Initial Inspection:** This inspection shall be performed as shown in the Contract Schedule. This inspection shall occur as soon as a representative portion of the particular phase of construction has been accomplished. This shall establish the acceptable standard of workmanship, including a review of control testing for compliance with contract requirements, review of mock-up, use of defective or damaged materials, omissions, and dimensional requirements. The Engineer shall be notified at least twenty four (24) hours in advance of the initial inspection and such inspection shall be made a matter of record in the Quality Control Reports as required by paragraph 3.3.
- D. **Follow-up Inspections:** Inspections shall be performed daily to assure continuing compliance with Contract requirements, including control testing, until completion of the particular phase of construction. Such inspections shall be made a matter of record in the Quality Control Reports as required by paragraph 3.3.

1.5 CONDITIONS OF PROJECT QUALITY ASSURANCE PROGRAM (PQAP)

- A. Furnish to the Engineer, a PQAP which shall include the personnel, instructions, procedures, records to be used, document controls and quality assurance overview. This document will include as a minimum:
- a. The Quality Control Organization (Chart) including major reporting lines and relationships.
 - b. Reporting relationships within and external to organization. Duties and responsibilities within the said organization shall be stated.
 - c. The name of the Quality Control Manager (QCM). This individual shall report directly to senior management, independent of manufacturing/ construction.
 - d. Names and Qualifications of Quality Control Personnel.
 - e. Authority and area of responsibilities of Quality Control Personnel.
 - f. An explanation as to how the Quality Control organization relates to other staff elements as regards Shop drawing submittals, As-Built drawings, revisions to the contract and safety.
 - g. Methods proposed to control the use of the various design documents, shop drawings, procedures, etc. to assure that only the latest reviewed documents are used and are distributed to the individuals performing the Work. Recall of documents which have been superseded or revised



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- shall be implemented. Describe the process used to determine what submittals are required by the Contract and the system used to track these submittals and their current status.
- h. A narrative discussion of how the Quality Control staff will accomplish the tasks assigned to quality control.
 - i. A copy of a letter of direction to each representative responsible for Quality Control, outlining his duties and responsibility and signed by a responsible officer.
 - j. Identification and description of all mock-up items.
 - k. Methods for accomplishing quality control inspections addressing the how, what, where, when and why of these inspections, including that for subcontractor's work (see paragraph 3.).
 - l. Method of documenting quality control operations, inspections and testing. This shall include how various records originated and maintained, received, filed, protected, and authenticated. Quality Records required for submittal to the Engineer shall be described.
 - m. Detailed listing by Specification Section and paragraph designating all QC requirements and tests to be performed and their frequency. Further indicate which tests will be performed by technicians or by an approved testing laboratory.
 - n. Methods to be employed when any Work is found not to meet Technical Specifications and the means to be implemented to document the items (non-conformance reports) and provide resolution.
 - o. A matrix of all Contract and Technical Specification requirements to enable monitoring of all items from start until acceptance and completion. This is to facilitate Contract close-out.
- B. To facilitate contract management and project administration the Contractor shall acquire and implement the Primavera Expedition Project Control system. The Contractor shall provide information on tracking and control of documentation extracted from the System as and when required by either the employer or the Engineer.

PART 2 – PRODUCTS (Not Used)



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PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Prior to submittal of the PQAP for acceptance, meet with the Engineer or his representative and discuss the PQAP. The meeting shall develop mutual understanding relative to details of the system, including the forms to be used for recording the Quality Control operations, inspection, administration of the program, and the interrelationship and the Engineer's inspection. Requirements for Hold Point Release sign offs on Quality Control checklists/ inspection sheets by the Engineer shall also be discussed and established.

3.2 QUALITY CONTROL ORGANIZATION

- A. The PQAP shall be implemented by the establishment of the Quality Control Organization whose sole duty will be to ensure conformance to the Contract of all QA/QC activities.
- B. Quality Control Manager (QCM) must be an individual with demonstrated experience implementing a QC program and supervising Inspectors.
1. This experience shall include at least five (5) years of Quality Control (QC) background in any combination of the following areas:
 - a. Field inspection.
 - b. Construction phase experience relevant to the scope of work.
 - c. Previous experience as a Quality Control Manager.
 - d. Fabrication/Manufacturing experience.
 2. In addition, the QCM shall have the following managerial experience:
 - a. Supervised at least two (2) people.
 - b. Experience on a government regulated project.
 - c. Implemented a Quality Control (QC) program.
 - d. Experience on a comparably sized project of similar complexity.
 3. Submit the résumé of proposed QCM for acceptance by the Engineer. If, for any reason, the QCM is replaced, the resume of the proposed replacement QCM shall be submitted and accepted by the Engineer prior the replacement taking effect.



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4. Due to the complexity and nature of this Contract a full time QCM is required.
- C. Quality Control Organization shall be sufficiently staffed to perform the following tasks:
1. Conduct phased inspections (Preparatory, Initial and Follow-up) in accordance with paragraph herein before.
 2. Perform all testing required under the Technical Specifications, including all listed Codes and Standards.
 3. Prepare daily and monthly QC reports in accordance with paragraph 3.3 hereinafter.
 4. Review and endorse all shop drawing submittals for compliance with Contract requirements prior to submission to the Engineer.
 5. Inspect materials as they are delivered on site to ensure compliance with reviewed shop drawings and contract specifications.
 6. Conduct off-site inspections of supplies and services to be incorporated into the work. Provide monthly report of off-site QC activities.
 7. Maintain record of all QC activities. These records shall be available for the Engineer's use.
- D. Where applicable and as a minimum, the Quality Control staff shall include the following suitably qualified personnel:
1. Structural Quality Control Inspector
 2. Architectural Quality Control Inspector
- E. If at any time during the contract period the Engineer determines the Contractor's Quality Control staff is not capable of performing all the tasks listed above, then the Engineer may direct to revise and/or supplement the present organization structure at own cost.

3.3 QUALITY CONTROL REPORTS

- A. **Daily Quality Control Report:** Submit a daily Quality Control Report. The report shall contain a record of inspections and tests for all work accomplished subsequent to the previous report and shall include the following information:



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1. Phase(s) of construction underway during the time frame of the report. (i.e. earthwork, concrete work, structural steel erection, mechanical and electrical installations, architectural finishes etc.)
 2. Phase Inspection (preparatory, initial or follow-up), phase of construction and location of inspections and/or tests that were made.
 3. Results of inspection, including nature of deficiencies observed and corrective actions taken or to be taken.
 4. Report of tests performed, including those specified, with the results of the tests, including failures and remedial action to be taken. Test results, including all computations shall be attached to the report form. Where test results cannot be completed by the time the report is submitted, a notation shall be made that the test was performed and the approximate date test results will be available. Delayed test results shall be submitted with the report form on the date received.
 5. Results of inspection of materials and equipment upon arrival at the site and prior to incorporation into the work for compliance with submittal approvals, damage and proper storage.
 6. Offsite QA/QC activities.
 7. Instructions received from the Engineer.
 8. All non-conformances, either in tests or inspections, shall be specifically listed under a separate heading.
 9. In all cases, the report must be verified and signed by QCM. The verification is to contain the statement that all supplies and materials incorporated in the work are in compliance with the Contract except as noted.
- B. Monthly Quality Control Report:** Submit a Monthly Quality Control Report. This report shall consist of an executive summary of all QA/QC activities executed in the previous month. The report shall contain the following information:
1. Phase(s) of construction underway during the time frame of the report. (i.e. earthwork, concrete work, structural steel erection, mechanical and electrical installations, architectural finishes etc.)
 2. Confirmation that all necessary Quality Control testing has been performed in accordance with the Technical Specifications and other Contract documents, with respect to quantity and quality.
 3. Summary of the tests performed during the month, including number passing and failing.
 4. Summary of all non-conformances, including actions taken or actions proposed.



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5. Details of significant trends in test results.
6. In all cases, the report must be verified and signed by QCM. The verification is to contain the statement that all supplies and materials incorporated in the work are in compliance with the Contract except as noted.

3.4 CHANGES TO QUALITY ASSURANCE PROGRAM

- A. Notify the Engineer or his authorized representative in writing of any proposed change to the Contractor's Quality Assurance Program. Any proposed changes must not be implemented until prior approval has been received from the Engineer.

END OF DOCUMENT



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CONSTRUCTION PROGRESS DOCUMENTATION

SECTION 3 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Division 1 Specification Sections, apply to this Section.
1. Refer to Conditions of Contract and Agreement for definitions and specific dates of Contract Time.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Preliminary Construction Programme.
 2. Construction Programme.
 3. Submittals Schedule.
 4. Daily construction reports.
 5. Monthly progress reports.
 6. Material location reports.
 7. Field condition reports.
 8. Accident reports.
 9. Special reports.
 10. Wage book and time sheet records.
- B. Related Sections include the following:
1. Division 1 Section "Summary of Multiple Contracts" for preparing a Combined the Contractor's Construction Programme.
 2. Division 1 Section "Project Management and Coordination" for distributing meeting and conference minutes.
 3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
 4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.



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5. Division 2 Sections for specific submittal requirements.

1.3 DEFINITIONS

- A. **CPM:** Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- B. **Critical Path:** The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- C. **Network Diagram:** A graphic diagram of a network schedule, showing activities and activity relationships.
- D. **Activity:** A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction programme consume time and resources.
 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 2. Predecessor activity is an activity that must be completed before a given activity can be started.
- E. **Event:** The starting or ending point of an activity.
- F. **Float:** The measure of leeway in starting and completing an activity.
 1. Float time is not for the exclusive use or benefit of either Party, but is a jointly owned, expiring Project resource available to both parties as needed to meet milestones and Contract completion date.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity or activities.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. **Fragment:** A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- H. **Major Area:** A storey of construction, a separate building, or a similar significant construction element.
- I. **Milestone:** A key or critical point in time for reference or measurement, including for example, but not necessarily limited to:



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1. Commencement Date.
2. Completion dates for specific Sections or parts of the Works.
3. Completion date for the whole of the Works.

1.4 SUBMITTALS

- A. **Qualification Data:** For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.
- B. **Submittals Schedule:** Submit three copies of schedule. Arrange the following information in a tabular format, identifying corresponding programme activity or event number for each scheduled date:
 1. Scheduled date for first submittal.
 2. Specification Section number and title.
 3. Submittal type and category (action or informational).
 4. Name of manufacturer and/or subcontractor, as applicable.
 5. Description of the work covered.
 6. Scheduled date for the Engineer's final release or approval.
 7. Scheduled dates for Purchase Order and first delivery to Project site.
 8. Scheduled date for commencement of installation.
- C. **Update Submittals Schedules:** Submit two copies of update schedules.
- D. **Construction Programme:** Submit two blue- or black-line print copies of programme, large enough to show entire programme for entire construction period. In title block indicate "Initial", "Revised" or "Update" as applicable, and date of issue.
 1. Submit an electronic copy of programme, using software indicated, on CD-ROM labeled to comply with requirements for submittals. Indicate type of programme (Initial, Revised or Update) and date on label.



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- E. **CPM Reports:** Concurrent with each CPM schedule submittal, submit three printed copies of each of the following corresponding, computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.
1. Activity Report: List of all activities sorted by major area, then by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
 4. Resource Allocation and Loading Report: List of all resources allocated to schedule activities, sorted in ascending order by activity number and then early start date, or actual start date if known, including but not necessarily limited to:
 - a. Number and trade classification of workmen.
 - b. Quantities of materials and products.
 - c. The Contractor's Equipment.
 5. Monetary Value Summaries.
- F. **Construction Photographs:** Submit two (2) print sets of each photographic view within five (5) days of taking photographs.
1. Format: 200 x 250-mm smooth-surface matte colour prints on single-weight commercial-grade stock, enclosed back to back in clear plastic sleeves that are punched for standard ring binder.
 2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
 - a. Name of Project.
 - b. Name of the Employer.
 - c. Name of the Engineer.
 - d. Name of the Contractor.



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- e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction, as applicable.
3. Negatives: Submit a complete set of corresponding photographic negatives, in protective envelopes, with each submittal of prints. Identify date photographs were taken.
- a. Negatives shall be for the Employer's free and unrestricted use.
- G. **Daily Construction Reports:** Submit two (2) copies daily, and no later than 4:00 pm on the day immediately following date of report.
- H. **Monthly Progress Reports:** Submit two (2) copies at monthly intervals. Report progress status coincidental with cutoff date associated with each Monthly Statement payment application.
- 1. Submit an electronic copy, using Microsoft Office software, on 90-mm diskette(s) labeled to comply with requirements for submittals.
- I. **Material Location Reports:** Submit two (2) copies at weekly intervals.
- J. **Field Condition Reports:** Submit two (2) copies at time of discovery of differing conditions.
- K. **Accident Reports:** Submit two (2) copies at time of accident event.
- L. **Special Reports:** Submit two copies at time of unusual event.
- 1.5 QUALITY ASSURANCE**
- A. **Scheduling Consultant Qualifications:** An experienced specialist in CPM scheduling and reporting.
- B. **Photographer Qualifications:** An individual of established reputation who has been regularly engaged as a professional photographer for not less than three years.
- C. **Computer Software:** Use a professional, high-end, reputable project management software program, acceptable to the Engineer that has been developed specifically to manage CPM construction programming, scheduling and reporting indicated for Project.



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- D. **Pre-scheduling Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Programme and the Contractor's Construction Programme, including, but not necessarily limited to the following, as appropriate:
1. Review software limitations and content and format for reports.
 2. Verify availability of qualified personnel needed to develop and update programme.
 3. Discuss constraints, including phases, sections, work sequences, area separations, interim milestones, interface with other contractors, statutory agencies and authorities having jurisdiction; staged completion, partial the Employer occupancy and the like, as applicable.
 4. Review programme for work of the Employer's separate contracts.
 5. Review time required for review of submittals and re-submittals.
 6. Review requirements for tests and inspections by independent testing and inspecting agencies.
 7. Review time required for completion and start-up procedures.
 8. Review and finalize list of construction activities to be included in programme.
 9. Review submittal requirements and procedures.
 10. Review procedures for updating programme.

1.6 COORDINATION

- A. Coordinate preparation and processing of programmes, schedules and reports with performance of construction activities and with programming, scheduling and reporting of separate contractors.
- B. Coordinate Construction Programme with the list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Works from parties involved.



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2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
- C. **Auxiliary Services:** Cooperate with photographer and provide auxiliary services requested, including access to Site and use of temporary facilities including temporary lighting.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. **Preparation:** Arrange Submittals Schedule in chronological order by dates required by construction programme. Include time required for review, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
1. Coordinate Submittals Schedule with list of subcontracts and the Contractor's Construction Programme.
 2. Submittal: Submit concurrently with the submittal of completed the Contractor's Construction Programme. List those required to maintain orderly progress of the Work and those required early because of long-lead time for manufacture or fabrication.
 3. Update Submittals: Continuously update Submittals Schedule to reflect actual and on-going current status, including additions to and changes in timing of submittals. Submit an Update Submittals Schedule on the day before each regular Progress Meeting.

2.2 CONTRACTOR'S CONSTRUCTION PROGRAMME, GENERAL

- A. **Arrangement:** Arrange activities on programme by Section and/or major area, as applicable.
- B. **Activities:** Treat each building storey and/or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by the Engineer.
 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in programme. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.



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3. Submittal Review Time: Include review and re-submittal times indicated in Division 1 Section "Submittal Procedures", in programme. Coordinate submittal review times in the Contractor's Construction Programme with Submittals Schedule.
 4. Startup and Testing Time: Indicate and include appropriate time allowances for startup and testing of each equipment and system installation.
 5. Substantial Completion: Indicate substantial completion in advance of date established for Taking-Over, and allow time for the Engineer's inspection and administrative procedures necessary for certification of Taking-Over.
- C. **Constraints:** Include constraints and work restrictions indicated in the Contract Documents and as follows in programme, and show how the sequence of the Work is affected.
1. Work under Multiple Contracts: Include a separate activity for each portion of work performed by each separate contract.
 2. Work by the Employer: Include a separate activity for each portion of work performed by the Employer.
 3. Work Restrictions: Show the effect of the following items on the programme:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before substantial completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 4. Work Stages: Indicate important stages of construction for each major portion of the Works, including, but not limited to, the following:
 - a. Subcontract awards.



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- b. Submittals.
 - c. Purchases.
 - d. Mock-ups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Start-up and placement into final use and operation.
5. Area Separations: Identify each major area of construction for each major portion of the Works. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial completion.
- D. **Sectional Completions and Milestones:** Include in programme, milestones and any and all sectional completion requirements, indicated in Contract Documents, including but not necessarily limited to Commencement Date, dates for Taking-Over sections or parts of the Works and date for Taking-Over the whole of the Works.
- E. **Cash Flow Correlation:** At the head of programme, provide a cash flow correlation line, indicating on the line, monetary value volume of the Works as planned and as actually performed.



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1. Tabulate cash flow correlation, coincidental with cut-off dates associated with Monthly Statement payment applications, and use as a basis for preparation of Cash Flow Estimate submittal.
- F. **Contract Variations:** If and when requested by the Engineer in connection with any proposed or instructed Contract Variation, prepare and submit a time-impact analysis, using fragnets if necessary, to demonstrate the effect of the proposed or instructed Variation on the overall construction programme.
- G. **Computer Software:** Prepare and update programmes and schedules using the following software program that has been developed specifically to manage construction programming and scheduling.
1. Primavera Project Planner, Latest Version, for Windows NT or Windows XP operating system.
- 2.3 PRELIMINARY CONSTRUCTION PROGRAMME (BAR-CHART SCHEDULE)**
- A. **Preliminary Schedule:** Submit preliminary horizontal bar-chart-type or network type construction programme with the Tender in accordance with the requirements of the "Instructions to Tenderers".
- 2.4 CONTRACTOR'S CONSTRUCTION PROGRAMME (GANTT CHART)**
- A. **Gantt-Chart Programme:** Submit a comprehensive, fully developed, horizontal Gantt-chart-type, the Contractor's Construction Programme within fourteen (14) days after the date of the Letter of Acceptance. Base programme on the Preliminary Construction Programme submitted with Tender and whatever updating and feedback received to date.
- B. **Preparation:** Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.
- 2.5 CONTRACTOR'S CONSTRUCTION PROGRAMME (CPM SCHEDULE)**
- A. **General:** Prepare network diagrams using AON (activity-on-node) format.
- B. **CPM Schedule:** Prepare and submit the Contractor's Construction Programme using a CPM network analysis diagram. Base programme on the Preliminary Construction Programme submitted with Tender and whatever updating and feedback received to date. Follow procedures and produce CPM schedule and



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reports in such form and detail as specified. Incorporate additional requirements, as the Engineer shall reasonably prescribe.

