ภาคผนวก 14
เอกสารขั้นตอนการปฏิบัติงาน

ภาคผนวก 14-1

เอกสาร Open cut Procedure

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PTT PUBLIC COMPANY LIMITED

โครงการวางระบบจำหน่ายก๊าซธรรมชาติ ไปยัง

กลุ่มลูกค้าเขตส่งเสริมอุตสาหกรรมนวนคร จ.นครราชสีมา

DOCUMENT NO. : **MS-C-2202.02-6807-001**

DOCUMENT TITLE : **METHOD STATEMENT FOR OPEN CUT**

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TRC CONSTRUCTION PUBLIC COMPANY LIMITED
No. 8 Soi Sukhaphiban 5 Soi 32, Kwang Tha-rang, Bangkhen, Bangkok, 10220 Thailand
Tel. 0 2022 7777 ext. 4810 | Fax. 0 2022 7788

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1. PURPOSE

The purpose of this procedure is to describe the traditional pipeline construction method of open cut for โครงการวางท่อระบบจำหน่ายก๊าซธรรมชาติไปยังกลุ่มลูกค้าเขตส่งเสริมอุตสาหกรรมนวนคร จ.นครราชสีมา.

This method provides a construction method which is different from other special methods. The processes of pipeline open cut construction activities are especially emphasized in this procedure.

2. SCOPE

A pipeline is defined as underground pipeline system used in the transportation of natural gas pipeline. This method applies to all areas where pipeline construction is carried out with open cut method.

3. REFERENCE CODE

ASME B31.8	Gas transmission pipeline
API 1104	Welding of pipeline and relate facility

4. RESPONSIBILITY

The Construction Manager shall be responsible for ensuring that all construction activities to be preformed by trained, experienced employees in a manner acceptable to Project Specifications and Procedure requirement. He shall ensure that resources are adequate for the safe execution of the work and all works are subjected to JSA.

The HSE Manager is responsible for provision of trained and competent personal to monitor and assist with compliance by construction personal with approved Project procedures. He shall ensure the work to be performed in a safe manner and up to requirement of Project HSE procedures with adequate equipments and resources. He shall Conduct and assist in developing JSA of this part of pipeline construction.

The QA/QC Manager is responsible for provision of trained and competent personal to monitor and assist with compliance by construction personal with approved Project quality procedures.

The land liaison coordinator of Contractor is responsible for liaising with each affected landowner to ensure that landowner concerns are identified and managed proactively.

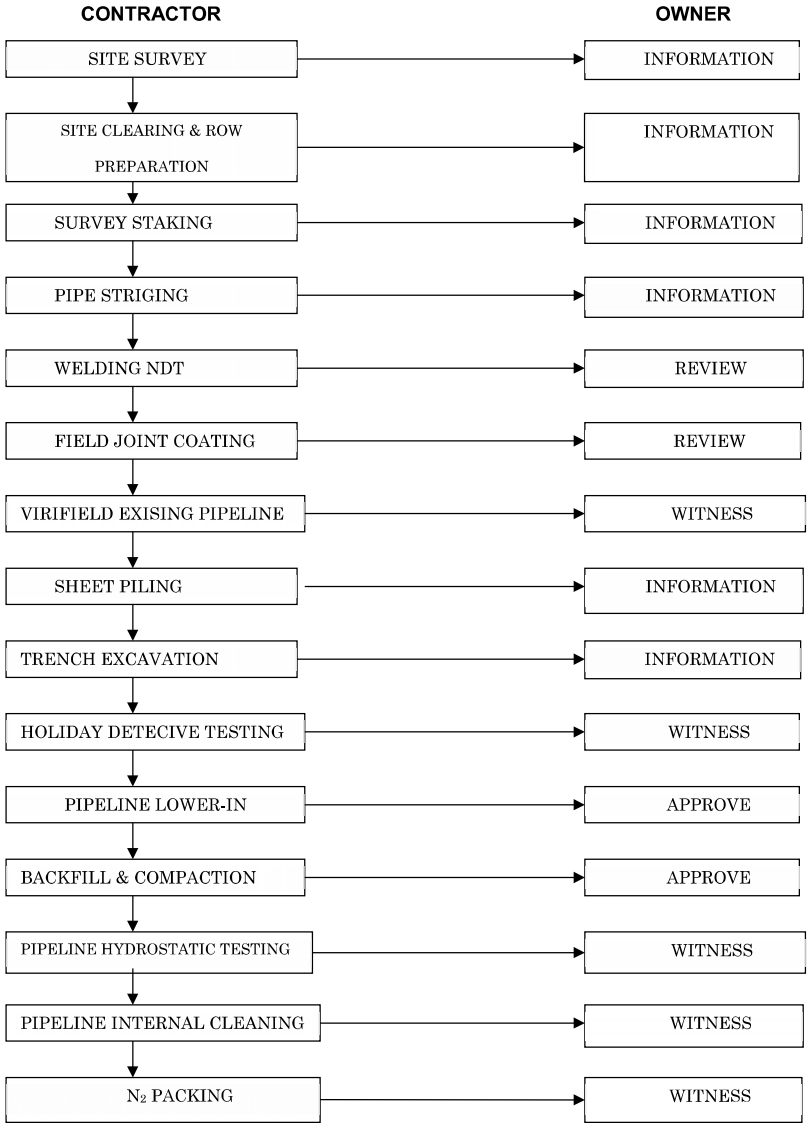
The Construction Superintendent shall be responsible for the day to day coordination and controlling construction activities in accordance with approved construction plan, project procedure and JSA.

