General Guidelines on Pre-Defined Learning Outcomes for Civil Engineering Students Interning in Contractor Built Environment Firms

1. UNDERSTANDING INDUSTRY DOCUMENTATION/ DRAWING STANDARD
   - Interpret as-built drawings
   - Understand the functions of common BIM/CAD softwares (such as Xref, block tools, layer system and etc.)
   - Interpret the scale, dimension, text and annotation in civil engineering drawings
   - If other, please specify*

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2. COMMUNICATION SKILLS FOR WORK
   - Learn formal report writing
   - Learn business email writing
   - Make oral presentation to seniors / management / clients
   - If others, please specify*

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3. EXPOSURE TO CONCEPT DESIGN
   - Introduction to project brief and related concept design information
   - Introduction to client and user needs
   - Process of generating ideas and inspiration to build design scheme
   - Support preparation of design presentation drawings including 3D rendering, coloured plan and elevation plan
   - Support building of 3D models (e.g. using 3D printers) to demonstrate the design concept
   - If other, please specify*

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4. PRE-CONSTRUCTION STAGE

- Building Information Modelling (BIM)
  - Develop Building Information Modelling (BIM) for site planning at pre-construction stage to better understanding on site constraints and logistic planning as well as cost estimation
  - Review Architectural, Structural and Mechanical, Electrical and Plumbing (MEP) models
    - All disciplines-specific models have the same levels
    - All M&E penetration areas that might affected the structural and architectural model
    - How building elements are modelled
    - Compliance with building regulations
  - Compare fabrication models and design construction models
  - Identify the conflict and manage clashes which as followed:
    - Develop process in managing multiple clash test
    - Group similar issues together that affect specific types of issue to narrow down the most serious issues
  - Identify / highlight the design discrepancies
  - Identify / highlight the constructability issues
  - Preparing and reviewing shop drawings

- If other, please specify*

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- ❖ Integrated Digital Delivery(IDD)
  - Understand the concept and objectives of IDD
  - Understand the scope of IDD in digital design/digital manufacturing and fabrication/digital construction/digital asset delivery and management
  - Understand the roles and responsibilities of mechanical engineers in IDD
  - Understand the roles and responsibilities of team members from other disciplines in IDD
  - Carry out / support collaborative and coordinated design via BIM/Virtual Design & Construction (VDC) and other computation tools Understand how digital design tools help to optimise downstream process (manufacturing, fabrication, construction and maintenance)
  - If other, please specify*

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- ❖ Design for Manufacturing and Assembly (DfMA)
  - Understand the concept and objectives of DfMA
  - Understanding the DfMA continuum and different DfMA construction technologies from prefabricated components to fully-integrated assemblies such as Prefabricated Prefinished Volumetric Construction (PPVC)
    - ➢ Application of DfMA construction technologies to different types of developments Understand design considerations and limitations for different DfMA technologies
    - ➢ Identify the suitable types of DfMA modules to be considered and the choice of material (e.g. reinforced concrete PPVC module or Steel PPVC Module)
    - ➢ Perform / assist in analysis to assess structural integrity
    - ➢ Exposure to different joints and connections and their design principles for different DfMA technologies
    - ➢ Understand project management consideration in site planning (e.g. staging areas for hoisting machinery and modules) and construction sequencing
  - If other, please specify*

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5. CONSTRUCTION STAGE

- ❖ Construction and Measurement (Piling, basement excavation, geotechnical instrumentations)
  - Understand and observe the actual site condition
  - Observe different types of piling used at the site and their limitation
  - Understand the different types of vertical retaining walls systems used at the site and their limitations
  - Understand the function of other geotechnical instruments used a site such as piezometer, water standpipe, settlement markers, inclinometer and etc.
  - If other, please specify*

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- ❖ Geographic Information System (GIS) and Global Positioning System (GPS)

- Expose the following surveying aspects:-
    - Application of levelling in construction projects
    - Traverse survey
    - Operation of ArcGIS software
    - Preparation of topographical survey plans
    - Hands-on surveying instrument
    - Preparation of hydrographic survey
- If other, please specify*

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❖ Geotechnical Engineering
- Observe ground investigation practices such as rotary drilling, soil sampling and etc.
- Understand the laboratory testing of various soil properties
- Observe the soil compaction associated with road work
- Understand the simple footing and retaining wall design
- Inspect the stability of soil slopes
- If other, please specify*

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❖ Civil and Structural
- Perform structural calculation, site survey and site installation works
- Understand structure steel design
- Liaise with sub-contractors to ensure works carried out in accordance to tender specification
- Liaise with Consultants on technical issue and coordinate site issue with subcontractor
- Assist project manager in coordinating / executing certain scope of works
- Assist project manager in oversee the project, planning and ensure work is according to master plan
- If other, please specify*

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❖ Project Management
- Understand the role and responsibilities of different personnel (e.g. site supervisor, Resident Technical Officer, Resident Engineer, project manager from contractor firm etc) in the project team
- Understand the contract procurement method used in the project
- Assist project manager in coordinating / executing certain scope of works
- If other, please specify*

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6. FACILITY MANAGEMENT RELATED

❖ Design for Maintainability
- Understand the basic principles of design for maintainability
- Basic understanding on the different material properties especially properties related to durability and maintainability
- Assess the quality of construction materials

- Able to recommend selection of materials to minimize maintenance issue
- Understand the inter-dependability of structural design with other disciplines that may affect maintenance
- Life-span of common façade materials in Singapore
- Façade maintenance and technologies
- If other, please specify*

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