1. Develop, finalize and submit completed CPM schedule and reports for the Engineer's review and acceptance no later than fourteen (14) days after the date of the Letter of Acceptance.
 2. Conduct educational workshops to train and inform key personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with regular Progress Meeting, Monthly Progress Report and Monthly Statement payment application dates.
 4. Use "one workday" as the unit of time and indicate number of shifts per workday.
 5. Use calendar to identify and indicate holidays and other non-work days.
- C. **CPM Schedule Preparation:** Prepare a list of all activities required to complete the Works.
1. Activities: Indicate for each activity, the estimated time duration, sequence requirements, resource requirements, relationship to other activities, and monetary value. Include dates and estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Purchase of materials.
 - c. Delivery.
 - d. Fabrication.
 - e. Installation.
 2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - a. Use resource-levelling method in computing the CPM schedule.



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3. Format: Mark the critical path. Locate the critical path near centre of network; locate paths with most float near the edges.
 - a. Sub-networks on separate sheets are permissible for activities clearly off the critical path.
- D. **Initial Issue of Schedule:** Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
1. The Contractor or subcontractor and the work or activity.
 2. Description of activity.
 3. Principal events and constraints of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Calendar for each activity
 9. Total float or slack time.
 10. Resource allocation and loading of activity.
 11. Monetary value of activity (coordinated with Bill of Quantities values).
 12. Average size of workforce.
 13. Holidays and non-work days
- E. **Schedule Updating:** Concurrent with making updates and/or revisions to schedule, prepare (in addition to other specified CPM reports) tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.



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4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in usage or availability of resources.
8. Changes in the Contract Time.
9. Indicate actual versus original planned progress.

F. **Monetary Value Summaries:** Prepare cash flow predictions based on indicated activities and include two cumulative value lists, sorted by finish dates.

1. In first list, tabulate the following:
 - a. Activity number.
 - b. Early finish date.
 - c. Monetary value.
 - d. Cumulative monetary value.
2. In second list, tabulate the following:
 - a. Activity number.
 - b. Late finish date.
 - c. Monetary value.
 - d. Cumulative monetary value.
3. Prepare lists for ease of comparison with Cash Flow Estimates and Monthly Statement payment applications.
4. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
5. Submit update value summary printouts with each Monthly Statement payment application.



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- a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.

2.6 REPORTS

A. **Daily Construction Reports:** Prepare a daily construction report, recording the following information concerning events at Project site:

1. List of construction work activities and operations performed on the Works, referenced to locations and CPM schedule activity numbers.
2. List of subcontractors on the Works.
3. List of separate contractors at Site.
4. Count and trade classification of workmen on the Works, allocated to CPM schedule activity numbers.
5. Count, category and status (working, idle, under maintenance) of the Contractor's Equipment at Site, allocated to CPM schedule activity numbers.
6. High and low temperatures and general weather conditions.
7. Accidents (refer to accident reports).
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Variation Orders received and implemented.
15. Site Instructions received.
16. Services connected and disconnected.
17. Equipment or system tests and start-ups.



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18. Partial Completions and occupancies.
 19. The Engineer's Inspections.
 20. Taking-Over Certificates issued.
 21. Any other general or specific information, requested by the Engineer to be reported.
- B. Monthly Progress Reports:** Prepare and submit monthly progress reports, summarizing activities, achievements, advancements and significant events at Site in month preceding, and reporting current progress status of Works; including but not necessarily limited to the following:
1. Summary of the information included in Daily Construction Reports for the month.
 2. Summary of the information included in Material Location Reports for the month.
 3. Latest update Submittals Schedule.
 4. Progress Review Statement: Refer to latest Update the Contractor's Construction Programme; include:
 - a. Listing of all current month programmed activities and report whether each is on time, ahead of schedule or behind schedule in relation to original the Contractor's Construction Programme.
 - b. On-going comparative line plot of Cash Flow Estimate against Interim Payment Certificates.
 - c. Description of means, methods and actions to be taken in following month to expedite construction behind schedule and ensure current and subsequent activities will be completed within Time for Completion.
 5. Any other general or specific information, requested by the Engineer to be reported.
- C. Material Location Reports:** At intervals indicated, prepare and submit a comprehensive listing, in tabular form, of materials delivered to and stored at Site. List shall be cumulative, showing materials previously reported plus items delivered since previous report. Coordinate reports with information in Product List submitted under Division 1 Section "Product Requirements".



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1. Form: Tabulate information for each material delivery under the following column headings:
 - a. Delivery date
 - b. Specification Section number and title.
 - c. Generic name used in the Contract Documents.
 - d. Proprietary name, model number, and similar designations.
 - e. Manufacturer's name and address.
 - f. Supplier's name and address.
 - g. Delivered quantity.

 - D. **Field Condition Reports:** Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Include a detailed description of the differing conditions, together with a request for instruction, if applicable.

 - E. **Accident Reports:** On the occurrence of any accident which causes personal injury or damage to the Works or any other property, prepare a detailed accident report and submit directly to the Engineer within one day of occurrence. Include details of date and time, location, prevailing conditions, chain of events and causes leading up to accident, persons involved, response by the Contractor's personnel and result or effect of accident. Obtain and attach witness statements, photographs and sketches as applicable.
 1. On the occurrence of an accident or event which causes serious injury to any person, summon emergency services, notify appropriate authorities and inform the Engineer immediately
- 2.7 SPECIAL REPORTS**
- A. **General:** Prepare and submit special reports, in an acceptable format, directly to the Engineer within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

 - B. **Reporting Unusual Events:** When an event of an unusual and significant nature occurs at Site, whether or not related directly to the Works, prepare and submit a special report. List chain of events, persons participating, response by the Contractor's personnel, evaluation of results or effects, and similar pertinent



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information. Advise the Engineer in advance when these events are known or predictable.

2.8 WAGE BOOK AND TIME SHEET RECORDS

- A. **Wage Books and Time Sheets:** Keep and maintain accurate and proper wage books and time sheets of wages paid to and time worked by all workmen employed by the Contractor and subcontractors at Site. Comply with regulations and requirements, if any, of authorities having jurisdiction. Store wage books and time sheets in field office and make available for the Engineer's inspection and reference during normal working hours. If requested, produce and submit photocopies to the Engineer.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION PROGRAMME

- A. **Scheduling Consultant:** Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. **In-House Option:** The Engineer may waive the requirement to engage and retain a consultant if the Contractor can demonstrate, to the Engineer's satisfaction, that he employs skilled and competent personnel with appropriate experience in CPM scheduling and reporting techniques. Submit a request, together with qualification data to demonstrate in-house employee capabilities and experience.
 2. **Meetings:** Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. **Update the Contractor's Construction Programmes:** Continuously monitor performance and progress of programmed activities, including submittals, procurement and deliveries, supply and availability of allocated resources, etc. At monthly intervals, update programme to reflect actual progress of construction and activities. Issue and submit update programme and corresponding CPM reports coincidental with each Monthly Statement payment application, unless otherwise directed by the Engineer.
1. As work progresses, indicate Actual Completion percentage for each activity.
 2. Revise programme immediately after each meeting or other activity where revisions have been recognized and accepted by the Engineer. Issue and submit revised programme within 3 days of such meetings or activities.



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3. Include a report with revised programme that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
- C. **Distribution:** Distribute copies of accepted initial programme to the Employer, separate contractors, and other parties identified by the Contractor with a need-to-know programme responsibility.
1. Post copies in meeting rooms and temporary field offices.
 2. Distribute accepted revised programmes to the same parties and post in the same locations. Delete parties from distribution when they have completed their assignments and are no longer involved in performance of construction activities.

3.2 CONSTRUCTION PHOTOGRAPHS

- A. **Photographer:** Engage a person capable of taking photographs of a standard acceptable to the Engineer. In the event of the photographs submitted are not of an acceptable standard the Contract shall, on the instructions of the Engineer and at his own cost, engage the services of a qualified commercial photographer to take construction photographs.
- B. **Photographic Film:** Medium-format, 60 mm x 70 mm.
- C. **Date Stamp:** Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- D. **Preconstruction Photographs:** Before starting construction, take twenty four (24) photographs of Site and surroundings from different vantage points, as directed by the Engineer.
1. Take additional photographs in sufficient number and detail to:
 - a. Show conditions of existing buildings, structures, site improvements and features on and/or adjacent to Site, accurately recording any physical condition, that might otherwise be misconstrued as damage caused by subsequent demolition or construction operations.
 - b. Show conditions of existing buildings, structures, assemblies, features or other components scheduled for selective demolition or dismantling, accurately recording physical condition, for subsequent reconstruction, restoration or rehabilitation.



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- E. **Construction Progress Photographs:** Take a minimum of thirty six (36) photographs monthly, adjusted to coincide with cut-off date associated with each payment application. Photographer shall select vantage points, in consultation with the Engineer and the Contractor, to best show status of construction and rate of progress since last photographs were taken.
1. **Field Office Prints:** Retain an additional print set of all preconstruction and construction progress photographs in field office at Site, and make available at all times for reference by the Engineer. Identify photographs the same as for those submitted to the Engineer.
- F. **Final Construction Photographs:** Take seventy two (72) photographs immediately after date of Taking-Over for the whole of the Works. The Engineer will direct photographer for desired vantage points.

END OF DOCUMENT



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SUBMITTAL PROCEDURES

SECTION 4 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting:
1. Shop Drawings.
 2. Other miscellaneous submittals.
- B. Related Sections include the following:
1. Division 1 Section "Project Management and Coordination" for submitting Coordination Drawings.
 2. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including the Contractor's Construction Programme, Submittals Schedule and construction photographs.
 3. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mock-ups.
 4. Division 1 Section "Closeout Procedures" for submitting warranties project record documents and operation and maintenance manuals.
 5. Division 1 Section "Project Record (As-Built) Documents" for submitting record drawings, documents and data.
 6. Division 2 Sections for specific submittal requirements.

1.3 DEFINITIONS

- A. **Action Submittals:** Written and graphic information that requires the Engineer's responsive action.
- B. **Informational Submittals:** Written information that does not require the Engineer's approval. Submittals may be rejected for not complying with requirements.
- C. **Shop Drawings:** Include but are not limited to the following:



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1. Setting diagrams.
2. Schedules.
 - a. Standard information prepared without specific reference to the Works is not Shop Drawings.
- D. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
 1. Preparation of Coordination Drawings is specified in Division 1 Section "Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

1.4 SUBMITTAL PROCEDURES

- A. **General:** Electronic copies of CAD Drawings of the Contract Drawings will not be provided by the Engineer for the Contractor's use in preparing submittals.
- B. **Coordination:** Coordinate preparation and processing of submittals with performance of construction activities.
 1. Transmit each submittal sufficiently in advance of performance of related procurement and construction activities, allowing ample time for review and re-submittal if necessary, in order to prevent delays to the Works.
 2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 3. Coordinate transmittal of different types of submittals for related parts of the Works so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. **Submittals Schedule:** Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. **Processing Time:** Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on the Engineer's receipt of submittal.



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1. Initial Review: Allow twenty one (21) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will advise the Contractor when a submittal being processed must be delayed for coordination.
 2. Concurrent Review: Where concurrent review of submittals by sub-consultants, the Employer, or other parties is required, allow thirty five (35) days for initial review of each submittal.
 3. If intermediate submittal is necessary, process it in same manner as initial submittal.
 4. Allow 21 days for processing each re-submittal.
- E. **Identification:** Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 100 x 125 mm on label or beside title block to record the Contractor's review and approval markings and action taken by the Engineer.
 3. Include the following information on label for processing and recording action taken:
 - a. Contract name.
 - b. The Employer's name.
 - c. Date.
 - d. Name and address of the Engineer.
 - e. Name and address of the Contractor.
 - f. Name and address of subcontractor.
 - g. Name and address of supplier.
 - h. Name and address of manufacturer.
 - i. Unique identifier, including revision number.
 - j. Number and title of appropriate Specification Section.



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- k. Drawing number and detail references, as appropriate.
 - l. Other necessary identification.
- F. **Deviations:** Highlight, encircle, or otherwise indicate and identify on submittals, deviations from the Contract Documents.
- G. **Additional Copies:** Unless additional copies are required for final submittal, and unless the Engineer observes non-compliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
- 1. For submittals requiring concurrent review, submit one extra copy in addition to specified number of copies to the Engineer.
 - 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- H. **Transmittal:** Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form attached to a cover letter. The Engineer will discard, without review, submittals received from sources other than the Contractor.
- 1. **Cover Letter:** On attached, numbered, separate sheet(s), prepared on the Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by the Engineer on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
 - a. Include the Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
 - 2. **Transmittal Form:** Use a form acceptable to and approved by the Engineer. Provide locations on form for the following information:
 - a. Contract name.
 - b. The Employer's name.
 - c. Date.
 - d. Destination (To:).
 - e. Source (From:).
 - f. Names of subcontractor, manufacturer, and supplier, as applicable.



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- g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Submittal and transmittal distribution record.
 - j. Remarks.
 - k. Signature of transmitter.
- I. **Distribution:** Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Permit only final submittals with appropriate approved stamp, or other mark indicating action taken by the Engineer, to be used in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. **General:** Prepare and submit Action Submittals required by individual Specification Sections.
- 1. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:
 - a. Initial Submittal: Submit a preliminary single copy of each submittal where selection of options, colour, pattern, texture, or similar characteristics is required. The Engineer will return submittal with options selected.
 - b. Final Submittal: Submit four (4) copies, unless otherwise indicated. Submit additional copies where copies are required for operation and maintenance manuals. The Engineer will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Record (As-Built) Document.
- B. **Shop Drawings:** Produce newly prepared, Contract-specific, information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Include the following information, as applicable:



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- a. Dimensions; in SI units unless otherwise indicated or directed.
 - b. Roughing-in and setting diagrams.
 - c. Schedules.
 - d. Compliance with specified standards.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
2. **Sheet Size:** Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least A4 size, and no larger than A1 size, unless otherwise approved.
 3. **Number of Copies:** Submit copies of each submittal, as follows:
 - a. **Initial Submittal:** Submit one (1) correctable, translucent, reproducible print and one (1) blue- or black-line print. The Engineer will return the reproducible print.
 - b. **Final Submittal:** Submit four (4) blue- or black-line prints, unless otherwise indicated. Submit additional prints where prints are required for operation and maintenance manuals. The Engineer will retain three (3) prints; remainder will be returned. Mark up and retain one returned print as a Record (As-Built) Drawing.
- C. **Coordination Drawings:** Comply with requirements in Division 1 Section "Project Management and Coordination."
 - D. **The Contractor's Construction Programme:** Comply with requirements in Division 1 Section "Construction Progress Documentation".
 - E. **Submittals Schedule:** Comply with requirements in Division 1 Section "Construction Progress Documentation."
 - F. **Subcontract List:** Prepare and submit a list identifying subcontractor individuals or firms proposed for principal portions of the Works, including those who are to fabricate products or equipment to a special design. Include the following information in tabular form:
 1. Name, address, and telephone number of entity performing subcontract.
 2. Number and title of related Specification Section(s) covered by subcontract.



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3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

- A. **General:** Prepare and submit Informational Submittals required by other Specification Sections.
 1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. The Engineer will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of the Contractor, testing agency, or design professional responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of the company.
 3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."
- B. **Qualification Data:** Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and employers, and other information specified.
- C. **Material Certificates:** Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- D. **Material Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- E. **Preconstruction Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- F. **Compatibility Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- G. **Field Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.



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- H. **Product Test Reports:** Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW AND APPROVAL

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to the Engineer.
- B. **Approval Stamp:** Stamp each submittal with a uniform, approval stamp. Include Contract name and location, submittal number, Specification Section title and number, name of reviewer, date of the Contractor's approval, and statement certifying that submittal has been reviewed, checked, coordinated and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

- A. **General:** The Engineer will not review submittals that do not bear the Contractor's approval stamp and will return them without action.
- B. **The Engineer's Action:** The Engineer's review is limited only to checking conformance with information given and the design concept expressed in the Contract Documents. It is not conducted for the purpose of determining the accuracy and completeness of details, dimensions or quantities, nor substantiating integrity or compatibility, nor confirming instructions for installation or performance. The Engineer's approval does not in any way relieve the Contractor of responsibility for compliance with specified provisions and the Contract Document requirements.
- C. **Action Submittals:** The Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it to the Contractor. The Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
1. **Final Unrestricted Release:** Where the submittal is marked "APPROVED", the work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance of the work will depend on that compliance.
 2. **Final-but-Restricted Release:** Where the submittal is marked "APPROVED AS NOTED", the work covered by the submittal may proceed provided it complies with both the Engineer's notations and corrections on the submittal



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and the Contract Documents. Final acceptance of the work will depend on that compliance.

3. Returned for Re-submittal: Where the submittal is marked "NOT APPROVED, REVISE AND RESUBMIT", do not proceed with the work covered by the submittal, including purchase, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to the Engineer's notations and corrections.
 4. Rejected: Where the submittal is marked "NOT APPROVED, RESUBMIT" or "REJECTED", do not proceed with the work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.
- D. **Informational Submittals:** The Engineer will review each submittal and will not return it, or will reject and return it if it does not comply with requirements.
- E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF DOCUMENT



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QUALITY REQUIREMENTS

SECTION 5 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.

- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit the Contractor's quality control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for the Contractor to provide quality control services required by the Engineer, the Employer, or authorities having jurisdiction are not limited by provisions of this Section.

- C. Related Sections include the following:

1. Divisions 2 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- A. **Quality Assurance Services:** Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

- B. **Quality Control Services:** Tests, inspections, procedures, and related actions performed during and after execution of work, by the Contractor, testing agencies or authorities having jurisdiction, to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by the Engineer.



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- C. **Testing Agency:** An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 SUBMITTALS

- A. **Qualification Data:** For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
1. Specification Section number and title.
 2. Description of test and inspection.
 3. Identification of applicable standards.
 4. Identification of test and inspection methods.
 5. Number of tests and inspections required.
 6. Time schedule or time span for tests and inspections.
 7. Entity responsible for performing tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- C. **Tests and Inspection Reports:** Prepare and submit certified written reports that include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the work and test and inspection method.



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7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Ambient conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and re-inspecting.
- D. **Permits, Licenses, and Certificates:** For the Employer's records, submit copies of permits, licenses, certifications, inspection reports, releases, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the work.

1.5 QUALITY ASSURANCE

- A. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated in the Contract Documents and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. **Factory Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated in the Contract Documents.
- C. **Specialists:** Certain sections of the Specifications may require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
- D. **Testing Agency Qualifications:** An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.