He shall ensure that Foremen are properly briefed and resources are appropriate for the safe execution of the work.

Each Foreman shall be responsible for ensuring that the activities under his control are undertaken in a safe and competent way and in accordance with this method and JSA.

5. EXECUTION

5.1 Work Flow Chart



5.1.1 General

The right of way shall be prepared so as to enable safe and efficient use of the construction corridor with no impact for the existing pipeline and facilities and with minimal impact to the environment.

Prior to the start of work boundary and centerline pegging shall be established and existing utilities shall be identified and marked. Contractor will ensure that all permits have been obtained and Verification to locate the existing utilities shall be done prior excavation activity.

5.1.2 ROW Preparation

Topsoil stripping operations shall be performed in areas of excavated including borrow areas, trench excavations, ROW cut excavations, beneath temporary ROW fills (such as side slopes) and all areas where sub soils are stockpiled.

Where trench line grading is carried out the topsoil shall be stripped and preserved. All stripped topsoil shall be stockpiled and segregated from excavated subsoil to prevent contamination.

In some areas particularly subject to flooding and where access is difficult, the access along the right of way may need to be raised by using material excavated from the ditch or edges of the right of way to provide and all weather pads. After finish work elevation of soil shall be original condition.

5.1.3 Topsoil stripping

Stripping shall consisted of the excavation, removal, and stockpiling of topsoil in sufficient quantities to ensure the proper reinstatement of the ROW.

Stockpile Contractor shall be submit location to OWNER approved.

5.1.4 Trenching

Sheet piling shall be used to shore the trench before trenching over the depth elevation -3.5 m. from existing ground.

Trenching will be carried out using conventional excavators dependent on the condition of right of way which is subject to the season of access in the paddy field. It may be necessary to install temporary bunds around the trench to prevent water ingress from adjoining paddy areas.

Excavation permit shall be obtained by contractor prior to excavation commence. For all mechanical excavation a watchman shall be positioned on or near the facilities to direct the excavator operator in order to avoid all possibility of damage to the facilities.

The trench shall be excavated to permit installation of the pipe at specified depths. Contractor shall supply survey equipment and manpower required to provide survey control for the trenching operation. The trench profile shall be such that the pipe has uniform bearing on the trench bottom for its full length. The trench profile shall be approved by OWNER prior to the pipeline crossing section being installed. Where material excavated from the trench is unsuitable for use as backfill it shall be removed from the site and disposed of in a manner subject to OWNER approval.

The trench line will be location in according to the alignment sheet. The width of the trench will be not less than 0.5 meters. The depth of the trench will be minimum 1.5 m. from existing ground for inlet gas pipeline to Gate station and 1.2 m. from existing ground for outlet of Gate station.

Trenching may be performed either before or after the stringing, welding and field joint coating operations dependent on ground conditions, progress of welding and coating.

Trenching width and depth shall include allowances for bends, tie in requirements, and any additional extra width requirements such as test section termination and isolating joints.

Excavator will be used for digging pipeline trench. Care will be taken to ensure that top soil in not in mixed with sub soil. It is required that excavated soil intended to backfill the pipe trench is not mixed with foreign material and good soil condition is required for backfill. The excavated material will never be deposited over against the strung pipe. Excavated material will be stock nearby the trench or transfer to temporary stockyard area which permission has been approved by related authorities and / or LANDOWNER.

In rocky area requiring bottom padding, the depth of the ditch shall be sufficient to allow for full width padding.

Temporary access ladders will be installed for personnel access. Barricades or bunting and sign posting will be installed around the perimeter of the excavation of the warn persons of the danger and prevent access where possible.

5.2 Stringing

The pipe shall be placed on wooden or sand bags or sawdust bags in order to elevate the pipe from the ground surface, standing water, mud and in a secure position against movement due to rain or settlement.

All damage to the pipe or coating caused during Contractor handling transportation, stacking, storage and stringing shall be marked for rectification and repaired according to manufacturer recommend.

The coated pipe shall always be handled with lifting devices such as wide canvas slings or padded tongs to prevent damage to the pipe or coating. Bare cables or chains shall not be used.

When the coated pipe is transported, it shall be supported on suitably padded skids or cradles designed for low unit load-bearing pressure to prevent deformation of the pipe and damage to the coating. Bare or narrow skids shall not be used.

5.3 Line up Welding, NDT and Joint Coating

Contractor will align and welding pipeline to verify length which length shall be consider to suitable lifting equipment, site condition such as soil & surrounding construction area condition, and will be tied – in to a continuous pipeline in the trench. All pipeline fields welding shall be in accordance with Welding Procedure Specification (GTAW + SMAW PROCESS) and shall be approved by OWNER.

During inclement weather, suitable enclosures, wind or rain guards shall be provided to ensure the quality of the welding operation.

The Open ends of pipe shall be securely closed at the completion of each day's work using plastic or metal protective pipe caps or reusable night caps. The ends shall be opened only as the work resumes.

Each weld shall be identified by the welder by imprinting the welder's unique assigned identification number using weld marking paint on the pipe adjacent to the weld. Metal stamps shall not be used.

Appropriate precautions shall be exercised during construction to prevent dirt, grease, and other foreign material from entering the pipe sections being joined. These contaminants shall be removed before staring the weld joint.

Gamma-Ray will examine all welds, Radiography and film interpretation shall be in accordance with API 1104 and requirements of this procedure.

Following the non-destructive testing of the welds and repair of any defects, the weld margins will be coated by the application of field joint coating.

5.4 Lowering-in

During the lowering operation, special care shall be taken to ensure the pipe coating sustains no damage and that pipe string fits the contour of the trench and is not laid in a stressed condition.

During lowering-in the entire length of 3LPE coating pipe shall be inspected with a holiday detector in accordance with holiday detection of 15 kv. Damaged coating shall be repaired prior to backfill in accordance manufacturer recommend.

Coated pipe shall be lowered in, lined up and tied in using wide belts or cradles. The pipe shall conform to the bottom contours of the ditch grade so that it is uniformly and continuously supported and shall not be closer than 15 cm. to either side of the ditch wall.

5.5 Backfill and Compaction

5.5.1 Backfilling

Initial backfilling shall consist of filling the ditch with sand material to a level not less than 15 cm above the top of pipe so as to prevent pipe damage due to ditch sloughing or collapse and the rest shall backfilling by existing soil.

Final backfilling shall consist of depositing native spoil for the remainder of the ditch depth. In rock areas the final grade of the backfilled ditch shall be to surrounding right-of-way finish grade elevations.

Loose rock may be returned to the ditch after the padding material has been placed, providing the rock placed in the ditch will not interfere with the use of the land by landowner or tenant. Minimum depth of rock in the ditch shall depend on the use of the land as approved by OWNER. Generally, al rock larger than 0.03 cubic meter in volume or 30 cm. in any dimension shall be excluded from the backfill.

5.5.2 Compaction

- Trench backfill shall be compacted to equivalent with surrounding area
- Compaction of backfill may be compact by mechanical or manual tamping devices or jetting of sand
- All open-cut road crossings shall have compacted backfill meeting the local municipality standards. A backfill compaction of at least 95%might be required. And each compaction layer thickness shall be less than 30 cm.
- Sand for compaction shall be approval by OWNER prior used.
- The contractor shall install the following protection devices in the trench during the backfilling operation at the locations specified on the project construction drawings.
- Brightly Colored Warning Tape. A warning tape shall be installed directly above the underground pipeline. The tape shall be installed at the depth shown in where Contract drawings depict the tape installation at a different depth, the contractor shall install the tape as specified on the drawing.

5.6 Internal Cleaning

5.6.1 Cleaning Methods

- The cleaning all pipelines shall be in accordance with Pipeline Pre-Commissioning Procedure Hydrostatic Test, Dry up, Nitrogen Purge
- The pipeline shall be inspected and meet the acceptance of cleanliness requirements contained in the Pre-Commissioning Procedure Hydrostatic Test, Dry Up, Nitrogen Purge

5.7 Pipeline Pressure Test

- The pressure test of pipeline shall be to Pre-Commissioning Procedure Hydrostatic Test, Dry Up, Nitrogen Purge.
- Refer to the test media and the pressure testing method to be used and the pressure to be achieved during the test.
- After the pressure test has been accepted by the OWNER representative, the line shall be thoroughly cleaned and purged. The line shall then be purged and packed with nitrogen to a minimum pressure of 0.5 bar g. Precautionary safety measures shall be enforced during the purging operation to preclude the possibility of personnel being exposed to high nitrogen concentrations at the downstream end at any confined spaces.

5.8 Pipeline Markers

The install pipeline markers, aerial surveillance markers, and navigable waterway crossing signs at the locations specified in the AFC DRAWING.

6. SAFETY

6.1 All personnel engaged in trenching are to comply with the induction and safety requirement of the Health and Safety Plan.

6.2 Bunting barriers shall be erected in areas of excavated trench at road and waterway crossing.

6.3 Safety precaution shall be displayed where trench has been excavated

6.4 Contractor shall provide the escape ladder from pit.

6.5 Review JSA to ensure site conditions do not require further control measures to be implemented.

6.6 All project HSE procedure shall be complied.

6.7 Health and Safety of all personnel during the construction and installation of all Safety Plan and the approved procedures.

6.8 Contractor shall provide the escape ladder from trench.

6.9 Restricted area is set and only granted person are allow to access within working area.

6.10 Prior to lifting or lowering of the pipeline into the trench all personnel shall be removed from the trench.

6.11 Safety equipment will be provide as appropriate.

7. QUALITY CONTROL

All site construction activities shall comply with Inspection and Test Plan Procedure

8. VENDOR DOCUMENT(S)

“Not Used”

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เอกสาร Hydrostatic Testing Procedure

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โครงการวางระบบจำหน่ายก๊าซธรรมชาติ ไปยัง

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TRC
TRC CONSTRUCTION PUBLIC COMPANY LIMITED
No. 8 Soi Sukhaphiban 5 Soi 32, Kwang Tha-rang, Bangkhen, Bangkok, 10220 Thailand
Tel. 0 2022 7777 ext. 4810 | Fax. 0 2022 7788

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TRC

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1. PURPOSE

The purpose of this procedure is to ensure that pressure testing activities will conform to the requirements of the contract and specifications for โครงการวางระบบจำหน่ายก๊าซธรรมชาติ ไปยัง กลุ่มลูกค้าเขตส่งเสริมอุตสาหกรรมนวนคร จ.นครราชสีมา.