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1.6 QUALITY CONTROL

- A. **The Employer Responsibilities:** Where quality-control services are indicated as the Employer's responsibility, the Employer will engage a qualified testing agency to perform these services.
1. The Employer will furnish the Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to the Contractor.
- B. **The Contractor Responsibilities:** Unless otherwise indicated, provide quality control services specified and required by authorities having jurisdiction.
- C. **Manufacturer's Field Services:** Where indicated, engage a factory authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- D. **Retesting/Re-inspecting:** Regardless of whether original tests or inspections were the Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction of revised or replaced work that failed to comply with requirements established by the Contract Documents.
- E. **Testing Agency Responsibilities:** Cooperate with the Engineer and the Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify the Engineer and the Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.
 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through the Contractor.
 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Works.
 5. Do not perform any duties of the Contractor.
- F. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary



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services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Site / work.
2. Incidental labour and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. **Coordination:** Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 28 days of Commencement Date.

1. **Distribution:** Distribute schedule to the Employer, the Engineer, testing agencies, and each party involved in performance of portions of the Works where tests and inspections are required.

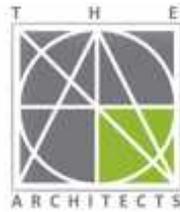
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. **General:** On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend



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restoration into adjoining areas in a manner that eliminates evidence of patching.

2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
 - B. Protect construction exposed by or for quality control service activities.
 - C. Repair and protection are the Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF DOCUMENT



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REFERENCE STANDARDS AND DEFINITIONS

SECTION 6 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. **General:** Basic contract definitions are included in the Conditions of the Contract.
- B. **"Approved":** The term "approved", when used in conjunction with the Engineer's action on the submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. **"Directed":** Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean directed by the Engineer, requested by the Engineer, and similar phrases.
- D. **"Furnish":** The term "furnish" means to supply and deliver to the Site, ready for unloading, unpacking, assembly, installation, and similar operations.
- E. **"Indicated":** The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help the user locate the reference. Location is not limited.
- F. **"Install":** The term "install" describes operations at the Site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- G. **"Installer":** The term "installer" means the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, who performs a particular construction activity including installation, erection, application, or similar operations. Installers shall be experienced in the operations they are engaged to perform.
1. **"Experienced":** The term "experienced", when used with the term "installer", means having successfully completed a minimum of 5 previous projects



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similar in size and scope to the Works; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

2. **Trades:** Using terms such as "carpentry" does not imply that certain construction activities shall be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
3. **Assigning Specialists:** Certain Sections of the Specifications require that specific construction activities will be performed by specialists who are recognized experts in those operations. The specialists shall be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.
 - a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Works. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

- H. **"Provide":** The term "provide" means to furnish and install, complete and ready for the intended use.
- I. **"Regulations":** The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Works.
- J. **"Testing Agencies":** The term "testing agency" means an independent entity engaged to perform specific inspections or tests, either at the Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. **Specification Content:** These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. **Abbreviated Language:** Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be



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interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood shall be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that shall be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall", "shall be", or "shall comply with", depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - b. The word "per" means "in accordance with", "according to", "in compliance with", "complying with", and similar phrases.

1.4 INDUSTRY STANDARDS

- A. **Applicability of Standards:** Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. If requested by the Engineer, the Contractor shall submit the equivalent to any standard referred to in the Specifications and the Contractor shall convert the parameters mentioned in the specifications to be comparable with the equivalent standard.
- C. **Publication Dates:** Unless otherwise indicated, comply with the standards in effect as of the date of the Contract Documents.
- D. **Conflicting Requirements:** Where compliance with 2 or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Engineer for a decision before proceeding.
 1. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these



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requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Engineer for a decision before proceeding.

- E. **Copies of Standards:** Each entity engaged in construction on the Project shall be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- F. **Abbreviations and Acronyms:** Trade association names and titles of general standards are frequently abbreviated. Where an abbreviation or acronym, as referred to in the Tender Documents, is not understood or recognized by the tenderers they should seek clarification of same from the Engineer prior to the submission of their tenders.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF DOCUMENT



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TEMPORARY FACILITIES AND CONTROLS

SECTION 7 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Related Drawing and Detail.

1.2 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
1. Sewers and drainage.
 2. Water service and distribution.
 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 4. Heating and cooling facilities.
 5. Ventilation and humidity control.
 6. Electric power service and distribution.
 7. Lighting.
 8. Telephone service and facilities.
- C. Support facilities include, but are not limited to, the following:
1. Temporary roads and paving.
 2. Dewatering facilities and drains.
 3. Identification of the Works and temporary signs.
 4. Waste disposal facilities.
 5. Temporary Site offices and site laboratory.
 6. Storage and fabrication sheds.



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TEMPORARY FACILITIES AND CONTROLS

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- 7. Temporary stairs.
 - 8. Construction aids and miscellaneous services and facilities.
 - D. Security and protection facilities include, but are not limited to, the following:
 - 1. Environmental protection.
 - 2. Storm-water control.
 - 3. Tree and plant protection.
 - 4. Site enclosure fence.
 - 5. Security enclosure and lockup.
 - 6. Barricades, warning signs, and lights.
 - 7. Covered walkways.
 - 8. Temporary enclosures.
 - 9. Temporary partitions.
 - 10. Fire protection.
 - E. Related Sections include the following:
 - 1. Division 1 Section "Summary of Multiple Contracts" for responsibilities for temporary facilities and controls.
 - 2. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 3. Division 1 Section "Execution Requirements" for progress cleaning requirements.
 - 4. Division 2 Section "Dewatering" for disposal of ground water at Project site.
 - 5. Divisions 2 through 16 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

- A. **Permanent Enclosure:** As determined by the Consultant, permanent or temporary roofing is complete, insulated, and weather tight; exterior walls are insulated and



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weather tight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

- A. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Site.
- B. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Site.
- C. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used in construction activities at Site.
- D. Telephone Service: Pay telephone service use charges, for telephones installed at Site.

1.5 SUBMITTALS

- A. Implementation and Termination Schedule: Within 14 days of date established for submittal of Contractor's Construction Programme, submit a schedule indicating implementation and termination of each temporary utility.
- B. **Temporary Utility Reports:** Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- C. Temporary Utilities: Submit detailed proposals including drawings and product data as requested; obtain the Consultant's approval prior to purchase, delivery, installation or implementation, as applicable, of the following:
 - 1. Sewers and drainage.
 - 2. Water service and distribution.
 - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - 4. Electric power service.
 - 5. Telephone service.
- D. **Support Facilities:** Submit detailed proposals including drawings and product data as requested; obtain the Consultant's approval prior to purchase, delivery, installation or implementation, as applicable, of the following:
 - 1. Temporary roads and paving.



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2. Dewatering facilities and drains.
 3. Identification of the Works and temporary signs.
 4. Temporary Site offices and site laboratory, including laboratory equipment.
 5. Storage and fabrication sheds.
 6. Construction aids and miscellaneous services and facilities:
 - a. Exterior scaffold system, including ladders, walkways, platforms and guardrails.
 - b. Protective screens and chutes.
 - c. Tower cranes.
 - d. Lifts and hoists for materials and workmen.
- E. **Security and Protection Facilities:** Submit detailed proposals including drawings and product data as requested; obtain the Consultant's approval prior to purchase, delivery, installation or implementation, as applicable, of the following:
1. Site enclosure fence.
 2. Covered walkways.
 3. Fire protection.

1.6 QUALITY ASSURANCE

- A. **Regulations:** Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
1. Building code requirements.
 2. Health and safety regulations.
 3. Utility company regulations.
 4. Police and fire department regulations.
 5. Environmental protection regulations.
- B. **Tests and Inspections:** Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.



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1.7 CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to the Consultant, change over from use of temporary service to use of permanent service.
- B. Temporary Use of Permanent Facilities: The Contractor shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Taking-Over, regardless of previously assigned responsibilities.
 - 1. Contractor's personnel and workmen, including subcontractors, are not permitted to use permanent toilet facilities or wash facilities.
- C. **Conditions of Use:** The following conditions apply to use of temporary services and facilities by all parties engaged in the Works:
 - 1. Keep clean and neat.
 - 2. Operate in a safe and efficient manner.
 - 3. Do not overload or permit them to interfere with progress.
 - 4. Take appropriate fire prevention measures.
 - 5. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisance to develop or persist on Site.
 - 6. Relocate as required by progress of the Works.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **General:** Provide new materials suitable for use intended. Undamaged, previously used materials in serviceable condition may be used for temporary facilities if approved by the Consultant.
- B. **Construction Materials and Products:** Comply with standards and applicable requirements in appropriate Sections of the Specification.
- C. **Tarpaulins:** Waterproof, fire-resistive, with low flame-spread rating.
- D. **Temporary Enclosures:** Translucent, fire-retardant, nylon-reinforced laminated polyethylene or polyvinyl chloride tarpaulins.



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- E. **Water:** Clean, fresh, potable.

2.2 EQUIPMENT

- A. **General:** Provide new equipment suitable for use intended. Undamaged, previously used equipment in serviceable condition may be used for temporary facilities if approved by the Consultant. Refer to Appendices 1 and 2 herein for the requirements.
- B. **Temporary Site Offices:** Prefabricated, mobile units or job-built construction, with lockable entrances, operable windows, serviceable finishes and robust and secure fittings; insulated, weather-tight, heated and air-conditioned.
1. Incorporate sanitary facilities to the extent required for the number and gender of personnel accommodated.
 2. Support on foundations adequate for loading.
 3. Provide and maintain all necessary and required services and utilities, including but not necessarily limited to:
 - a. Sewers and drainage.
 - b. Water service and distribution.
 - c. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - d. Air-conditioner heating and cooling.
 - e. Ventilation.
 - f. Electric power service.
 - g. Lighting.
 - h. Telephone service.
 - i. Firefighting appliances.
 - j. Janitorial services and facilities, and general attendance.
 4. Consultant's and Employer's Site Offices: Provide new office furniture and equipment suitable for use intended. If acceptable to the Consultant, the Contractor may provide undamaged, previously used furniture and equipment in serviceable condition, to the extent approved by the Consultant.



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- C. **Computers for the Consultant:** New computer equipment and peripheral hardware, licensed software, Internet connection and associated accessories, including local area networking, computer workstation desking, and all necessary cabling as required.
1. PC: Acceptable Brand Name Pentium IV, 3 GHz; 1 GB MbRam; 60 Gb Hard Drive; 128 MbVRam Video Graphic Adaptor; 56 kbs Internal Fax/Modem; each with:
 - a. Colour Monitor: 17" flat, non-interlaced screen, 1280x1024 dpi; low power, low radiation.
 - b. Drives: One 3.5 inch floppy drive; one 32 x speed CD-Rom drive writeable.
 - c. Ports: One parallel, two serial, keyboard and mouse.
 - d. Keyboard: 101 key, English - Urdu.
 - e. Mouse: "Microsoft".
 - f. Operating System: "Windows XP".
 - g. Anti-static dust covers.
 2. Laser Printer: Similar to HEWLETT PACKARD "HP LaserJet 9000", with A3/A4 paper cassettes (Network enabled).
 3. Internet: Multi-user subscription and connection to approved, local, Internet service provider.
 4. Computer Workstation, comprising:
 - a. Desking with wire management; to accommodate PC, monitor, keyboard and mouse.
 - b. Operator's swivel chair.
- D. **Fire Extinguishers:** Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.



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- E. **Temporary Site Toilets:** Prefabricated, self-contained, single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- F. **Drinking-Water Fixtures:** Containerized, tap-dispenser, bottled-drinking-water units, including paper cup supply.
 - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 7.2 to 12.7 deg. C (45 to 55 deg. F).
- G. **Electrical Outlets:** Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- H. **Power Distribution System Circuits:** Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- I. **Consultant's and Employer's Field Offices:** Provide new office furniture and equipment suitable for use intended. If acceptable to the Consultant, the Contractor may provide undamaged, previously used furniture and equipment in serviceable condition, to the extent approved by the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve the Works adequately and result in minimum interference with performance of the Works. Relocate and/or modify facilities as often as required by progress of the Works.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove facilities until permitted or directed to do so by the Consultant, or until replaced, to the satisfaction of the Consultant, by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. **General:** Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company requirements and recommendations.
 - 1. Arrange with utility company, the Consultant, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.



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2. Provide for adequate capacity and peak-demand or special load requirements at each stage of construction. Before temporary utility is available, provide trucked-in services if necessary.
 3. Obtain any necessary easements to bring temporary utilities to Site.
 4. Charges and Costs; Pay for all connection, service and user charges and costs arising in connection with the provision of temporary utilities.
- B. **Sewers and Drainage:** If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to municipal system as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
- C. **Water Service:** Install water service and distribution piping in sizes and pressures adequate for construction.
1. Sterilize temporary water piping before use.
 2. Provide storage tanks and/or rubber hoses as necessary to serve Site.
 3. If at any time, temporary water service supply is interrupted or inadequate for requirements, provide back-up storage and truck-in water supplies as necessary.
 4. If water pressure is inadequate, provide pumps to supply a minimum of 200-kPa static pressure at highest point. Equip pumps with surge and storage tanks and automatic controls to supply water uniformly at reasonable pressures.
- D. **Water Service:** If use of the Employer's existing or permanent water service facilities is permitted, service, clean and maintain in a condition acceptable to the Consultant. At Substantial Completion, restore these facilities to condition existing before initial use.



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- E. **Sanitary Facilities:** Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations, health codes and the Consultant's directions for type, number, location, operation, and maintenance of facilities and fixtures. Provide separate toilet facilities for male and female personnel.
1. **Generally:** Install where facilities will best serve needs of the Works, including relocation whenever necessary.
 - a. Service and maintain, and keep clean, sanitary and orderly for use.
 - b. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 2. **Toilets:** Install toilet facilities connected to local water and sewer lines. Provide lavatories, mirrors, and water closets. Provide only potable-water connections. Provide individual compartments for water closets. Provide suitable enclosure with nonabsorbent sanitary finish materials and adequate ventilation and lighting.
 3. **Toilets:** If use of the Employer's existing or permanent toilet facilities is permitted, service, clean and maintain in a condition acceptable to the Consultant. At Substantial Completion, restore these facilities to condition existing before initial use.
 4. **Temporary Site Toilets:** Install self-contained toilet units. Shield toilets to ensure privacy.
 5. **Wash Facilities:** Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash-up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
 6. **Drinking-Water Facilities:** Install containerized, tap-dispenser, bottled-drinking-water units, including paper cup supply.
- F. **Cooling:** Provide temporary cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.



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1. Maintain a minimum temperature of 18 deg. C (64 deg. F) in permanently enclosed portions of building for normal construction activities, for finishing activities and areas where finished work has been installed.
- G. **Ventilation and Humidity Control:** Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. **Electric Power Service:** Provide weatherproof, grounded electric power service and distribution system of appropriate and sufficient size, capacity, and power characteristics required for use during construction, including necessary start-up, testing and commissioning of building operating systems and equipment. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install electric power service underground, unless overhead service must be used.
 2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
 3. If at any time, temporary electric power service supply is interrupted or inadequate for requirements, provide and operate back-up electric generators as necessary.
- I. **Electric Power Service:** If use of the Employer's existing or permanent electric power service is permitted, maintain equipment in a condition acceptable to the Consultant. At Substantial Completion, restore equipment to condition existing before initial use.
- J. **Electric Distribution:** Provide receptacle outlets adequate for connection of power tools and equipment.
1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- K. **Lighting:** Provide temporary lighting with appropriate control and local switching to facilitate safe and proper execution of the Works. Provide adequate illumination to internal areas during finishing operations and for inspections.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.



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2. Install exterior site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
3. Install lighting for Works identification sign.

L. **Telephone Service:** Provide and maintain adequate temporary telephone facilities and service for the duration of the Contract including Defects Liability Period, for all personnel accommodated in temporary field offices.

M. **Telephone Facilities for the Consultant:** Provide and install a PABX in the Consultant's field offices, with sufficient line connections and capacity to provide at least one extension in every office or occupied space:

1. Provide the following telephone facilities, line connections and services for the exclusive use of the Consultant and his staff:
 - a. 1 separate land line dedicated to PABX in the Consultant's field offices.
 - b. 1 separate land line dedicated to fax machine or modem in the Consultant's field offices.
2. **Charges and Costs:** Pay for all connection, service and user charges and costs arising in connection with the provision of telephone facilities and services for the Consultant.

3.3 SUPPORT FACILITIES INSTALLATION

A. **General:** Comply with the following:

1. Locate field offices, site laboratory, storage and fabrication sheds, workshops, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Maintain support facilities until near Substantial Completion. Unless otherwise directed, remove before Substantial Completion, but retain adequate support facilities to accommodate personnel remaining on Site after Substantial Completion, including relocating if necessary and under conditions acceptable to the Employer / Consultant.

B. **Contractor's Site Offices:** Provide and maintain temporary offices and facilities of sufficient size, number and type to accommodate required office personnel, including sub-contractors, at the Site. Furnish and equip as necessary. Keep clean and orderly for use.



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- C. **Site Laboratory:** Provide temporary site laboratory facility of sufficient size to accommodate, conduct, perform and report on-site sampling and testing of materials as prescribed and specified in various Sections of Divisions 2 through 16 of the Specification. Furnish and equip as necessary. Keep clean and orderly for use.
1. Employ qualified laboratory technicians familiar with specified industry standards and skilled in the testing of construction materials and associated administrative procedures.
- D. **Employer's and Consultant's Field Offices:** maintain and service all the temporary offices and facilities for the exclusive use of the Consultant/Employer's Representative, and their staff, sized, arranged, finished and equipped to the approval of the Consultant:
1. General Reception area and circulating corridor;
 2. Staff Offices;
 - a. Regularly service and maintain office machines and equipment in good serviceable condition. Provide and continuously stock offices with all associated consumables, and supplies as and when required or requested, including stationery and papers. The cost of which are to be borne by the Contractor.
 3. Toilets;
 - a. Service and maintain, and clean toilets on a daily basis. Provide and continuously stock with all associated consumable and supplies as and when required or requested, including soaps, toilet paper and paper towels. The cost of which are to be borne by the Contractor.
- E. **Temporary Roads and Paved Areas:** Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Submit proposals and obtain prior approval to locate temporary roads and paved areas coincidental with and in same location as permanent roads and paved areas. In such cases review any proposed modifications to permanent paving with the Consultant, and:
1. Comply with applicable requirements in appropriate Sections of the Specification for sub-grade, sub-base and base course construction of temporary paving.