2. SCOPE

2.1. This procedure covers the requirements for the pipeline hydrostatic test and pipeline dewatering.

2.2. Contractor shall perform a detail design showing test section, time schedules, calculation and testing procedure, etc.

2.3. Contractor shall supply all materials, test equipment's, instruments, pumps, piping. Etc., in order to meet all requirement of proper and workman like test procedure.

2.4. This procedure covers only underground steel pipeline have entire length over 100m. if pipeline entire length less than 100m. then procedure hydrostatic test for aboveground pipe shall be applied or suitable test method which approved by OWNER

3. DEFINITION

OWNER	PTT Public Company Limited (PTT).
Contractor	TRC Construction Public Company Limited (TRC)
HSE	Health Safety & Environment
JSEA	Job Safety and Environmental Analysis
MOP	Maximum Operating Pressure
TPI	Third Party Inspection
DOEB	Department of Energy Business, Ministry of Energy

4. APPLICABLE CODE AND DOCUMENTATION

ASME B31.8	Gas Transmission and Distribution Pipeline Systems
API STANDARD 1104	Welding of Pipeline and Related Facilities
SP-P-1002.NGR-XXXX-016	Specification for station piping hydrotesting
PR-P-2202.02-6807-002	Inspection and Test Plan for Pipeline

5. RESPONSIBILITY

5.1 Construction Manager

Construction Manager is responsible for ensuring that testing activities for the pipelines shall always be performed by trained, experienced employees in a manner acceptable to Project Specification and Procedure requirements.

5.2 QC Manager

QC Manager is responsible to ensure that all construction inspection and testing requirements have been completed and that the relevant Release certificate has been issued prior to commencement of testing activities. All Quality Assurance and Control activities are carried- out in accordance with Project Requirements.

5.3 HSE Manager

The HSE Manager is responsible for ensuring compliance of all parties with the HSE requirements of the Project as summarized in Section 8.0 of this document. He will provide trained and competent personnel to monitor and assist with compliance by construction personnel with the HSE requirements.

5.4 Permits Officer

The Permits Officer shall be responsible for ensuring all permits for access to site, water extraction, EGAT's regulations and etc. have been issued and approved ready for the work to proceed.

6. EXCUTION

6.1 Schedule and Test Package

Prior to commencement of pipe line hydrostatic testing activities a plan will be submitted to the OWNER for their approval. The OWNER will respond with their comments /approval within 7 days of receipt of the plan. The test plan shall contain as a minimum:

- Test profile
- Elevation profile
- Pressure at Test Heads, Highest and Lower points
- Location of test equipment
- Calibration Certificates

- Dates and duration
- Water sources and certificates of water analyses
- Details of test head connections and fittings, including schematic diagram of test set up Release Certificate
- The release certificate will include a copy of the approved test head certification, a copy of the audited Pipe Book for the appropriate test section which has been verified by OWNER ensuring that all Welding, NDT, Coating, Backfilling operations have been completed and are acceptable to the OWNER.
- OWNER approval to commence testing.

6.2 Approval and Calibration of Test Instruments

An independent third-party testing laboratory shall calibrate the dead-weight instruments used to conduct the pressure tests also included other instrument such as pressure gauge temperature gauge, pressure recorder and etc. Calibration shall be within six (6) months prior to commencing testing. Instrumentation calibration certificates shall be submitted to OWNER prior to the conducting testing operations.

6.3 Cleaning

- Following back filling the test section shall be internally cleaned and gauged by an OWNER approved gauging pig. The contractor may elect, based on construction requirement, to clean and gauge the pipeline in shorter sections and join these sections to create a hydrostatic test section.
- Pigs shall be propelled through the pipeline with compressed air and controlled to proper speed.
- The test section shall be cleaned to remove all dirt, construction debris and foreign matter.
- The pipeline section shall be accepted as clean when the last pig has no more debris, magnetic matter and/or foreign matter ahead of the pig.
- The number of cleaning runs made, quantity and make-up of any foreign matter removed from the test section shall be recorded for each cleaning run performed. All records from each cleaning run, will be included in the final cleaning report.
- Acceptance criteria for cleaning pig as deep of dirt not more than 1.0 cm

6.4 Gauging

- At least a gauging pig with one (1) minimum 8 mm thick aluminum plate with a minimum diameter of 95% inner diameter which smallest in the test sections shall be run through each test section to ensure that the line is free from unacceptable dents, buckles or obstructions.
- The gauging plate shall be installed within the front section of the gauging pig between the leading and trailing seals, and run prior to hydrostatically testing the pipeline section. The gauging operation may be combined and run as part of the cleaning and filling operation.
- The gauging plate shall be allocated a run number and signed/stamped prior to loading. The OWNER shall witness the signing/stamping and loading operation. The gauging run will not be permitted to commence without the approval of the OWNER.
- The removal of the gauging plate from the test section shall be witnessed by Test Engineer, QC inspector and the authorized OWNER.
- The plate shall be inspected for deflection and/or dents and shall be accepted / rejected in accordance with the provisions in Article 841.2.4 of ASME Code B31.8 and the OWNER.