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2. Coordinate elevations and development of temporary roads and paved areas with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 3. Install temporary roads and paved areas to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Employer.
 4. Recondition and repair base after temporary use, including removing contaminated material, regrading, proof-rolling, compacting and testing.
 5. Delay installation of the final course of permanent pavement until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 6. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations, including delivery and storage of materials, equipment usage, administration and supervision.
- F. **Traffic Controls:** Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
- G. **Dewatering Facilities and Drains:** Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Site, excavations, and construction free of water.
1. Dispose of rainwater in a manner that will not result in flooding of Site or adjoining property nor endanger Permanent Works or temporary facilities.
 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
- H. **Works Identification and Temporary Signs:** Provide Works identification and other signs of appropriate sizes and types. Install signs to inform public generally and persons seeking entrance to Site. Do not permit installation of unauthorized signs.
1. Design, fabricate and erect two Works identification signs in approved locations. Support on posts or framing of paint finished, preservative-treated wood or galvanized steel.



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2. Engage an experienced sign manufacturer to apply graphics for Works identification signs. Write sign in both English and Arabic, and include:
 - a. Works name.
 - b. Employer's name, style and logo.
 - c. Consultant's name, style and logo
 - d. Contractor's name, style and logo.
 - e. Such other names, details and information as permitted and/or directed.

3. Provide other appropriate temporary signs to provide directional and safety information to construction personnel and visitors.

- I. **Waste Disposal Facilities:** Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.
 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

- J. **Janitorial Services:** Provide janitorial cleaning services on a daily basis for all temporary offices, toilets, wash facilities, and similar areas.

- K. **Office boys:** Provide 3 office boys exclusively for Consultant's/Employer's services.

- L. **Storage and Fabrication Sheds:** Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on site.

- M. **Construction Aids and Miscellaneous Facilities:** Provide all necessary aids and miscellaneous facilities incidental and ancillary to the safe and efficient execution of construction operations and the carrying-out of work in a proper workmanlike manner, including but not necessarily limited to:
 1. Scaffolds, ladders, walkways, platforms and guardrails.
 2. Protective screens, chutes, coverings and roofs.
 3. Small tools; hand and power operated.



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4. Mechanical plant, machinery and equipment; stationary and mobile.
5. Tower cranes.
6. Truck mounted cranes.
7. Transportation equipment and vehicles; on and off Site.
8. Lifts and hoists for materials and workmen.
9. Protective clothing, including helmets, goggles, ear protectors and steel-toed safety boots.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints and nuisance to persons or establishments near Site.

- A. **Stormwater Control:** Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- B. **Tree and Plant Protection:** Unless otherwise indicated, install temporary fencing located outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.
- C. **Pest Control:** Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so that the Site will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- D. **Site Enclosure Fence:** Before construction operations begin install an enclosure fence with lockable entrance gates. Locate where directed. Enclose entire Site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people and animals from easily entering site except by entrance gates.
 1. Provide approved open mesh or solid panel fencing with posts set in concrete bases.



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2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations
 3. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- E. Security Enclosure and Lockup:** Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
1. **Secure Storage:** Where materials and/or equipment are of high value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of such materials and/or equipment to minimize the opportunity for theft.
- F. Barricades, Warning Signs, and Lights:** Comply with standards, code requirements and directions of the Consultant for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- G. Covered Walkways:** Where necessary, erect structurally adequate, protective, covered walkways for passage of persons along adjacent public streets adjacent to Site. Coordinate with entrance gates, other facilities, and obstructions. Comply with Consultant's directions and with regulations of authorities having jurisdiction.
1. Construct covered walkways using scaffold or shoring framing.
 2. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 3. Paint and maintain in a manner acceptable to the Consultant.
- H. Temporary Enclosures:** Provide temporary enclosures for protection of construction, in progress and completed, from exposure, inclement weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. **Vertical Openings:** Close openings of 2.5 m² or less with plywood or similar materials.



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3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
- I. **Temporary Partitions:** Where necessary, construct, erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration, and to separate areas from fumes and noise.
- J. **Temporary Fire Protection:** Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Strictly observe all requirements and recommendations pertaining to fire safety on construction sites

as contained in the latest edition of the Fire Instruction Manual produced by the Fire Service Department of the Department of Civil Aviation.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 - a. Field Offices: Class A stored-pressure water-type extinguishers.
 - b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
 - c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Works, complete installation of permanent fire-alarm and fire-protection facilities, including connected services, and place into operation and use. Instruct key personnel on use of facilities.



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6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
8. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. **Supervision:** Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. **Maintenance:** Maintain facilities in good operating condition until removal. Protect from damage caused by extreme temperatures and similar elements.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 2. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. **Temporary Facility Changeover:** Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. **Termination and Removal:** At the Consultant's sole discretion, remove each temporary facility either when need for its service has ended, or when it has been replaced by authorized use of a permanent facility, or at Substantial Completion. Complete, or if necessary, restore permanent construction that may have been delayed because of interference with a temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.



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1. Unless otherwise specified, materials, products, equipment and facilities that constitute temporary facilities are the property of the Contractor.
2. The Employer reserves right to take possession of Works identification signs.
3. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, damaged by construction operations, as required by authorities having jurisdiction.
4. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

3.6 SAFETY PROGRAM

- A. In addition to the requirements of the provisions of the General Conditions of Contract and other Contract requirements, the Contractor shall submit for the Consultant's approval, within 15 days after the effective date of the notice to proceed for the Works, a proposed Safety Program covering the following items:
1. Health and Safety Plan:
 - a. The Health and Safety Plan shall contain but not be limited to the following:
 - 1) Safety Policy and Strategy.
 - 2) Statutory and Contractual Framework for Safety.
 - 3) Management Safety Responsibilities.
 - 4) Safety Training and awareness.
 - 5) Safety Reviews.
 - 6) Safety Method Statements.
 - 7) Reporting and Investigation.
 - 8) Contingency Arrangements.



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- 9) Safety Inspections and Audits.
 - 10) Accident Procedures.
 - 11) Site cleanliness and removal of rubbish.
 - 12) Labor messing facilities.
- b. The Contractor shall take into account that the works under this Contract may be undertaken simultaneously with other Package Contracts. The Contractor is to coordinate safety procedures with the Consultant and Safety Representatives from other Package Contracts to implement and maintain a common safety strategy.
 - c. Site Cleaning and Housekeeping: Each Package Contractor shall be responsible for cleaning and housekeeping in their own work areas. The provision of waste chutes, garbage skips and disposal shall be provided by each package Contractor Package Contractor.
2. Health and Safety Representatives:
- a. The Contractor shall include within the Health and Safety Plan the name of the company's qualified Safety Officer. He shall also submit the name and qualification of a Health and Safety representative on site responsible for the implementation of the Health and Safety Plan on site. The site safety representative shall remain on site during operational working hours and shall coordinate with the safety representatives of other package Contractors.
 - b. Appointment of the site Health and Safety representative will be subject to the Consultant's approval.
 - c. If in the opinion of the Consultant there is an infringement or breach in the approved Health and Safety Plan, the Consultant reserves the right to instruct the Contractor to undertake immediate corrective action without any liability for any additional costs or time implication incurred by the Contractor in undertaking the corrective action.
- B. Upon the Consultant's approval of the Safety Program the Contractor shall, for the full term of the Contract, operate the Safety Program, maintain accurate records of safety activities and accident, and submit safety and accident reports to the Consultant on the approved forms.

END OF DOCUMENT



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PRODUCT REQUIREMENTS

SECTION 8 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Related Drawing and Detail.

1.2 PROPRIETARY NAMES

- A. In accordance with the PAKISTAN statutory requirements, unless unavoidable, no proprietary products or manufacturers have been named within this Specification.

1.3 SUMMARY

- A. This Section includes administrative and procedural requirements relating to products to be used in the Works, including the following:
1. Selection of products for the Works.
 2. Quality assurance.
 3. Product delivery, storage, and handling.
 4. Product warranties.
 5. Product substitutions.
 6. Comparable products.
- B. Related Sections include the following:
1. Division 1 Section "References Standards and Definitions" for applicable industry standards for products specified.
 2. Division 1 Section "Execution Requirements" for general procedural requirements governing execution of the Work.
 3. Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.
 4. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.



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1.4 DEFINITIONS

- A. **Products:** Items purchased for incorporating into the Works, whether purchased for the Works or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. **Named Products:** Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 2. **New Products:** Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 3. **Comparable Product:** Product that is demonstrated and approved through submittal process, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed the requirements of the Specification.
 4. **Local Products:** Naturally occurring materials found in GCC countries that satisfy the required standards, products manufactured in the PAKISTAN from naturally occurring materials found in GCC countries that satisfy the required standards, or products manufactured in the PAKISTAN that satisfy the required standards.
 5. **Other Products:** All other products required for the Works that satisfy the required standards and which are excluded from the category of "Local Products".
- B. **Substitutions:** Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by the Contractor after the date of issue of the Letter of Acceptance. The following are not Substitutions:
1. Revisions to Contract Documents required by the Consultant or Employer.
 2. Options for products, materials, equipment and methods of construction, already specified in Contract Documents, including "or approved equal" and "but are not limited to" options.
 3. Contractor's compliance with governing regulations or lawful orders issued by authorities having jurisdiction.



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- C. Manufacturer's Instructions and Manufacturer's Recommendations mean latest published or printed version of 'manufacturer's written instructions' and 'manufacturer's written recommendations.
- D. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to the Employer.
- E. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, whether to extend time limit provided by manufacturer's warranty, or to provide for joint and several liability, or to provide more rights for the Employer.

1.5 SUBMITTALS

- A. **Product List:** Prepare and submit a list, in tabular form, identifying those products that the Contractor intends to propose for the Works and include the generic names of such products. Include manufacturer's and supplier's name and proprietary product name for each product.
 1. Coordinate product list with Contractor's Construction Program, the Submittals Schedule, and the Subcontract List.
 2. Initial Submittal: Within 14 days after Commencement Date, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 3. Completed List: Within 42 days after Commencement Date, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 4. Consultant's Action: The Consultant will respond in writing to the Contractor within 28 days of receipt of completed product list. The Consultant's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. The Consultant's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
- B. **Substitution Requests:** Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.



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1. Substitution Request Form: Use a form acceptable to the Consultant.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product could not be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Works and to construction performed by the Employer and separate contractors, which will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the product or work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or if requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects/Consultants and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Detailed comparison of Contractor's Construction Program using proposed substitution with products specified for the Works, including effect, if any, on the overall Time for Completion. If specified product or method of construction cannot be provided within the Time for Completion, include letter from manufacturer, stating reason for non-availability and/or delays in delivery.
 - i. Cost information, including a proposal of change, if any, in the Contract Sum.
 - j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.



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3. **Consultant's Action:** If necessary, the Consultant will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Consultant will notify Contractor of acceptance or rejection of proposed substitution within 28 days of receipt of request, or within 14 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Variation Order.
 - b. Use product specified if the Consultant cannot make a decision on use of a proposed substitution within time allocated.
- C. **Comparable Product Requests:** Submit three copies of each request for consideration. Identify product or fabrication to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Request Form: Use a form acceptable to the Consultant.
 2. Documentation: Show compliance with requirements for approval.
 3. Consultant's Action: If necessary, the Consultant will request additional information or documentation for evaluation within one week of receipt of a request. The Consultant will notify the Contractor of acceptance or rejection of proposed comparable product within 28 days of receipt of request, or within 14 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Variation Order, without additional compensation.
 - b. Use product specified if the Consultant cannot make a decision on use of a proposed comparable product within time allocated.

1.6 QUALITY ASSURANCE

- A. **Alternative Equivalent Standards:** Product references to industry standards establish quantitative and qualitative attributes, characteristics and properties, required to be inherent in the specified product. Standard products not conforming to referenced standards, but otherwise exhibiting the same essential properties and conforming to another recognized equivalent industry standard may be used, subject to approval and compliance with other specified requirements.
1. Comply with provisions in "Comparable Products" Article to obtain approval for use of a product conforming to an alternative equivalent standard.



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- B. **Compatibility of Options:** If the Contractor is given the option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, the Consultant will determine which products shall be used.
- C. **Source Limitations:** To the fullest extent possible, provide products of the same type and kind from a single source.
1. If a specified product is available only from a source that cannot produce or supply sufficient quantities to execute and/or complete requirements in a timely manner, request the Consultant to determine the most essential qualities, attributes and characteristics required in the specified product, in order to select a comparable product possessing the same relevant, significant properties.
 2. Comply with provisions in "Comparable Products" Article to obtain approval.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
1. Schedule delivery to minimize long-term storage at Site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.



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5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger the structure of the Permanent Works.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

1.8 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of any obligations under requirements of the Contract Documents.
- B. Warranty Requirements:
 1. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
 2. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
 3. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Employer has benefited from use of the work through a portion of its anticipated useful service life.
 4. Employer's Recourse: Expressed warranties made to the Employer are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods



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shall not be interpreted as limitations on the time in which the Employer can enforce such other duties, obligations, rights, or remedies.

- C. **Rejection of Warranties:** The Employer reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- D. Where the Contract Documents require a special warranty, or similar commitment on the Works or part of the Works, the Employer reserves the right to refuse to accept the Works, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.
- E. **Manufacturer's and Special Warranties:** Prepare a written document, ready for execution, that contains appropriate terms and conditions, and identifies commencement date and warranty period. Submit a draft and obtain the Consultant's written approval before final product selection.
 - 1. **Manufacturer's Standard Form:** Modified to include requirements and information specific to the Works, and properly executed; or
 - 2. **Special Form:** Individually prepared and specially drafted to include requirements and information specific to the Works, and properly executed.
 - 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- F. **Submittal of Warranties:** Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 SELECTION OF PRODUCTS WHERE PROPRIETARY NAMES ARE NOT USED

- A. All products shall be to a standard not less than the minimum requirements specified.
- B. In addition to compliance with the Specification, the Contractor shall submit such further documentation and warranties as the Consultant may request to demonstrate compliance.
- C. The products selected and submitted by the Contractor shall fulfill the following criteria:
 - 1. In selecting and submitting products for approval, the Contractor shall only submit products where the stated performance criteria are fully adequate for



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the operation intended and the Contractor in making the submittal warrants the fitness of purpose of the products.

2. Product manufacturers shall be fully qualified to manufacture the respective products and they shall possess a proven track record of not less than 5 (five) years (preferably 10 years) manufacturing experience in their field. Those with the maximum experience shall be given preference in approval by the Consultant.
3. "Other Products" shall be either manufactured in, or be a naturally occurring material found in, any of the following geographical locations: Western Europe, North America, Australia or Japan. However, Manufacturers originating from the stated geographical locations who operate in a geographical location other than the stated ones are also acceptable provided that the Contractor can demonstrate that the parent manufacturing company still operates in one of the stated geographical locations.
4. Submittals for "Other Products" assembled in the PAKISTAN must include evidence that demonstrates that the assembly is approved by the original manufacturer.
5. Submittals shall only include products where manufacturers can certify 'forward compatibility' (as applicable) of current models of their products with future models.
6. Submittals shall only include products produced by manufacturers who have received ISO certification for a period of not less than 3 years (preferably 7 years) and preference shall be given by the Consultant to those possessing the longest periods of certification.
7. Submittals shall only include products produced by manufacturers who have had not less than 3 years commercial experience (preferably 7 years) and preference shall be given by the Consultant to those possessing the longest periods.
8. Submittals shall include evidence to demonstrate that the various components of the products are certified by the product manufacturer with respect to specific suitability, country of origin, quality and reliability.
9. Submittals shall include type test certificates (as applicable) issued by an Internationally reputable and accredited testing facility.
10. Submittals for "Other Products" shall include evidence to demonstrate that proposed products have been represented in the PAKISTAN for a period of not less than 3 years (as at date of Tender) and that the PAKISTAN



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representative maintains a fully equipped and capable technical support facility.

11. Submittals for "Other Products" shall include evidence to demonstrate that the proposed products are supplied through an authorized dealer in the PAKISTAN.
12. Product submittals (as applicable) shall include a re-submittal of the following information as originally submitted by the Contractor for all products included in his Tender lists for "Local Products" and "Other Products":
 - a. Guarantee particulars of the Product.
 - b. Original catalog of the proposed product manufacturer.
 - c. Schedule of users (including names of contact persons) for the previous 5 years.
 - d. Schedule of recommended minimum spares based on normal running/usage in the environment proposed projected over a ten year period together with current price lists (major equipment).
 - e. Life cycle cost for the product covering the cost of the equipment, spare parts, maintenance and energy consumption in the environment proposed for the lifetime of the product.
 - f. Manufacturers' website address.

2.2 PRODUCT OPTIONS

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. **Standard Products:** If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. The Employer reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," the Consultant will make selection.



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5. Where products are accompanied by the term "match sample," sample to be matched is the Consultant's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Approved Equal: Where products are specified by name and accompanied by such terms as "or other equal and approved", "or approved equal" "or equal", or "but are not limited to" comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. The Consultant reserves the right to limit selection to named products specified.
 - b. Unless otherwise agreed, contract unit rates and prices will be deemed to be based on the use of named products specified in the Contract Documents.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named, unless otherwise indicated.
2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements, unless otherwise indicated.
3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements, unless otherwise indicated.
4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements, unless otherwise indicated.
5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.



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6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of a product by another manufacturer.
7. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
8. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches the Consultant's sample. The Consultant's decision will be final on whether a proposed product matches satisfactorily.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, the Consultant will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, the Consultant will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.



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2.3 PRODUCT SUBSTITUTIONS

- A. **Timing:** The Consultant will consider requests for substitution if received within 60 days after date of Letter of Acceptance. Requests received after that time may be considered or rejected at discretion of the Consultant.
- B. **Conditions:** The Consultant will consider the Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, the Consultant will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers the Employer a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Employer must assume. The Employer's additional responsibilities may include compensation to the Consultant for redesign and evaluation services, increased cost of other construction by the Employer, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect the Contractor's Construction Program.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Works.
 8. Requested substitution has been coordinated with other portions of the Works.
 9. Requested substitution provides specified warranty.
 10. If requested substitution involves other contractors, requested substitution has been coordinated with the work of such other contractors, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.



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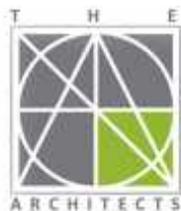
PRODUCT REQUIREMENTS

2.4 COMPARABLE PRODUCTS

- A. Where products are specified by name or industry standard, submit the following, in addition to other required submittals, to obtain approval of an unnamed or alternative equivalent industry standard, product:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Works.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty, if any.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects/Consultants and employers, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT



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EXECUTION REQUIREMENTS

SECTION 10 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

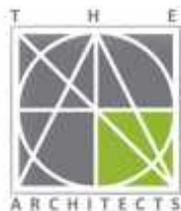
- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Related Drawing and Detail.

1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Works including, but not limited to, the following:
1. Construction layout.
 2. Field Consultations and surveying.
 3. General installation of products.
 4. Coordination of the Employer-installed products.
 5. Progress cleaning.
 6. Starting and adjusting.
 7. Protection of installed construction.
 8. Correction of work.
- B. Related Sections include the following:
1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field Consulting with other construction activities.
 2. Division 1 Section "Submittal Procedures" for submitting surveys.
 3. Division 1 Section "Closeout Procedures" for final cleaning.

1.3 SUBMITTALS

- A. Method Statement: Submit method statement to be used for construction layout.



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- B. **Landfill Receipts:** If Contract Documents contain requirement for hazardous waste disposal, submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials.

PART 2 - PRODUCTS (Not Used)

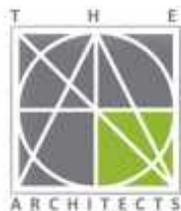
PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Existing Conditions:** The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Works.
1. Before construction, verify the location and points of connection of utility services.
- B. **Existing Utilities:** The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Works.
- C. **Acceptance of Conditions:** Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. **Written Report:** Where a written report listing conditions detrimental to performance of the work is required by other Sections, include the following:
 - a. Description of the work.
 - b. List of detrimental conditions, including substrates.
 - c. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3.2 PREPARATION

- A. **Existing Utility Information:** Furnish information to the Consultant that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate, where necessary, with authorities having jurisdiction.



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1. Notify the Consultant and the Employer not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without the Consultant's written permission.
- B. **Field Measurements:** Take field measurements as required to fit the construction properly. Recheck measurements before installing each product. Where portions of the Works are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Works.
- C. **Space Requirements:** Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. **Review of Contract Documents and Field Conditions:** Immediately on discovery of any discrepancy or the need for a clarification of the Contract Documents, submit a request for information or instruction to the Consultant. Include a detailed description of discrepancy or problem encountered, together with recommendations.
- 3.3 CONSTRUCTION LAYOUT**
- A. **Method Statement:** Before verifying layout information shown on Drawings, prepare a detailed method statement comprising a descriptive narrative and drawings, clearly describing and identifying means and methods to be used for construction layout including but not limited to:
1. Establishing benchmarks and control points to set lines and levels at each storey of construction and elsewhere as needed to locate each element of the Works.
 2. Locating offsets for gridlines.
 3. Locating and sizing penetrations in structures as needed to transfer lines and levels horizontally and vertically.
- B. **Verification:** Before proceeding to set out the Works, verify layout information shown on Drawings, in relation to the Contractor's site survey and existing benchmarks. If discrepancies are discovered, notify the Consultant promptly.
- C. **General:** Set out the Works using accepted surveying techniques and practices.



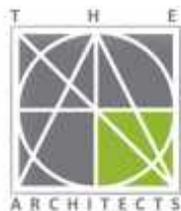
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1. Establish benchmarks and control points to set lines and levels at each storey of construction and elsewhere as needed to locate each element of the Works.
 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as work progresses.
 5. Notify the Consultant when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard indicated or otherwise as acceptable to the Consultant.
- D. **Record Log:** Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the Consultant.
1. Advise the Consultant when deviations, exceeding indicated or recognized tolerances, are detected.
 2. Record deviations that are accepted and not corrected on Record (As-Built) Drawings.
- E. **Auxiliary Services:** Cooperate with the Consultant and provide, when requested, auxiliary services to enable and assist the Consultant to check the Contractor's site survey, layout and control work, including means of access to Site, use of instruments and tapes, and supply of survey crew.

3.4 FIELD CONSULTANTING

- A. **Identification:** The Consultant will identify existing benchmarks and control points.
- B. **Reference Points:** Locate existing permanent benchmarks, control points, and similar reference points before beginning the Works. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of the Consultant. Report lost or destroyed permanent



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- benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to the Consultant before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. **Benchmarks:** Establish and maintain a minimum of two permanent benchmarks on Site, referenced to data established by survey control points. Comply with the Consultant's instructions for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Record (As-Built) Drawings.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Works.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. **Record Log:** Maintain a log of field Consulting work. Include dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the Consultant.

3.6 PROGRESS CLEANING

- A. **General:** Clean Site and work areas daily, including common areas. Coordinate and contribute to progress cleaning for Site and work areas jointly-used with other separate contractors. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 27 deg C.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. **Site:** Maintain Site free of waste materials and debris.
- C. **Work Areas:** Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Works.



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- E. **Concealed Spaces:** Remove debris from concealed spaces before enclosing the space.
- F. **Exposed Surfaces:** Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. **Cutting and Patching:** Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 - 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. **Waste Disposal:** Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- E. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- F. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- G. **Limiting Exposures:** Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 CORRECTION OF WORK

- A. **Repair or remove and replace defective construction.** Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their original condition, unless otherwise specified.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.



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- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF DOCUMENT



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RECORD (AS-BUILT) DOCUMENTS

SECTION 13 - RECORD (AS-BUILT) DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and other Related Drawing and Detail.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Record (As-Built) Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Miscellaneous Records.

- B. Related Sections include the following:

1. Division 1 Section "Summary of Multiple Contracts" for coordinating Project Record Documents covering the Work of multiple contracts.
2. Division 1 Section "Closeout Procedures" for general closeout procedures.
3. Divisions 2 Sections for specific requirements for Record (As-Built) Documents in those Sections.
4. Divisions 2 Sections for specific requirements for Miscellaneous Record keeping and submittal in those Sections.

1.3 SUBMITTALS

- A. **Record Drawings:** Submit copies of Record Drawings as follows:

1. Initial Submittal: Submit two sets of plots from Record CAD Drawing files and the original marked-up Record Prints. The Consultant will initial and date one set of plots and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. The Consultant will return one set of plots and Record Prints together with review comments, for completing, printing, binding, and final submittal.



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2. Final Submittal: After incorporating the Consultant's initial submittal review comments, submit:
 - a. Original marked-up Record Prints set.
 - b. Sets of (As-Built) Drawings as follows:
 - 1) One (1) Set electronic format: (in CD-ROM)
 - 2) One (1) set of Mylar reproducible polyester film (Mylar)
 - 3) Two (2) bound sets of prints (A2 Size)
 - 4) One (1) set of loose copy (blue print/black line print). Size should be the same as the original Mylar/Polyester films
 - 5) One (1) set of any other document/report about the project, Test results and any other information/documents..
- B. **Record Specifications:** Submit two (2) copies of Record Specifications, including addenda and contract modifications.
- C. **Miscellaneous Records:** Submit two (2) sets of original miscellaneous records.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. **Record Prints:** During construction period, print and maintain one set of blue- or black-line white prints of all Contract Drawings, approved Shop Drawings and newly prepared Drawings, for Record Print purposes.
 1. Preparation: Mark Record Prints to indicate all changes and field adjustments and to show the actual installation where installation varies from that shown originally.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the mark-up before enclosing concealed installations.



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2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Changes made by Variation or Site Instruction directives.
 - g. Changes made following the Consultant's written orders and the Consultant's acceptance of substitutions or alternatives, etc.
 - h. Details not on the original Contract Drawings.
 - i. Field records for variable and concealed conditions.
 - j. All coordinates shown on the drawings should be in DLTM.
 3. Mark record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 4. Mark record prints with erasable, red-coloured pencil. Use other colours to distinguish between changes for different categories of work at the same location.
 5. Mark important additional information that is either shown only schematically or omitted from original Drawings.
 6. Note Variation numbers, Site Instruction numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings:** Prepare new Drawings where the Consultant determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Variation is issued or as a result of the Consultant accepting an alternate, substitution, or other modification.



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2. Consult with the Consultant for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. **Progress Review:** Unless otherwise indicated or directed, submit a copy of marked-up Record Prints and newly prepared Record Drawings at monthly intervals, for progress review and acceptance by the Consultant.
1. Limit submittals to drawings marked-up, prepared or further amended since previous submittal. List drawings contained in each submittal on transmittal form.
- D. **Record CAD Drawings:** Before requesting inspection for determining date of Substantial Completion, review marked-up final Record Prints with the Consultant. When authorized, prepare a full set of CAD Drawings of all Contract Drawings, Shop Drawings and newly prepared Drawings, whether or not changes or additional information are recorded:
1. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
 2. Refer instances of uncertainty to the Consultant for resolution.
 3. Identify and date each Record Drawing; include the designation "RECORD (AS-BUILT) DRAWING" in a prominent location.
- E. **Record CAD Drawing Plots:** Produce a full set of Record Drawing Plots from completed Record CAD Drawing files.
- F. Final Submittal Format:
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with thick cover sheets. Include identification and list contents on cover sheets.
 2. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Record Prints. Produce "List of Drawings" sheet. Name each file with the sheet identification number. Include identification in each CAD file. All as follows:
 - a. All As-Built drawings and GIS files to be submitted in DLTM coordinate system, which is UAE Standard coordinate system.



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- b. The master map unit for As-Built drawings and GIS files should be in meter (m) only. (For Microstation drawings, sub unit should be 1000 (mm) and positional unit should be 80).
- c. All As-Built CAD drawings and GIS files to be submitted in digital formats on CD's media.
- d. As-Built CAD and GIS formats are both required for any As-Built design / entity submission.
- e. All As-Built GIS maps to be submitted in standard shape files.
- f. All As-Built CAD drawings should be submitted in original Microstation format, (not converted), unless special permission is obtained from DCA for other format.
- g. In the event of such special permission being granted, for AutoCAD drawings, pen width details for plotting should also be provided in each drawing. (Outside the drawing area).
- h. In Microstation files for 2D drawings always use 2D seed files.
- i. All reference files (if used) should be copied in a directory called 'reference'.
- j. If any of the files/drawings are using fonts other than the normal fonts provided by the software, that fonts also should be copied in a separate directory called 'fonts'.
- k. Drawing should be neat and perfect. None of the items should be outside the drawing sheet area.
- l. Drawings of different disciplines (i.e. Architectural, Structural, Electrical, Mechanical etc.) should be kept in separate directories with suitable names.
- m. One file shall contain only one drawing.
- n. Drawing should be drawn/organized in suitable/proper layers/levels. Same kind of items should always be in the same layer/level.
- o. Drawing should be copied into CD' in such a way that, when one drawing from the CD is opened, it must be complete and all reference files, fonts and libraries (if used) should attach automatically.



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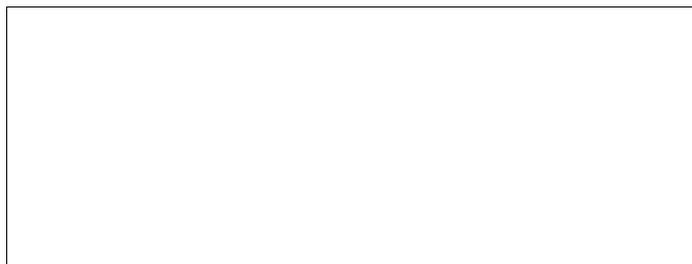
- p. The index of drawings should also be provided in the original format of the drawing (DGN or DWG) and it must be kept in a directory called "general".
 - q. Total number of As-Built drawings in the index and in the CD should be the same.
 - r. Change notice drawings should submit along with all other drawings of that TD in a new CD.
3. Polyester Copy (Mylars): Organize into unbound sets matching Record Prints. Place in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set of Drawings, attach label and identify Drawings included. All as follows:
- a. All the drawings must be either A0 or A1 size. (Standard).
 - b. Maximum size of the sheet should not exceed 1200 x 880 mm.
 - c. All drawings must be in good quality polyester films and not in tracing paper.
4. Copy Prints: Organize into bound sets matching Record CAD Drawing Plots. The Consultant will deliver the Employer copy sets. All as follows:
- a. They must be in standard in A2 size.
 - b. They must be properly bound using thick covering sheets.
 - c. Laminated labelling must be as in the following format:

<PROJECT TITLE>

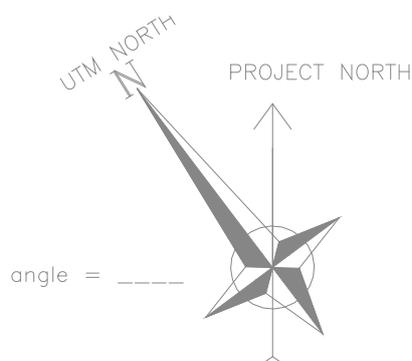


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- d. The scale of the drawings in the bound book should match with the scale shown in the title block of the drawing of bound book.
5. General (for Soft copy & Hard copy)
- a. Each document should be verified thoroughly by the consultant/contractor before submission.
 - b. "As-Built" stamp/seal with date and signature of the verified person should be provided in each drawing.
 - c. "As-Built" stamp/seal (item 5. b above) should be exactly like below:
 - d. Drawing should be in proper scale and Contract number, its description & scale of the drawing should also be mentioned in the title block along with other details.
 - e. Key plan & north symbol should be provided in the upper right corner of the drawings (wherever it is applicable).
 - f. North symbol (item 5. e above) should be like as below sample:



- g. Provide hard copy of list (index) of drawings as in the following format:



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Discipline (Architectural, Structural, Mechanical, etc.)					
Sl. No.	Sheet no.	Drg. No.	Rev no.	Drg. File name	Description

- h. All the drawings must be numbered serially (sheet number), starting from 001 (drawing index as sheet no. 001) and it must be showed in the drawing index. (Total number of drawings in one Contract should be same as the sheet number of the last drawing).
- i. One file should contain only one drawing. (This point is also incorporated under item 2.1. F.2 above).
- j. All As-Built drawings and GIS files to be submitted in DLTM coordinate system which is UAE Standard coordinate system.
- k. All As-Built CAD drawings and GIS files to be submitted in digital formats on CD's media.
- l. As-Built CAD and GIS formats are both required for any As-Built design / entity submission.
- m. All As-Built GIS maps to be submitted in standard shape files.
- n. All naming, numbering and related attribute information for As-Built to be matched with DCA standards.

2.2 RECORD SPECIFICATIONS

- A. **Record Specifications:** During construction period, print and maintain two copies of the Specifications, including addenda and contract modifications issued, for Record Specification purposes.
- B. **Preparation:** Mark Record Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.



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RECORD (AS-BUILT) DOCUMENTS

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Variation numbers and Record Drawings where applicable.

2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Miscellaneous records include, but are not limited to, the following:
 1. Field records on excavations and fillings.
 2. Surveys showing locations and elevations of underground lines.
 3. Special and authorized measurements.
 4. Tests and inspections.
 5. Inspections and certifications by governing authorities.
 6. Final inspection and correction procedures.
 7. Any other information / documents which are not included on As-Built Drawings and Operation and Maintenance Manuals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. **Recording:** Mark up Record Documents as the Work is progressively accomplished and completed relative to each Record Document. Record changes and modifications as they occur; do not wait until the end of Project.
- B. **Maintenance of Record Documents:** Store Record Documents in field office, apart from the Contract Documents used for construction. Do not use Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Make



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RECORD (AS-BUILT) DOCUMENTS

Record Documents available for the Consultant's inspection and reference during normal working hours.

END OF DOCUMENT



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OPERATION AND MAINTENANCE DATA

SECTION 14 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including Conditions of Contract and other Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Operation and Maintenance (O&M) Manuals, including the following:

1. Preparing and submitting O&M Manuals for operating systems and equipment.
2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of Consultanted components and systems and architectural products and finishes.
3. Instruction of the Employer's operating personnel in the operation and maintenance of systems and equipment.

B. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 1 "Data Requirements" for preparation of Shop Drawings and Product Data.
2. Divisions 2 through 16 Sections for special O&M data requirements for specific pieces of equipment or building operating systems.

1.3 QUALITY ASSURANCE

A. **O&M Manual Preparation:** In preparation of O&M Manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.

1. Where O&M Manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.



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2. Where O&M Manuals require drawings or diagrams, use CAD operators or drafters capable of preparing drawings clearly in a clear, understandable industry standard format.
 3. System-Level O&M Manuals for mechanical and electrical systems shall be developed specifically for this Project. Compilation of equipment vendor catalogs and O&M Manuals is not acceptable.
- B. Instructions for the Employer's Personnel: Use experienced instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved to instruct the Employer's O&M personnel.

1.4 SUBMITTALS

- A. **Submittal Schedule:** Comply with the following schedule for submitting O&M Manuals:
1. Not later than sixty (60) days prior to initial startup of the subject work scope equipment, when each installation that requires O&M Manuals is nominally complete, submit two (2) draft copies of each manual to the Consultant for review and approval. Include a complete index or table of contents of each manual.
 2. The Consultant will return one (1) copy of the draft with comments within thirty (30) days of receipt.
 3. After receipt of the Consultant's approval, make any required corrections or modifications to comply with the Consultant's comments. After approval, and at least thirty (30) calendar days in advance of initial startup of an item (i.e., within thirty (30) days of receipt of the Consultant's final comments and approval), submit the O&M Manuals, in final form, to the Consultant for distribution and use by the Employer, as follows:
 - a) Three (3) bound sets of O&M Manuals
 - b) One (1) loose set (blue line / black line prints) of O&M Manuals
 - c) One (1) set of O&M Manuals in electronic format (in CD-ROM)
- B. **Form of Submittal:** Prepare O&M Manuals in the form of an instructional manual for use by the Employer's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.



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1. Complete Listing: Provide a complete list showing the actual number of volumes and files of O&M Manuals, for the project. Also provide a list showing the number of volumes and files included in a particular submittal.
2. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive Metric-Size "A4" (210 mm by 297 mm) paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets on the inside of the covers to receive folded sheets.
 - a. Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings for similar items. Establish a logical, well organized table of contents and O&M Manual binders layout. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
 - b. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL", Works title or name, and subject matter covered. Indicate volume number for multiple-volume manuals. Indicate applicable 5-digit specification section number for reference as appropriate on the front of each major O&M Manual section.
 - c. They must be filled with good quality files and proper labeling.
3. Organize each O&M Manual into separate sections for each piece of related equipment. Each manual section shall contain a title page; a table of contents; copies of pertinent product data, supplemented by drawings and written text; and copies of each warranty, bond, and service contract issued.
 - a. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following:
 - 1) Subject matter covered by the manual section.
 - 2) Name and address of the Works.
 - 3) Contract Number (e.g., AX....).
 - 4) Date of submittal.
 - 5) Name, address, and telephone number of the Contractor.
 - 6) Name and address of the Consultant.



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- 7) Cross-reference to related systems in other O&M Manuals or sections of the subject O&M Manual.
 - b. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume. Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.
 - c. General Information: Provide a general information section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or installer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities
 - d. Product Data: Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.
 - e. Written Text: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.
 - f. Drawings: Original project record documents as part of O&M Manuals.
 - g. Warranties, Bonds, and Service Contracts: Original documentation.
4. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the section on each divider.