6.5 Water Sources

- The location of water sources for use in filling and testing the pipeline is the responsibility of the Contractor. The water used for tests must be clean, free of sediment and shall have pH between 5 - 8, Salt Content leass than 1000 mg/l, Chlorine leass than 50 ppm. Contractor shall collaborate with the OWNER to obtain the necessary authorizations for test water and subsequent water discharge, and shall comply with all regulations and conditions imposed by authorities with respect to hours of utilization and flow rates if applicable.
- Contractor shall use fresh water for the hydrotest. Contractor shall sample and analyze test water to ensure against the presence of excessive quantities of corrosive chemical agents. The hydrotest water
- Contractor shall provide and install all temporary piping required to bring water to the fill pump sites.
- Additional test headers installed for Contractor's convenience to access water sources shall be described in the detailed Test Plan.

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เอกสาร Welding Procedure

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โครงการวางระบบจำหน่ายก๊าซธรรมชาติ ไปยัง

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TRC CONSTRUCTION PUBLIC COMPANY LIMITED
No. 8 Soi Sukhaphiban 5 Soi 32, Kwang Tha-rang, Bangkhen, Bangkok, 10220 Thailand
Tel. 0 2022 7777 ext. 4810 | Fax. 0 2022 7788

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Prepared by	Wanchalerm Suksanit Wisit Tuntisungwarakul			Pipeline Maintenance and Safety Engineering Division Transportation Management and Technical Service Department
Checked by	Amnuay Wongpanich			
Approved by	Choochart Panusumporn			
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PTT PUBLIC COMPANY LIMITED

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Welding Procedure Specification (WPS)

SP-W-000-01 Rev.0

	PTT PUBLIC COMPANY LIMITED	SP-W-000-01 Rev. 0
	Welding Procedure Specification (WPS)	20 August 2009

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ข้อกำหนดงานเชื่อม

Welding Procedure Specification (WPS)

(SP-W-000-01 Rev.0)

1. บทนำและวัตถุประสงค์

ในปัจจุบัน ประเทศไทยมีการใช้ก๊าซธรรมชาติเป็นแหล่งพลังงานทดแทน ทั้งโรงไฟฟ้า โรงงานอุตสาหกรรม รวมถึงยานยนต์ เนื่องจากเป็นเชื้อเพลิงที่สะอาดมีการเผาไหม้สมบูรณ์ ก่อให้เกิดปัญหามลภาวะน้อยกว่าเชื้อเพลิงประเภทอื่น นอกจากนี้ยังเป็นพลังงานที่ผลิตได้ภายในประเทศ จึงลดการนำเข้าพลังงานจากต่างประเทศด้วย สำหรับการขนส่งก๊าซธรรมชาติไปยังผู้ใช้ก๊าซต่างๆ โดยส่วนมากทำโดยวิธีการส่งทางท่อส่งก๊าซ ทั้งท่อประธานและท่อย่อย

การก่อสร้างท่อส่งก๊าซธรรมชาติ ขั้นตอนการเชื่อมท่อ(Welding) เป็นขั้นตอนที่มีความสำคัญมากขั้นตอนหนึ่งในการก่อสร้างท่อส่งก๊าซฯ ให้มีความปลอดภัยถูกต้องตามมาตรฐานสากล อนึ่งเพื่อให้การเชื่อมท่อส่งก๊าซฯ มีความปลอดภัย จำเป็นต้องมีการทำข้อกำหนดงานเชื่อม (Welding Procedure Specification : WPS) และผลการทดสอบข้อกำหนดงานเชื่อม (Procedure Qualification Record : PQR) ก่อนเริ่มงานก่อสร้างท่อส่งก๊าซฯ ทุกครั้ง

ดังนั้น บริษัท ปตท. จำกัด (มหาชน) (ปตท.) จึงได้จัดทำข้อกำหนดงานเชื่อม (Welding Procedure Specification) ฉบับนี้ขึ้น เพื่อใช้ในการก่อสร้าง การบำรุงรักษา การปรับปรุงเปลี่ยนแปลง ตลอดจนการซ่อมแซมระบบท่อส่งก๊าซ ของ ปตท. เป็นรูปแบบเดียวกัน และสะดวกต่อการตรวจสอบ ตลอดจนเพื่อลดค่าใช้จ่ายที่ซ้ำซ้อนของโครงการต่างๆ

2. เอกสารอ้างอิง

เอกสารอ้างอิงให้ใช้ฉบับปรับปรุงล่าสุด (Latest Revision) เท่านั้น

API 1104	Standard for Welding of Pipelines and Related Facilities
API 5L	Specification for Line Pipe
ASME B31.8	Gas Transmission and Distribution Piping Systems
AWS A5.1, 5.5, 5.18, 5.23	Filler Metal Specifications
	รายงานการจัดข้อกำหนดงานเชื่อมท่อส่งก๊าซ สำหรับ ปตท.