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5. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
6. Text Material: Where O&M Manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, typewritten, on Metric Size "A4" (210 mm by 297 mm), 75-g/sq. m white bond paper.
7. Drawings: Provide reinforced, punched binder tabs on drawings and bind in with text.
 - a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.
 - b. If drawings are too large to be used practically as a foldout, place the drawing, folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.
8. Loose Copy: Shall be in blue / black line prints. Enclosed drawings shall be same sign as original mylar / polyester films.
9. Electronic Format: Provide one (1) set of O&M Manuals in CD – ROM format including file index, procedures and all related catalogues and brochures.
10. All O&M Manuals should be stamped as "Final Copy" on the front page assuring that such are final.
11. All drawings, sketches and diagrams included in the O&M Manuals shall also be stamped as "As-Built" and certified accordingly by the contractor.
12. Other Documents / Reports: Provide one list of full report about the project, Test results and any other information / documents, which are not included in the O&M manuals and As-Built drawings.

1.5 O&M MANUAL CONTENT

- A. Each O&M Manual shall include the information specified in the applicable individual Specification Section and, as a minimum, shall include the following general sections/subsections and information. The O&M Manual shall address each component/equipment/item and its controls and each major facility included within the scope of work.
 1. How to Use the Manual. This section shall be a guide to the contents, structure, and layout of the manual. It shall enable the reader to comprehend



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- the scope of the document and identify readily where specific information can be obtained.
2. Overall Purpose. This section shall provide a general overview of the original design intent.
 3. Description. This section shall include the following:
 - a. Type of system.
 - b. System location and what it serves.
 - c. System inputs/interfaces; i.e., what the system depends upon in order to function.
 - d. Design data, basic design parameters, and basic assumptions made during design. The appropriate the Employer's Design Criteria documents will be made available for the Contractor's use and information and to assist in the preparation of this section of the O&M Manual.
 - e. Rationale for selecting particular plant processes/equipment.
 - f. Expected service life (where available).
 - g. Planned operational efficiencies.
 4. Equipment Schedule and Identification. This section shall include the following for all components within each system:
 - a. Type of equipment.
 - b. Name of manufacturer.
 - c. Equipment model number of each component.
 - d. Equipment serial number of each component.
 - e. Items within each system shall be listed, together with the names of their respective manufacturers or suppliers.
 5. Parts Identification and Recommended Spares. This section shall include the following for all components within each system:



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- a. A parts identification list detailing and identifying replaceable assemblies, sub-assemblies, and components. It shall include suppliers' recommendation for both spares and "running spares" for the First year period and Second year period as a minimum; i.e., parts required for scheduled replacement due to wear or deterioration.
 - b. Items normally held in stock locally by the supplier or for which a refurbishment service is available shall be clearly identified.
 - c. Recommended stocking levels of spare parts.
 - d. Manufacturing and shipping time required for imported spare parts.
6. Commissioning Data. This section shall include the following:
- a. Measured data.
 - b. Measurement points.
 - c. Test equipment used.
 - d. Calibration certificate details.
 - e. Test certificates.
 - f. Safety and fire certificates (where applicable).
 - g. A statement of whether the design requirements were achieved.
7. Operation. This section shall include instructions for the safe and efficient operation, under both normal and emergency conditions. These will be in addition to manufacturers' literature for all plant items and shall include the following:
- a. A recommended strategy for operation and control.
 - b. An outline of the general operating mode.
 - c. Control data (location, effect, object, sequence, limits of capability, modes, set points).
 - d. For electric and electronic systems, provide complete circuit directories of control panels, local panels/racks, programmable logic controller units, panelboards, etc. including the following:



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- 1) Electric service.
 - 2) Controls.
 - 3) Communications.
- e. Charts of valve-tag numbers, with the location and function of each valve.
 - f. Procedure and sequences for startup, running, and shutdown, under both normal and emergency conditions.
 - g. Interlocks between various plant items.



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- h. Operating procedure for standby operations and plant.
 - i. Precautions necessary to overcome known hazards.
 - j. The means by which any potentially hazardous condition may be made safe.
 - k. Target figures for both energy consumption and energy costs.
 - l. Forms for recording plant running hours, energy consumption, and energy costs.
8. Maintenance. This section shall include the following:
- a. Manufacturers' recommendations and instructions for maintenance for each item of plant and equipment. A clear distinction shall be made between planned tasks (preventative maintenance) and work done on a corrective basis. Instructions shall be given on each of the following, as appropriate:
 - 1) The isolation and return to service of systems and equipment.
 - 2) Adjustments, calibration, and testing.
 - 3) Dismantling and re-assembly.
 - 4) The exchange of components and assemblies.
 - 5) Dealing with hazards which may arise during maintenance.
 - 6) The nature of expected deterioration and the types of defects anticipated.
 - 7) Special tools, test equipment, and ancillary services.
 - b. Maintenance schedules shall be provided for preventative maintenance tasks and shall be based on manufacturers' recommendations and other authoritative sources and shall include the following:
 - 1) Inspections.
 - 2) Examinations.
 - 3) Tests.



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- 4) Adjustments.
 - 5) Calibration.
 - 6) Lubrication.
 - 7) Periodic overhaul.
- c. Procedures for the logical diagnosis and correction of faults.
 - d. A schedule for all systems/components requiring lubrication shall be provided together with manufacturers' recommendations on the type of lubricant and the method and frequency of application. Where the type of lubricant is identified by product name, a generic reference (e.g., BS) shall also be given. Special requirements for the handling and storage of lubricants shall be provided. Where applicable, names of locally available lubricants shall be provided.
9. Modification Information. This section shall include information on permitted plant or system modifications allowed for by the manufacturers or system designers for each system. Space shall be provided in the manual for the recording of all modifications and changes as they occur.
 10. Disposal Instructions. This section shall include the following:
 - a. Any known dangers likely to arise during the disposal of specific items of systems or equipment, together with the necessary precautions and safety measures.
 - b. Methods for safely disposing of or destroying the equipment or any parts thereof, including packaging, insulation, and fluids.
 - c. Sources from which further advice on safe disposal can be obtained.
 11. Names and Addresses of Manufacturers. This section shall include the following:
 - a. Name of each equipment/item.
 - b. Name of manufacturer.
 - c. Address of manufacturer.
 - d. Telephone number and telex/fax number of manufacturer. Include E-Mail address if available.



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- e. Name of local supplier/agent.
 - f. Address of local supplier/agent.
 - g. Telephone number and telex/fax number of local supplier/agent. Include E-Mail address if available.
12. Index of Plans and Drawings. This section shall include the following:
- a. An index shall be provided of all "As Fitted" drawings supplied during the course of the installation work, included by number and title.
 - b. The index shall also include a schedule of all drawings issued by each manufacturer and supplier during the course of the installation work; e.g., control panel wiring diagrams.
 - c. In addition to manufacturer-prepared documentation and drawings as specified below, the O&M Manual shall contain copies of the Contractor-prepared Coordination Drawings which accurately represent the final as-built condition of the facility/system.
13. Emergency Information. This section shall include the following:
- a. Names, addresses, telephone, and telex/fax numbers of the appropriate contacts in the event of fire, theft, burglary, and fuel, gas, electricity or water failure/leaks. It shall also list those firms or staff to contact in the event of the failure or breakdown of such facility items as elevators, security gates, and miscellaneous mechanical and electrical equipment.
 - b. Where applicable, location of fire-fighting equipment, hydrants, and rising mains shall be identified and described.
14. Manufacturers' Literature. This section shall include the following:
- a. A complete set of all manufacturers' literature shall be provided for each of the systems and equipment installed and assembled. As a minimum, the following document types shall be provided:
 - 1) Product data shall be manufacturers' original printed data (not copies).
 - 2) Copies of applicable Shop Drawings and Product Data.
 - 3) Assembly drawings and diagrams required for maintenance.



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- 4) Wiring diagrams.
 - 5) Inspection and test procedures.
 - 6) Repair instructions including spare parts listing.
 - 7) Maintenance procedures and schedules.
 - 8) Precautions against improper use and maintenance.
 - 9) Sources of required maintenance materials and related services.
 - 10) Description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
 - 11) Specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.
- b. This literature shall provide the following:
- 1) Description of the product as purchased.
 - 2) The cost and date of purchase.
 - 3) Performance - behavioral characteristics of the equipment in use (e.g., performance curves for pumps).
 - 4) Equipment or system function.
 - 5) Operating characteristics.
 - 6) Limiting conditions.
 - 7) Consultanting data and tests.
 - 8) Complete nomenclature and number of replacement parts.
 - 9) Applications - suitability for use.
 - 10) Operation and Maintenance details.



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- 11) Resources of labor, plant, material, and space required.
 - 12) Methods of operation and control.
 - 13) Cleaning and maintenance requirements.
 - 14) Protective measures.
 - 15) Labor safety and welfare associated with the equipment.
 - 16) Public safety considerations.
15. Manufacturers' Guarantees and Warranties. This section shall include copies of each warranty, bond, or service contract in the appropriate manual for the information of the Employer's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.
16. INSTRUCTIONS FOR THE EMPLOYER'S PERSONNEL
- A. Prior to final inspection, instruct the Employer's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed upon times.
 1. Use O&M Manual sections for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF DOCUMENT



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DEMOLITION & REMOVAL

SECTION 15 - DEMOLITION & REMOVAL

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

1.1.1 Read and conform to:

- a. Comply with Division 1 requirements and documents referred to herein.

1.2 SUMMARY

1.2.1 Work Included: Provide demolition and salvage including but not limited to following:

- a. selective demolition to accommodate alterations.
- b. new openings.

1.2 DEFINITIONS

- a. Hand Demolition: Systematic demolition of structures by workers using hand-held tools.
- b. Mechanical Demolition: Systematic demolition of structures using powered equipment.
- c. Systematic Demolition: Methodical dismantling of structure piece by piece, usually carried out in reverse order of construction.

1.3 SUBMITTALS

- a. Plan of Action: Submit "Plan of Action" immediately after award of Contract for review by Consultant.
- b. Where required by authorities having jurisdiction, submit drawings, diagrams or details showing sequence of dismantling work and shoring of structures during demolition.

1.4 QUALITY ASSURANCE

- a. Regulatory Requirements:
 - i. Conform to Health and Safety laws in Pakistan for Construction Projects



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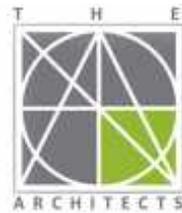
-
- ii. Conform to Fire Department Regulations.
 - iii. Post danger signs conspicuously around property. If requested, provide a watchman for patrolling site when work is not in progress to prevent public entering danger zone and to maintain barricades.
 - iv. Provide fire extinguishers acceptable to fire prevention authorities in locations and of type suitable to enable personnel to with fire occurring during progress of work.

1.5 Qualifications:

- a. Employ for this work, a demolition company having 5 years experience in this type of work satisfactory to Consultant. If requested, submit proof of experience. Employ a full time professional structural Consultant registered in PAKISTAN to prepare plan of action, Consultant temporary shoring, bracing. Inspect this work during demolition, fabrication and erection of shoring and bracing. Provide site administration and inspection of work of this Section.
- b. Pre-Demolition Meeting:
- c. Prior to start of work, arrange for site meeting of all parties associated with work of this Section. Presided over by Consultant, meeting shall include Contractor, demolition Subcontractor, testing company's representative and structural Consultant.
- d. Review specification for work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, inspection of construction to be demolished, methods to be used, sequence and quality control, Project staffing, restrictions due to environmental protection requirements and other matters affecting demolition, to permit compliance with intent of this Section. Review structural load limitations of existing structures. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays. Review and finalize protection requirements.

1.6 PROJECT CONDITIONS

- a. Maintain Access Road to Buildings: Do not disturb existing temporary fencing. Maintain construction traffic reasonable distance away from fence line. Repair damage which is result of Work of this Contract.
- b. Do not close or obstruct roads, streets, sidewalks, passageways without



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permits. Do not place or store materials in streets or passageways. Conduct operations with minimum interference with roads, streets, driveways and passageways.

1.7 SCHEDULING

- a. Phase selective demolition as indicated on Drawings to accommodate new construction.
- b. Demolition and removal of electrical equipment services designated for removal on Drawings and as required by Work. Disconnecting and capping prior to authorizing removal

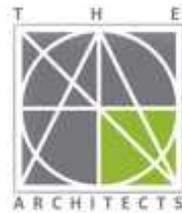
2. PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 PREPARATION

- a. Preliminary Survey:
 - i. Before commencing demolition operations, examine site and when requested, provide Consulting survey to determine type of construction, condition of structure and site conditions. Assess strength and stability of damaged or deteriorated structures.
 - ii. Assess potential effect of removal of any part or parts on remainder of structure before such part(s) are removed.
 - iii. Assess effects of demolition on adjacent properties and consider need for underpinning, shoring and/or bracing.
 - iv. Investigate for following conditions:
 - a. load-bearing walls and floors.
 - b. structure suspended from another.
 - c. cantilevered construction.
 - d. presence of prestressed or post-tensioned elements.
 - e. effects of soils, water, lateral pressures on retaining or foundations walls.



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- f. presence of hazardous materials.
 - v. Contact municipal authorities or utility companies for assistance in locating and marking services passing under, through, overhead or adjacent to structure to be demolished. Such services without limitations include:
 - a. electrical power lines.
 - b. gas mains.
 - c. oil pipelines.
 - d. communication cables.
 - e. water mains.
 - f. drainage piping (storm and sanitary).
 - g. steam distribution.
 - 1. After determining demolition methods, determine area of possible vibration. Carefully inspect beyond those adjacent areas. List potential damage areas and photograph each for record purposes before starting work.

3.2 Protection:

- a. Do not interfere with use and activities of occupants where applicable and adjacent buildings. Maintain free and safe passage to and from buildings. Maintain integrity of existing fire exits.
- b. Protect existing adjacent work against damages which might occur from falling debris or other causes due to work of this Section.
- c. Provide, erect and maintain required hoarding, sidewalk sheds if applicable, catch platforms, lights and other protection around site before commencing work. Maintain such areas free of snow, ice, mud, water and debris. Lighting levels shall be equal to that prior to erection.
- d. Provide flagmen where necessary or appropriate to provide effective and safe access to site to vehicular traffic and protection to pedestrian traffic.
- e. Ensure scaffolds, ladders, equipment and other such equipments are not accessible to public. Protect with adequate fencing or remove and dismantle at end of each Day or when no longer required.



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- f. Do not interfere with use and activities of adjacent buildings. Maintain free and safe passage to and from buildings.
- g. Where necessary to seal fire exits of adjoining or adjacent buildings, provide other exits in compliance with applicable fire safety and building regulations.
- h. Where demolition operations prevent normal access to adjacent properties, provide and maintain suitable alternative access.
- i. If at any time safety of adjacent buildings appear to be endangered, cease operations and notify Consultant; take precautions to support buildings; do not resume operations until permission is granted by Consultant.
- j. If Consultant considers additional bracing and shoring necessary to safeguard and prevent such movement or settlement, install bracing or shoring upon Consultant's orders. Should Contractor fail to comply promptly with such request, such bracing or shoring may be placed by Consultant at Contractor's expense.
- k. Take precautions to guard against movement, settlement or collapse of adjacent services, sidewalks, driveways, or trees. Be liable for such movement, settlement or collapse caused by failure to take necessary precautions. Repair promptly such damage when ordered.
- l. Erect and maintain partitions as required to prevent spread of dust, fumes and smoke to other parts of building. Maintain fire exits from site. On completion, remove partitions and Make Good surfaces to match adjacent surfaces of building.

3.3 Restrictions:

Restrict demolition activities between hours of 7:30 a.m. and 5:00 p.m., Monday through Friday. Special permission for after hour may be obtained from Owner / Authorities.

3.4 Existing Services:

- a. Notify Local City Government to cut-off, remove and cap Municipal services. Verify services are cut off and properly capped before commencing associated or effected demolition. Cap and cover catch basins outside the building during the work of this Section. Do not allow demolition debris into the drains.
- b. Provide and maintain temporary services required during demolition to satisfaction of authorities having jurisdiction, fire departments and utility companies.



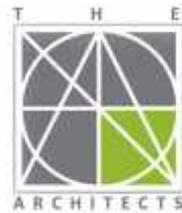
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DEMOLITION & REMOVAL

- c. Verify prior to commencement work of this Section that disconnection and capping of mechanical services have been carried out under Division 15 in accordance with requirements of local authority having jurisdiction. Make sure Natural gas supply lines are being removed by Gas Company or by qualified tradesman in accordance with Gas Company instructions. Removal and disposal of other existing underground services and mechanical equipment shall be by Division 15.
- d. Before commencing demolition, contact Electrical Department of local authority and tour site with them. Disconnect and seal electrical power lines and communications cables entering buildings to be demolished. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- e. In event of unexpected discovery of buried fuel or other tanks, do no further work and immediately report discovery, orally and in writing to Consultant. Consultant will authorize remedial work, if any, in writing. Do such remedial work, as addition to Contract.
- f. Remove electrical equipment scheduled for removal on Drawings and as required by Work.
- g. Remove sewer and water lines to extent indicated on Drawing and cap to prevent leakage.

3.5 PERFORMANCE

- a. Demolition action plans may indicate only general scope of work to be demolished and removed. It is Contractor's sole responsibility to determine exact extent of demolition required. Contractor may not rely solely on Drawings to limit scope of selective demolition work required. Review site conditions and assess exact scope of demolition and removal.
- b. Examine and review existing conditions prior to starting demolition. Initially perform demolition only in selected and designated test areas prior to proceeding full scale demolition work. Obtain approval on technique of demolition in test areas from Consultant. Only after approval, proceed in other areas.
- c. Materials and debris shall not be stacked in building to extent that overloading of any part of structure will occur.
- d. At end of each Day's work leave work in safe condition ensuring no parts of structure are in danger of collapsing.



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- e. Demolition:
- f. Ensure demolition work is supervised by licensed structural Consultant at all times.
- g. Do not create falling materials hazard.
- h. Remove all mechanical and electrical items indicated to be removed.
- i. Keep work wetted down to minimize dust.
- j. Minimize noise. Avoid use of noisy machinery outside working hours.

3.6 Building Services:

- a. Arrange with Owner to disconnect existing building services. Cut-off and cap existing building services under Owner's supervision. Provide caps to abandoned services.
- b. Prevent demolition debris from entering building drains.
- c. All items indicated on Drawings or designated on site by Consultant, materials forming permanent part of structure being demolished shall become property of this Section. Remove from site.

3.7 DISPOSAL OF WASTE MATERIALS

- a. Clear away dirt, rubbish and loose litter resulting from work of this Section, minimum daily. Keep dust to a minimum. When necessary and practical demolition works shall be sprayed periodically with water to reduce dust. Wet down debris from time to time to control dust. Maintain roadways, lanes and street sidewalks in the vicinity of the premises safe and clear.
- b. Selling or burning of materials on site is not permitted.
- c. Conform to requirements of municipality's Works Department regarding disposal of waste materials.
- d. Materials prohibited from municipality waste management facilities shall be removed from site and dispose of at recycling companies specializing in recyclable materials.
- e. Excavated material including contaminated excavated material shall be removed from site and dispose of to requirements of authorities having jurisdiction without any additional cost to Owner.



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- f. Any additional materials prohibited from waste management facilities shall be removed from site and dispose of to requirements of authorities having jurisdiction without any additional cost to Owner.

END OF DOCUMENT



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SECTION 17 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. General provisions of the Contract, including Conditions of Contract apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Preparing and grading sub-grades for slabs-on-grade and pavements.
 2. Preparing sub-grades for roadways and vehicular pavements.
 3. Excavating and backfilling for buildings and structures.
 4. Excavating and backfilling for roadways and vehicular pavements.
 5. Drainage and moisture-control fill course for slabs-on-grade.
 6. Subsurface drainage backfill for walls and trenches.
 7. Excavating and backfilling trenches and pits within building lines.
 8. Excavating and backfilling trenches and pits for buried mechanical and electrical utilities and appurtenances.
 9. Excavation support and protection not otherwise provided for in other Sections of the Specification.
- B. Related Sections include the following:
1. Division 2 Section "Dewatering" for lowering and disposing of ground water during construction.
 2. Division 2 Section "Aggregate Sub-base" for sub-base to roadways and vehicular pavements.
 3. Division 2 Section "Aggregate Base Course" for base course to roadways and vehicular pavements.
 4. Division 2 Section "Bituminous Concrete Pavement" for areas to be paved with asphalt.

1.3 DEFINITIONS

- A. **Excavation:** consists of the removal of material encountered to sub-grade elevations and the reuse or disposal of materials removed.
- B. **Backfill:** Soil materials used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.



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2. Final Backfill: Backfill placed over initial backfill to fill a trench.

- C. **Borrow:** Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. **Drainage Blanket:** Course of washed granular material placed to cut off upward capillary flow of pore water.
- E. **Unauthorized Excavation:** Unauthorized excavation consists of removing materials beyond indicated sub grade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, will be at the Contractor's expense.
- F. **Structures:** Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- G. **Utilities:** Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.
- H. **Bedding Course:** Layer placed over the excavated sub-grade in a trench before laying pipe.
- I. **Capillary Water Barrier:** Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- J. **Fill:** Soil materials used to raise existing grades generally.
- K. **Sub-grade:** Surface or elevation remaining after completing excavation, or top surface of a fill or backfill or sub grade layer, immediately below sub base, drainage fill, slab-on-grade, or topsoil materials.

1.4 SUBMITTALS

- A. **Pre-construction Records:** Before an excavation is started:
 - 1. Ground levels shall be agreed at suitable intervals with the Engineer.
 - 2. Surface materials and conditions shall be recorded in presence of the Engineer and where appropriate, the Employer or occupiers of the land.
 - 3. The Contractor shall take photographs to illustrate existing damage or conditions, which may prove contentious at the time of reinstatement.
 - 4. This information shall be neatly presented and submitted to the Engineer.
- B. Any significant details of any existing natural or piped subsoil drainage or other underground features shall be identified to the Engineer as work proceeds.
- C. For excavations for pipelines or lengthy conduit installations, trial excavations shall be carried out along the route of pipeline/underground conduit for location of all existing services and findings shall be presented on drawings with location, type



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and levels. All services shall be included in final drawings. The excavations shall not be backfilled without approval.

- D. **Temporary Support System:** Design of temporary support system, where required.
- E. **Product Data:** For the following:
1. Each type of plastic warning tape.
 2. Drainage fabric.
 3. Separation fabric.
- F. **Samples:** For the following:
1. 50 kg samples sealed in airtight containers, of each proposed soil material from on-site or borrow sources.
 2. 300 mm x 300 mm sample of drainage fabric.
 3. 300 mm x 300 mm sample of separation fabric.
- G. **Material Test Reports:** From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for backfill, fill, embankment and sub grade layer.
 2. Laboratory compaction curve according to ASTM D 1557 (Modified Proctor) for each on-site or borrow soil material proposed for backfill, fill, embankment and sub grade layer.
- 1.5 QUALITY ASSURANCE**
- A. **Geotechnical Testing Agency Qualifications:** An independent testing agency acceptable to the Engineer and qualified according to ASTM E 329 to conduct soil materials testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. **Pre-excavation Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Coordination."
- 1.6 PROJECT CONDITIONS**
- A. **Existing Utilities:** Survey to determine locations, sizes, and types of such utilities within construction areas in advance of disturbing them. Provide proper safeguard, support and protection from construction activities. Do not interrupt existing utilities serving facilities occupied by the Employer or others except when permitted in writing by the Engineer and then only after acceptable temporary utility services have been provided.
1. Provide a minimum 48-hours' notice to the Engineer and receive written notice to proceed before interrupting any utility.



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- B. **Traffic Control:** Maintain access for vehicular and pedestrian traffic as required for other construction activities in the area and as discussed/directed by the Engineer.
- C. Demolish and completely remove from site existing underground piping, conduit, manholes, and other utilities within the limits of excavations, which are indicated to be abandoned, and plug open ends with concrete.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. **General:** Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. **Satisfactory Soils:** ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 75 mm in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. **Unsatisfactory Soils:** ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. **Backfill and Fill:** Satisfactory soil materials.
- E. **Sub grade Layer:** Satisfactory roadway soil materials, but conforming with the following requirements:
1. Size: 100 percent passing a 75 mm sieve and not more than 18 percent passing a 0.075 mm sieve.
 2. Organic Matter: Not more than 5 percent; AASHTO T 267.
 3. Maximum Dry Density: Not less than 1.7; AASHTO T 180.
 4. CBR: Not less than 15 percent; AASHTO T 193.
 5. Maximum Plasticity Index: 12 percent.
 6. The top 150 mm sub grade material should not contain more than 0.2% total sulphate content and 0.05% total chloride content.
- F. **Controlled Fill:** Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; AASHTO M 57; with at least 90 percent passing a 38 mm sieve and not more than 12 percent passing a 0.075 mm sieve.
- G. **Bedding:** Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 25 mm sieve and not more than 8 percent passing a 0.075 mm sieve.



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- H. **Drainage Fill:** Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 38 mm sieve and 0 to 5 percent passing a 2.36 mm sieve.
- I. **Filter Material:** Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 25 mm sieve and 0 to 5 percent passing a 4.75 mm sieve.

2.2 ACCESSORIES

- A. **Warning Tape:** Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities and as per DEWA standard, 150 mm wide and 0.1 mm thick, continuously inscribed with a description of the utility; colored as follows:
- B. **Detectable Warning Tape:** Acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities and as per local authority guidelines, minimum 150 mm wide and 0.1 mm thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 750 mm deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
- C. **Drainage Geocomposite:** composed of a drainage geonet core with nonwoven geotextile bonded to both sides of the geonet core. The geotextile shall only be heat bonded to the geonet core; no other means of bonding shall be used. The polymer used to manufacture the geonet core shall be high density polyethylene. Manufacturer shall certify that the geonet is manufactured from first quality virgin polymer and no regrind material is used in the geonet manufacturing process. The nonwoven geotextile shall be made from needle punched or heat-bonded polypropylene or polyester staple or continuous fiber. Alternative to these materials and manufacturing processes may be approved by the Engineer. Conformance to the following properties shall be according to ASTM D 4759 and referenced standard test methods:

Geonet

Thickness (Min): 0.635 cm; ASTM D 5199

Tensile Strength (Min): 5.8 kN/m; ASTM D 4595

Density (Min): 0.94 g/cm³, ASTM D 1505



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Melt Flow Index (Max): D 1238 g/10 min 1.0; ASTM D 1238

Carbon Black Content (range): 2 -3 %; ASTM D 1603

Geotextile

1. Grab Tensile Strength (Min): 712 N; ASTM D 4632.
2. Tear Strength (Min): 266 N; ASTM D 4533.
3. Puncture Resistance (Min): 266 N; ASTM D 4833.
4. Apparent Opening Size (Max): 0.21 mm; ASTM D 4751.

Geocomposite

Ply Adhesion (Min): 90 g/cm; ASTM D7005

Transmissivity (Min): 1.0E-03 m²/sec; ASTM D4716. Transmissivity is measured after 100 hours seating period with boundary conditions: Ottawa Sand/ GDL/ Geomembrane/ Steel Plate at a hydraulic gradient of 0.33 and normal stress of 50 kPa.

- D. Separation Fabric Nonwoven geotextile made from needle punched or heat-bonded polypropylene or polyester staple or continuous fiber. Alternative to these materials and manufacturing processes may be approved by the Engineer. Conformance to the following properties shall be according to ASTM D 4759 and referenced standard test methods:
1. Grab Tensile Strength (Min): 890 N; ASTM D 4632.
 2. Tear Strength (Min): 355 N; ASTM D 4533.
 3. Puncture Resistance (Min): 355 N; ASTM D 4833.
 4. Apparent Opening Size (Max): 0.18 mm; ASTM D 4751.

2.3 EXCAVATION SUPPORT AND PROTECTION SYSTEMS

- A. Materials need not be new, but must be suitable and fit for purpose, in serviceable condition and acceptable to the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Shore, support and protect buildings, structures, utilities, sidewalks, pavements, and other facilities, on or adjacent to the Project site, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect sub grades and foundation soils. Provide protective insulating materials as necessary.



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- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared sub grades, and from flooding Project site and surrounding area.
- B. Protect sub grades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep sub grades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXCAVATION SUPPORT AND PROTECTION

- A. Design, provide, install, monitor, and maintain at the Contractor's sole risk and responsibility, excavation support and protection systems capable of resisting soil and hydrostatic pressure and supporting sidewalls of excavations.
1. Work includes removing when no longer needed.
 2. Install and remove without damaging existing structures, utilities, pavements, and other facilities adjacent to excavations.
- B. Install excavation support and protection systems as excavation works proceed, in a manner acceptable to the Engineer.
1. Locate clear of permanent construction to permit access for subsequent construction operations and inspections.
 2. Trim excavation as required and fill voids behind with soil, and compact.
- C. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure excavation support and protection remains stable.
- D. Remove excavation support and protection systems when construction has progressed sufficiently. Remove in stages to avoid disturbing underlying soils and damaging adjacent structures, utilities, pavements and other facilities.
- E. Promptly repair or replace as directed and approved by the Engineer, adjacent work, structures, utilities, pavements and other facilities, damaged or displaced by installing or removing excavation support and protection systems.



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3.4 EXCAVATION, GENERAL

- A. **Unclassified Excavation:** Excavation to sub grade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, boulders, and obstructions.
1. If excavated materials intended for backfill, fill, embankment, or sub grade layer include unsatisfactory soil materials and rock, replace with satisfactory soil materials, as applicable.
 2. Excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other encountered items indicated or directed to be removed; together with other materials not classified as unauthorized excavation; including intermittent drilling, blasting if permitted, ram hammering, ripping and other acceptable means and methods.
 3. Excavation includes removal and disposal of unsatisfactory soils and any surplus satisfactory soils.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm. Extend excavations a sufficient distance from permanent structures for working space requirements. Place blinding concrete, where indicated, immediately after excavating to final grades.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement or concrete. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 25 mm. Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR PAVEMENTS AND SITE IMPROVEMENTS

- A. Excavate surfaces under roadways, parking lots, walks, pedestrian pavements, lawns, planted areas and the like, to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

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



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1. Set out trenches so that they do not encroach below a line drawn at an angle, from the horizontal of the nearest lower edge of any adjacent building foundation, as follows:
 - a. In Dry Stable Soils: 45 degrees.
 - b. In Wet Clays, or Soils Below Water Table: 30 degrees.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 300 mm higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 300 mm on each side of pipe or conduit, unless otherwise indicated.
- C. **Trench Bottoms:** Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape sub grade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench sub grade.
 1. For pipes and conduit less than 150 mm in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed sub grade.
 2. For pipes and conduit 150 mm or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 3. Excavate trenches 150 mm deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. **Trench Bottoms:** Excavate trenches 100 mm deeper than bottom of pipe elevation to allow for bedding course. Remove projecting stones and sharp objects along trench sub grade. Hand excavate for bell of pipe.
 1. Excavate trenches 150 mm deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 APPROVAL OF SUBGRADE

- A. Notify the Engineer when excavations have reached required sub-grade.
- B. If the Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill, fill or sub-grade layer material as applicable, and as directed.
 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof rolls expansive sub-grade areas with heavy pneumatic tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated sub-grades.



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- D. Reconstruct sub-grades damaged by rain, accumulated water, or construction activities, as directed by the Engineer.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by the Engineer.
1. Fill unauthorized excavations under other construction or utility pipe as directed by the Engineer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrows materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
1. Construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for record documents.
 3. Inspecting and testing underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 450 mm of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Provide 100 mm thick, concrete-base slab support for piping or conduit less than 750 mm below surface of roadways and vehicular pavements. After installing and testing, completely encase piping or conduit in a minimum of 100 mm of concrete before backfilling.
- D. Place and compact initial backfill of satisfactory soil material, free of particles larger than 25 mm, to a height of 300 mm over the utility pipe or conduit.



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1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final sub grade.
- H. Install warning tape directly above utilities, 300 mm below finished grade, except 150 mm below sub grade under pavements and slabs.

3.13 FILL AND EMBANKMENT

- A. **Preparation:** Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fill and embankment material.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill and embankment material will bond with existing material.
- C. Place and compact fill and embankment material in layers to required elevations as follows:
 1. Under footings and foundations, use controlled fill.
 2. Under building slabs, ramps and steps, use controlled fill.
 3. Under roadways and vehicular pavements, use embankment material.
 4. Under walks and pedestrian pavements, use satisfactory soil material.
 5. Under lawns and planted areas, use satisfactory soil material.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate sub grade and each subsequent backfill, fill or embankment layer before compaction to within 2 percent of optimum moisture content.
 1. Do not place backfill, fill or embankment material on surfaces that are muddy.
 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry density.

3.15 COMPACTION OF BACKFILLS, FILLS AND EMBANKMENT

- A. Place soil materials in layers not more than 200 mm in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm in loose depth for material compacted by hand-operated tampers.
- B. Place soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.



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- C. Compact backfills and fills to not less than the following percentages of maximum dry density according to ASTM D 1557:
- D. Compact backfills and fills to not less than the following percentages of maximum dry density according to ASTM D 698:
 - 1. Under structures, building slabs, ramps and steps, scarify and recompact top 300 mm of existing sub grade and each layer of backfill or fill material at 100 per cent.
 - 2. Under walks and pedestrian pavements, scarify and recompact top 150 mm below sub grade and compact each layer of backfill or fill material at 100 per cent.
 - 3. Under lawns or unpaved areas, scarify and recompact top 150 mm below sub grade and compact each layer of backfill or fill material at 85 per cent.

3.16 GRADING

- A. **General:** Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. **Site Grading:** Slope grades to direct water away from buildings and to prevent ponding. Finish sub grades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 25 mm.
 - 2. Walks and Pedestrian Pavements: Plus or minus 25 mm.
 - 3. Roadways and Vehicular Pavements: Plus or minus 25 mm.
- C. **Grading inside Building Lines:** Finish sub grade to a tolerance of 13 mm when tested with a 3 m straightedge.

3.17 SUBSURFACE DRAINAGE

- B. **Subsurface Drain:** Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a 150 mm course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 300 mm of filter material and wrap in drainage fabric, overlapping sides and ends at least 150 mm.
 - 1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 1557.
- C. **Drainage Backfill:** Place and compact filter material over subsurface drain, in width indicated, to within 300 mm of final sub grade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 150 mm.



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1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 1557.
2. Place and compact impervious fill material over drainage backfill to final sub grade.

3.18 DRAINAGE COURSE

- A. Under slabs-on-grade, install drainage fabric on prepared sub grade according to manufacturer's written instructions, overlapping sides and ends. Place drainage course on drainage fabric and as follows:
- B. Under slabs-on-grade, place drainage course on prepared sub grade and as follows:
 1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry density according to ASTM D 1557
 2. When compacted thickness of drainage course is 150 mm or less, place materials in a single layer.
 3. When compacted thickness of drainage course exceeds 150 mm, place materials in equal layers, with no layer more than 150 mm thick or less than 75 mm thick when compacted.

3.19 FIELD QUALITY CONTROL

- A. **Testing Agency:** Engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test sub grades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. **Foundation and Footing Sub grades:** At foundation and footing sub grades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing sub grades may be based on a visual comparison of sub grade with tested sub grade when approved by the Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 698, ASTM D 1556, ASTM D 1557, ASTM D 2167, ASTM D 2922, ASTM D 2937, ASTM D 4429, and AASHTO T 180, as applicable. Tests will be performed at the following locations and frequencies:
 1. **Paved and Building Slab Areas:** At sub grade and at each compacted fill and embankment layer, at least one test for every 200 sq. m or less of each type of paved area or building slab, but in no case fewer than three tests.
 2. **Foundation Wall Backfill:** At each compacted backfill layer, at least one test for each 30 m or less of wall length, but no fewer than two tests.



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EARTHWORK

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 50 m or less of trench length, but no fewer than two tests.
- E. When testing agency reports that backfills, fills, sub grades, or embankments have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace with satisfactory soil to depth required; recompact and retest until specified compaction is obtained.
- 3.20 PROTECTION**
- A. **Protecting Graded Areas:** Protect newly graded areas from traffic, and erosion. Keep free of trash and debris.
 - B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by the Engineer; reshape and recompact.
 - C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.
- 3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS**
- A. **Disposal:**
 - a. Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and dispose of at designated spoil areas on the Employer's property shall be disposed outside the site premises to any lead and lift or as directed by the Engineer.
 - b. Transport surplus satisfactory soil to designated storage areas on Employer's property. Stockpile or spread soil as directed by the Engineer.