3. ข้อกำหนดงานเชื่อม (Welding Procedure Specification: WPS)

ข้อกำหนดงานเชื่อมฉบับนี้ได้ออกแบบข้อกำหนดงานเชื่อม (Welding Procedure Specification: WPS) ไว้ 7 ชุด ครอบคลุมการใช้งานกับการเชื่อมท่อทุกขนาดของ ปตท. ดังนี้

1.1.API/D-2.375/T-0.188/Y-42

(สำหรับท่อที่มีขนาดเล็กกว่า NPS 2" , thickness < 0.188", SMYS ≤ 42,000 psi.)

1.2.API/2.375-D-12.75/T-0.188/Y-42

(สำหรับท่อที่มีขนาด 2" ≤ NPS ≤ 12", thickness < 0.188", SMYS ≤ 42,000 psi.)

1.3.API/2.375-D-12.75/0.188-T-0.75/Y-42

(สำหรับท่อที่มีขนาด 2" ≤ NPS ≤ 12", 0.188" ≤ thickness ≤ 0.75", SMYS ≤ 42,000 psi.)

1.4.API/12.75-D/0.188-T-0.75/Y-42

(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.188" ≤ thickness ≤ 0.75", SMYS ≤ 42,000 psi.)

1.5.API/12.75-D/0.188-T-0.75/42-Y-65

(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.188" ≤ thickness ≤ 0.75", 42,000 psi. ≤ SMYS< 65,000)

1.6.API/12.75-D/0.188-T-0.75/65-Y

(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.188" ≤ thickness ≤ 0.75", SMYS = 65,000)

1.7.API/12.75-D/0.75-T/65-Y

(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.75" ≤ thickness, SMYS = 65,000)

โดย WPS ข้างต้นสามารถนำไปใช้กับท่อขนาดต่างๆ ดังตารางที่ 1

ตารางที่ 1 Welding Procedure Specification: WPS ลำดับที่ 1-7

ลำดับที่	WPS No.	ท่อที่สามารถใช้งานได้		
		OD (in)	T (in)	SMYS (psi)
1.1	API/D-2.375/T-0.188/Y-42	OD < 2.375	T < 0.188	SMYS ≤ 42,000
1.2	API/2.375-D-12.75/T-0.188/Y-42	2.375 ≤ OD ≤ 12.75	T < 0.188	SMYS ≤ 42,000
1.3	API/2.375-D-12.75/0.188-T-0.75/Y-42	2.375 ≤ OD ≤ 12.75	0.188 ≤ T ≤ 0.75	SMYS ≤ 42,000
1.4	API/12.75-D/0.188-T-0.75/Y-42	12.75 < OD	0.188 ≤ T ≤ 0.75	SMYS ≤ 42,000
1.5	API/12.75-D/0.188-T-0.75/42-Y-65	12.75 < OD	0.188 ≤ T ≤ 0.75	42,000 < SMYS < 65,000
1.6	API/12.75-D/0.188-T-0.75/65-Y	12.75 < OD	0.188 ≤ T ≤ 0.75	SMYS = 65,000

ลำดับที่	WPS No.	ท่อที่สามารถใช้งานได้		
		OD (in)	T (in)	SMYS (psi)
1.7	API/12.75-D/0.75-T/65-Y	12.75 < OD	0.75 < T	SMYS = 65,000

หมายเหตุ

OD หมายถึง เส้นผ่านศูนย์กลางภายนอกของท่อ

T หมายถึง ความหนาของท่อ

SMYS หมายถึง ค่า Specific Minimum Yield Strength ของท่อ

ค่าตัวแปรในการเชื่อม (Welding Parameters) ของ WPS มีรายละเอียดดังต่อไปนี้

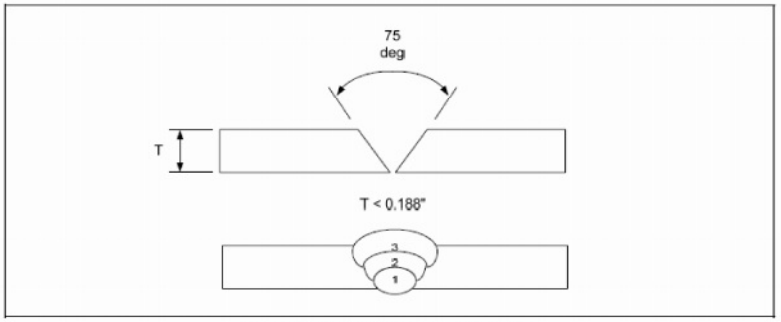
ลำดับที่ 1 WPS No. API/D-2.375/T-0.188/Y-42

PROCEDURE SPECIFICATION NO. API/D-2.375/T-0.188/Y-42

For ALLIANCE PLANT SERVICES Welding of PTT PLC. Pipe and fittings

Process	GTAW
Material	API 5L, SMYS<=42,000
Pipe outside diameter and wall thickness	DIA <2.375", THICKNESS<0.188"
Joint design	BUTT JOINT 75 degree "SINGLE VEE"
Filler metal and no. of beads	ER70S-6
Electrical or flame characteristics	DC-
Position	FIX 5G
Direction of welding	VERT. UP
No. of welder	1
Tim lapse between passes	180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY
Preheat/stress relief	n/a
Shielding gas and flow rate	Ar, 20 lpm
Shielding flux	n/a
Speed of travel	3-6 in/min
Plasma gas flow rate	n/a
Plasma gas composition	n/a
Plasma gas orifice size	n/a
Sketches and tabulations attached	as below

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

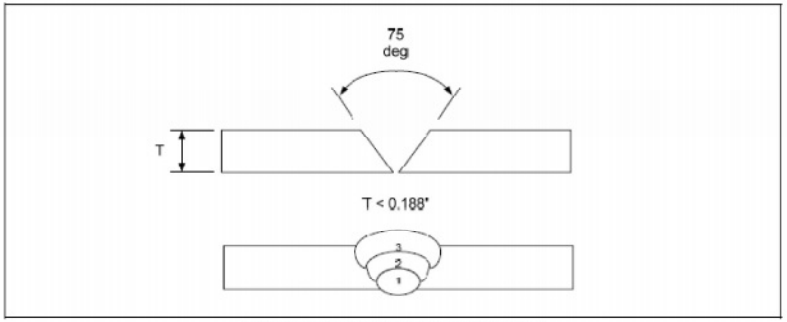
Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 and 3	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm

ลำดับที่ 2 WPS No. API/2.375-D-12.75/T-0.188/Y-42

PROCEDURE SPECIFICATION NO. API/2.375-D-12.75/T-0.188/Y-42

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC. Pipe and fittings
Process	GTAW		
Material	API 5L, SMYS<=42,000		
Pipe outside diameter and wall thickness	2.375"<=DIA <=12.75", THICKNESS<0.188"		
Joint design	BUTT JOINT 75 degree "SINGLE VEE"		
Filler metal and no. of beads	ER70S-6		
Electrical or flame characteristics	DC-		
Position	FIX 5G		
Direction of welding	VERT. UP		
No. of welder	1 or 2		
Tim lapse between passes	180s max		
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE		
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY		
Preheat/stress relief	n/a		
Shielding gas and flow rate	Ar, 20 lpm		
Shielding flux	n/a		
Speed of travel	3-6 in/min		
Plasma gas flow rate	n/a		
Plasma gas composition	n/a		
Plasma gas orifice size	n/a		
Sketches and tabulations attached	as below		

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

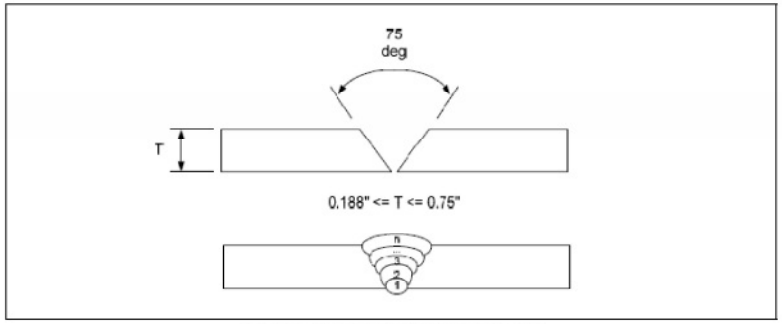
Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 and 3	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm

ลำดับที่ 3 WPS No. API/2.375-D-12.75/0.188-T-0.75/Y-42

PROCEDURE SPECIFICATION NO. API/2.375-D-12.75/0.188-T-0.75/Y-42

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC.	Pipe and fittings
Process	GTAW	and	SMAW	
Material	API 5L, SMYS<=42,000			
Pipe outside diameter and wall thickness	2.375"<=DIA <=12.75", 0.188"<=THICKNESS<=0.75"			
Joint design	BUTT JOINT 75 degree "SINGLE VEE"			
Filler metal and no. of beads	ER70S-6 (2 Beads)		E7016 (n Beads)	
Electrical or flame characteristics	DC-		DC+	
Position	FIX 5G		FIX 5G	
Direction of welding	VERT. UP		VERT. UP	
No. of welder	1 or 2		1 or 2	
Tim lapse between passes	180s max		180s max	
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE			
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY			
Preheat/stress relief	n/a			
Shielding gas and flow rate	Ar, 20 lpm		n/a	
Shielding flux	n/a		as electrode	
Speed of travel	3-6 in/min		2-6 in/min	
Plasma gas flow rate	n/a			
Plasma gas composition	n/a			
Plasma gas orifice size	n/a			
Sketches and tabulations attached	as below			

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

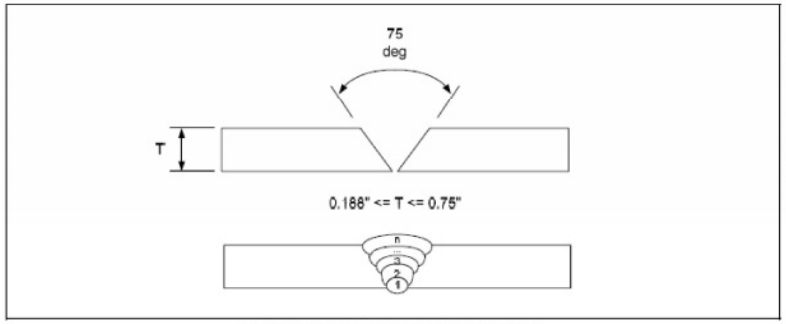
Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to... n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 4 WPS No. API/12.75-D/0.188-T-0.75/Y-42