END OF DOCUMENT



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TERMITE CONTROL

SECTION 18 - TERMITE CONTROL

PART 1 – GENERAL

A. General provisions of the Contract, including Conditions of Contract apply to this Section.

1.1 SUMMARY

A. This Section includes the following for termite control:

1. Termite prevention
2. Soil treatment
3. Wood protection

1.2 TERMITE PREVENTION

- A. Avoid creation of conditions that invite termites wherever possible. Take the following measures:
1. Remove stumps, roots, wood, and other cellulose materials from the building site before commencing construction.
 2. Remove cellulose materials from around the foundation before final backfill.
 3. Promptly remove form boards and grade stakes used in construction from site.
 4. Allow no contact between building woodwork and soil or fill material.
 - a. Locate exterior woodwork a minimum of 15 cm above ground and beams in crawl spaces at least 45 cm above ground to provide ample space to make future inspections.
 - b. Make foundation areas accessible for inspection if possible.
 - c. If wood that contacts the soil, such as fence posts and foundation elements, use pressure treated wood.
 5. Design ventilation openings in foundations to prevent dead air pockets and to help keep the ground dry.
 6. Direct water away from the structure through proper grading.
 7. Assure that the roof drainage system directs all water away from the foundation.
 8. Avoid plantings near the foundation. Any tree that has the potential to grow to a height of 12 meters or taller shall not be planted within 15 meters of the foundation.



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1.3 DEFINITIONS

- A. EPA: United States Environmental Protection Agency.
- B. PMP: Pest Management Professional

1.4 SUBMITTALS

- A. Product Data: For termiticide and borate.
 - 1. Include the EPA-Registered Label for termiticide and borate products.
- B. Product Certificates: For termite control products, signed by product manufacturer.
- C. Qualification Data: For Installer of termite control products.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.
- E. Wood Treatment Application Report: After application of borate is completed, submit report for Owner's record information, including the following:
 - 1. Date and time of application.
 - 2. Brand name and manufacturer of borate.
 - 3. Quantity of undiluted borate used.
 - 4. Dilutions, methods, volumes, and rates of application used.
 - 5. Areas of application.
- F. Warranty: Special warranty specified in this Section.



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TERMITE CONTROL

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A PMP who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this
Project and whose work has a record of successful in-service performance.
- B. Regulatory Requirements: Formulate and apply termiticide, and label with a US EPA registration number, to comply with EPA regulations and authorities having jurisdiction.
- C. Document any applicable local codes or authorities and ensure that all relevant work is in compliance.
- D. Implement applicable provisions of the Quality Control program as established in Section "Contractor Quality Control."

1.6 PROJECT CONDITIONS

TERMITE CONTROL SECTION -18

Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction

1.8 WARRANTY

- A. Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, retreat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: Five years from date of Substantial Completion.



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TERMITE CONTROL

PART 2 – PRODUCTS

2.1 TERMITICIDES

- A. Soil Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or amusable, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by the COR.
1. The Department of State currently authorizes Termidor and Premise as soil termiticide.
 2. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.
- B. Wood Protection Termiticide:
1. Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by COR.
 2. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.

END OF DOCUMENT



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CONCRETE TOPPING

SECTION 19

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract.

1.02 SUMMARY

- A. This Section includes standard aggregate concrete floor toppings applied over previously placed base slabs.

1.03 SUBMITTALS

- A. Furnish product data, samples laboratory test reports, and materials certificates as per Engineer instructions. Allow fourteen (14) days for Engineer review.

PART 2 -PRODUCTS

2.01 CEMENT AND AGGREGATES

- A. Portland Cement: ASTM C 150, Type I.
- B. Normal Weight Aggregate: ASTM C 33: Fine aggregate, consisting of sand or crushed stone screenings, clean hard, free of deleterious matter.

2.02 TOPPING MIX

- A. Standard Topping: Design mix to produce topping material with the following characteristics:
 - 1 Compressive strength: 3500 psi at 28 days.
 - 2 Slump: 200mm maximum at point of placement for concrete containing high-range water-reducing admixture (super-plasticizer) and 75mm maximum for other concrete.
 - 3 Maximum W/C ratio: 0.51.



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2.03 MIXING

- A. Provide batches type mechanical mixer for mixing topping material at Project site. Equip batch mixer with a suitable charging hopper, water storage tank, and a water-measuring device. Use only mixers that are capable of mixing aggregates, cement, and water into a uniform mix within specified time, and of discharging mix without segregation.
- B. Mix each batch of 2 cu. m or less for at least 1-1/2 minutes after ingredients are in mixer. Increase mixing time 15 seconds for each additional cu. m or fraction thereof.
 - 1. Ready-mixed topping may be used complying with requirements of ASTM C 94.

PART 3 -EXECUTION

3.01 CONDITION OF SURFACES

- A. **Topping Applied to Fresh Concrete:** Do not begin placement of topping until water ceases to rise to surface, and water and laitance have been removed from base slab surface.
 - 1. When base slab surface is unacceptable for good bonding, roughen surface by chipping or scarifying before cleaning. Prior to placing topping mixture, thoroughly dampened slab surface but do not leave standing water. Over dampened surface apply good quality bonding compound as approved by the Architect or epoxy adhesive. Place topping mix after bonding compound has dried or epoxy adhesive is still tacky.
- B. **Joints:** Mark locations of joints in base slab that joints in top course will be paced directly over them.

3.02 PLACING AND FINISHING

- A. **Trowel Finish:** After floating, begin first trowel finish operation using power driven trowels. Continue troweling until surface is ready to receive final troweling, begin final troweling when a ringing sound is produced as trowel is moved over surface.



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- B. Continue final trowel operation to produce finished surface free of trowel marks, uniform in texture and appearance, and achieving and F/F of 25 and F/L of 20 tolerances when tested in accordance with ASTM E 1155.
- C. Where joints are required, construct to match and coincided with joints in base slab. Provide other joints as shown.

3.03 CURING AND PROTECTION

- A. Cure and protect topping applications and finishes as specified in Section "26 Concrete"

3.04 PERFORMANCES

- A. Failure of concrete topping to bond to substrate (as evidenced by a hollow sound when tapped), or disintegration or other failure of topping to perform as a floor finish, will be considered failure of materials and workmanship. Repair or replace toppings in areas of such failures, as directed.

3.05 MATERIAL

A non-toxic solvent free high build, protective epoxy resin coating.

A. Primary Uses:

For the internal protection of concrete.

As an impervious, resilient and chemically resistant floor.

As a protective and decorative coating in the project.

- B. Appearance and finish: The material should be High, gloss, heavy bodied, ultra dense surface. Hygienic and easily cleaned. Standard colours should be light and dark grey.

D. It must have the following Advantages

Durable

Non-toxic

Waterproof and protective



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High chemical resistance

Solvent free

Easily applied by brush or roller.

E. Typical properties

<i>Pot life at 30°C</i>	<i>30 minutes</i>
<i>Mixed density</i>	<i>1.6gm/cm² at 25°C</i>
<i>Track free time</i>	<i>Approx. 4 hours at 35°C</i>
<i>Initial cure:</i>	<i>12 hours at 30°C</i>
<i>Final cure:</i>	<i>4 days at 30°C</i>
<i>Coverage:</i>	<i>0.29 - 0.40kg /m² /coat</i>
<i>Finish film thickness:</i>	<i>180 - 240 microns per coats</i>
<i>Bond to concrete</i>	<i>In excess of the cohesive strength of concrete</i>

F. The Product must be Approve by Engineer. Water Researched Approval for use with Potable Water.

G. Application Procedure:

1. Surface preparation: The substrate should be a smooth or semi-smooth sound surface such as concrete or metal. It is most important to ensure that thorough surface preparation is undertaken prior to application of the protective epoxy resin coating.

a. *Concrete:*

Ensure concrete is free from excessive laitance, grease, oil, curing compound, etc. Ensure concrete is sound, cutting back where necessary and making using good protective epoxy resin compound. Ensure all blow holes and surface imperfections are



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made good prior to the application.

MASTERSEAL 180 coating.

Ensure concrete is at least 28 days old. Contamination by oil, grease, fats etc. must be removed before other forms of preparation begin. Remove laitance to expose blow holes, by light grit blasting.

b. Steel:

All previous surface treatment should be removed taking the surface back to base metal. The base metal should be abraded and preferably shot blasted with grit, steel shot or propriety abrasive. Where shot blasting is impractical pre-treatment may be carried out with pneumatic de-scaling guns, tap hammers, rotary wire brushes or by flame scaling.

c. Mixing:

MASTERSEAL 180 is supplied in two pre-weighed components, base and reactor, or use any other material approved by the Architect. No additions or omissions are required. Add reactor contents to the base component and mix thoroughly for using a slow speed drill fitted with a suitable mixing paddle until a uniform streak free colour is achieved.

- H. Application: MASTERSEAL 180 (or any other good quality material approved by the Architect) coating should be applied using good quality rollers or short haired brushes or by airless spray. It is recommended that MASTERSEAL 180 coating be applied in two coats of contrasting colours to ensure complete coverage.

Prior to the application of each coat the surface should be examined for signs of pin-holing, etc. Where pin-holing is evident these should be filled using CONGRESIVE 2200 thixotropic epoxy resin filler, or equivalent as approved by the Architect.

If the application is delayed more than 16 hours at 40°C or 36 hours at 20°C after the previous coat (the higher the ambient temperature, the shorter the maximum period), then the previous coat must be thoroughly abraded to give an adequate mechanical key and solvent wiped.

1. Airless Spray:

For application by airless spray, use a 45.1 or higher ratio pump, minimum



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9mm dia hoses and HD tip 19-23 thou.

2. *Over coating:*

Where areas need to be over coated due to damage etc. it is important that the areas to be treated are well abraded using a stiff rotary wire brush or coarse sand paper to give an adequate key. Completely strip off any unsound coating and proceed with over coating as for new work.

I. Chemical resistance MASTERSEAL 180 or other material (approved by the Architect) should be resistant to the following typically encountered chemicals:-

- a. Formaldehyde, 40% solution
- b. Sulphuric Acid, 50% solution
- c. Hydrochloric Acid, 50% solution
- d. Lactic Acid, 50% solution
- e. Nitric Acid, 10% solution
- f. Sodium Hydroxide, 50% solution
- g. Diesel oil ♦ Wine
- h. Sea and brackish water
- i. Aviation hydraulic fuels (Skydrol)
- j. Vegetable oils

J. Specification Clause MASTERSEAL 180: Where indicated, apply MASTERSEAL 180 protective epoxy coating as manufactured by MBT or similar approved to the following specification:

Composition: Two component, non-toxic, pigmented solvent less a epoxy resin based compound.

Coverage: 0.29 to 0.40kg/m²/coat, two coats are recommended.

Dry film thickness: 180 to 240 microns/coat.



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- K. Storage Store under cover out of direct sunlight and protect from extremes of temperature. In tropical climates the product must be stored in an air conditioned environment. Failure to comply with the recommended storage conditions may result in premature deterioration of the product or packaging. For specific storage advice consult the Architect.
- L. Safety Precautions As with all chemical products, care should be taken during use and storage to avoid contact with eyes, mouth, skin and foodstuffs. Treat splashes to eye and skin immediately. If accidentally ingested, seek immediate medical attention. Keep away from children and animals. Reseal containers after use. For further information, refer to material safety data sheet.

3.06 ACCEPTED MATERIALS

- A. TASKI H-16 (Pore Filter, Based on Acrylic Polymer)
- B. FOSROC FC-100
- C. MASTERSEAL 180
- D. Or Equal as Approved by the Architect.

3.07 SPECIAL NOTE

The hardener topping is carried out in 2 stages

- A. Stage 1: Apply powder based hardener as detailed in Clause 2 & 3.
- B. Stage 2: Apply dust proofing as detailed in Clause 3.05 / 3.06. The stage 1 & 2 are complimentary to each other.

END OF DOCUMENT



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CEMENT-BASED SCREED

SECTION 20 - CEMENT-BASED SCREED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes:
1. Standard aggregate concrete leveling floor screeds.
 2. Roof screeds necessary to provide roof slopes.
- B. Related Sections include the following:
1. Division 7 Section "Joints Sealants".
 2. Division 9 Section "Resinous Flooring".
 3. Division 9 Section "Ceramic Tiles".

1.3 DEFINITIONS

- A. **Screed:** A layer of cement-sand or concrete mix, with or without reinforcement, applied over structural floor or roof deck slab to achieve correct level and receive another finish material.

1.4 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Mix Design and Test Reports:** For each mix used for screeds.
- C. Joint details and arrangements.
- D. Test reports for field control testing.

1.5 QUALITY ASSURANCE

- A. Quality System: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.



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- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.7 PROJECT CONDITIONS

- A. **Environmental Limitations:** For proprietary products, comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting screed performance.
- B. Close areas to traffic during screed application and for appropriate time period after application as recommended in writing by the manufacturer.

1.8 COORDINATION

- A. Coordinate cement-based screed with requirements of finish flooring products, including adhesives, specified in Division 9 Sections.

PART 2 - PRODUCTS

2.1 SCREED MATERIALS

- A. **Cement:** ASTM C 150, Type I, ordinary Portland cement.
- B. **Normal-Weight Aggregate:** ASTM C 33 and as follows:
 1. Fine aggregate, consisting of sand or crushed stone screenings, clean, hard, free of deleterious matter. Grade according to approval design mix.
 2. Coarse aggregate, consisting of gravel or crushed stone, clean, hard, free of deleterious matter. Grade according to approval design mix.
- C. **Water:** Potable and at a temperature of not more than 21 deg. C.

2.2 REINFORCEMENT

- A. **Fibrous Reinforcement:** 100% virgin polypropylene, fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. Proportion shall be in accordance with the written manufacturer instructions of the manufacturer.
 1. Specific Gravity: 0.91.
 2. Tensile strength: 345 - 758 N/mm².
- B. **Galvanized Plain-Steel Welded Wire Fabric:** For screeds 70 mm deep and more is to be electrically welded, fabricated from galvanized steel wire into flat sheets, 150 x 150 mm mesh and 3.00 mm minimum wire diameter.

2.3 CURING MATERIALS

- A. **Absorptive Cover:** AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 305 g/sq. m when dry.
- B. **Water:** Potable.



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2.4 DESIGN MIXES

- A. Prepare design mixes for each type and strength of cement-based screed by either laboratory trial batch or field-test data methods. For trial batch method, use an approved qualified independent testing agency for preparing and reporting proposed mix designs.
- B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.
- C. Minimum Compressive Strength after 28 days is to be as follows:
 1. 220kg/cm² for screed with fine concrete mix (coarse aggregate of maximum size of 10 mm is used).
 2. 180 kg/cm² for cement-sand screeds.

2.5 RELATED MATERIALS

- A. **Joint-Filler Strips:** ASTM D 1752, cork or self-expanding cork.
- B. Water: Potable.
- C. **Acrylic-Bonding Agent:** ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. **Admixtures:** Admixtures certified by manufacturer to contain not more than 0.1 % water-soluble chloride ions by mass of cementitious material and compatible with other admixture and cementitious materials. Do not use admixtures containing calcium chloride.
- E. **Epoxy Adhesive:** ASTM C 881, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.6 MIXING

- A. **Bonding Slurry:** Mix 1 part Portland cement and 2 parts sand with water and an acrylic-bonding agent according to manufacturer's written instructions to a thick paint consistency.
- B. **Screed Mix:** Design mix, with or without admixture, to produce a mix with the following characteristics:
 1. Minimum Compressive Strength: As specified.
 2. Maximum Slump: 125 mm.
 3. Mix proportions: Submit proposed mix design for approval.
 4. Minimum Cement-Sand Ratio: Not less than 1:4 by volume.
 5. Maximum Water-Cement Ratio: 0.51.



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6. Mix screed materials, admixtures and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for conditions affecting performance of screed. Proceed with application only after unsatisfactory conditions have been corrected.
- B. Verify that base slabs meet finish and surface profile requirements in Division 3 Section "Cast-in-Place Concrete."

3.2 PREPARATION

- A. **Existing Concrete:** Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 6 mm.
 1. Prepare and clean existing base slabs according to topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
 2. Mechanically remove contaminants from existing concrete that might impair bond of topping.
- B. Install joint-filler strips where screed abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with screed surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips 13 mm below screed surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.3 SCREED APPLICATION

- A. **Fibrous Reinforcement:** For screeds of depth less than 70 mm, apply fibrous reinforcing as per manufacturer's written instructions.
- B. **Reinforcing Mesh:** Screeds 70 mm deep and more shall have a reinforcing layer at mid height. Reinforcement shall be as specified this Section. Place steel wire mesh with reinforcing wire parallel to longest dimension of screed bay. Cut mesh to fit around roof openings and projections. Terminate mesh at control joints. Lap sides and ends of mesh at least 150 mm.
- C. **Deferred Screed:** Mix and scrub bonding slurry into dampened concrete to a thickness of 1.5 to 3 mm, without puddling. Place screed while slurry is still tacky.
- D. Place screed continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.



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1. Screed surface with a straightedge and strike off to correct elevations.
 2. Slope surfaces uniformly where indicated.
 3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.
- E. **Finishing:** Consolidate surface with power-driven floats as soon as screed can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate screed by power-driven trowel so no blisters develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
 - a. Finish and measure surface so gap at any point between screed surface and an unlevelled freestanding 3 m long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 3 mm.
- F. **Construction Joints:** Construct joints true to line with faces perpendicular to surface plane of screed, at locations indicated or as approved by the Engineer.
1. Coat face of construction joint with epoxy adhesive at locations where screed is placed against hardened or partially hardened screed.
- G. **Contraction Joints:** Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3 mm wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before screed develops random contraction cracks.
1. Form joints in screed over contraction joints in base slabs, unless otherwise indicated.
 2. Construct contraction joints for a depth equal to one-half of screed thickness, but not less than 13 mm deep.
- H. **Screed Mix:** Use cement-sand mix for screeds less than 70 mm in depth. Use fine concrete mix for 70 mm deep and more.

3.4 PROTECTION AND CURING

- A. **General:** Protect freshly placed screed from premature drying and excessive cold or hot temperatures.
- B. Begin curing immediately after finishing screed. Cure by one or a combination of the following methods, according to screed manufacturer's written instructions:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with water or absorptive cover, water saturated and kept continuously



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wet. Cover screed surfaces and edges with 300 mm lap over adjacent absorptive covers.

3.5 REPAIRS

- A. **Defective Screed:** Repair and patch defective screed areas, including areas that have not bonded to concrete substrate.

3.6 FIELD QUALITY CONTROL

- A. **Sample Sets:** At point of placement, testing and inspecting agency shall take a set of 3 molded-cube samples from the screed mix for the first 90 sq. m plus 1 set of samples for each subsequent 450 sq. m of screed, or fraction thereof, but not less than 6 samples for each day's placement. Samples shall be tested according to ASTM C 109M for compliance with compressive strength requirements.

3.7 CLEANING AND PROTECTING

- A. Protect screeds from damage and wear during the remainder of construction period. Use protective methods and materials approved by the Engineer, including temporary covering.
- B. Clean screeds not more than 4 days before dates scheduled for inspections intended to install final finishes.

END OF DOCUMENT