PROCEDURE SPECIFICATION NO. API/12.75-D/0.188-T-0.75/Y-42

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC. Pipe and fittings
Process	GTAW	and	SMAW
Material	API 5L, SMYS<=42,000		
Pipe outside diameter and wall thickness	12.75"<DIA, 0.188"<=THICKNESS<=0.75"		
Joint design	BUTT JOINT 75 degree "SINGLE VEE"		
Filler metal and no. of beads	ER70S-6 (2 Beads)		E7016 (n Beads)
Electrical or flame characteristics	DC-		DC+
Position	FIX 5G		FIX 5G
Direction of welding	VERT. UP		VERT. UP
No. of welder	1 or 2		1 or 2
Tim lapse between passes	180s max		180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE		
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY		
Preheat/stress relief	n/a		
Shielding gas and flow rate	Ar, 20 lpm		n/a
Shielding flux	n/a		as electrode
Speed of travel	3-6 in/min		2-6 in/min
Plasma gas flow rate	n/a		
Plasma gas composition	n/a		
Plasma gas orifice size	n/a		
Sketches and tabulations attached	as below		

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

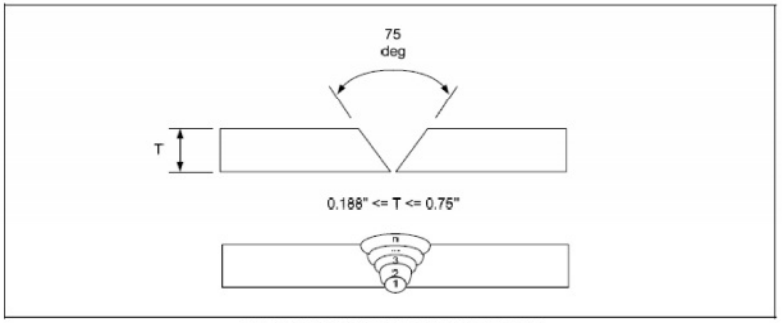
Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to... n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 5 WPS No. API/12.75-D/0.188-T-0.75/42-Y-65

PROCEDURE SPECIFICATION NO. API/12.75-D/0.188-T-0.75/42-Y-65

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC. Pipe and fittings
Process	GTAW	and	SMAW
Material	API 5L, 42,000<=SMYS<=65,000		
Pipe outside diameter and wall thickness	12.75"<DIA, 0.188"<=THICKNESS<=0.75"		
Joint design	BUTT JOINT 75 degree "SINGLE VEE"		
Filler metal and no. of beads	ER70S-6 (2 Beads)		E7016 (n Beads)
Electrical or flame characteristics	DC-		DC+
Position	FIX 5G		FIX 5G
Direction of welding	VERT. UP		VERT. UP
No. of welder	1 or 2		1 or 2
Tim lapse between passes	180s max		180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE		
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY		
Preheat/stress relief	n/a		
Shielding gas and flow rate	Ar, 20 lpm		n/a
Shielding flux	n/a		as electrode
Speed of travel	3-6 in/min		2-6 in/min
Plasma gas flow rate	n/a		
Plasma gas composition	n/a		
Plasma gas orifice size	n/a		
Sketches and tabulations attached	as below		

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

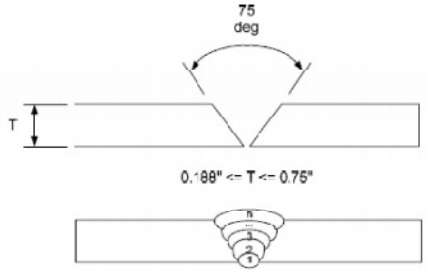
Bead Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to... n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 6 WPS No. API/12.75-D/0.188-T-0.75/65-Y

PROCEDURE SPECIFICATION NO. API/12.75-D/0.188-T-0.75/65-Y

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC. Pipe and fittings
Process	GTAW	and	SMAW
Material	API 5L, 65,000<SMYS		
Pipe outside diameter and wall thickness	12.75"<DIA, 0.188"<=THICKNESS<=0.75"		
Joint design	BUTT JOINT 75 degree "SINGLE VEE"		
Filler metal and no. of beads	ER70S-6 (2 Beads)	E7016 (n Beads)	
Electrical or flame characteristics	DC-	DC+	
Position	FIX 5G	FIX 5G	
Direction of welding	VERT. UP	VERT. UP	
No. of welder	1 or 2	1 or 2	
Tim lapse between passes	180s max	180s max	
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE		
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY		
Preheat/stress relief	n/a		
Shielding gas and flow rate	Ar, 20 lpm	n/a	
Shielding flux	n/a	as electrode	
Speed of travel	3-6 in/min	2-6 in/min	
Plasma gas flow rate	n/a		
Plasma gas composition	n/a		
Plasma gas orifice size	n/a		
Sketches and tabulations attached	as below		

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

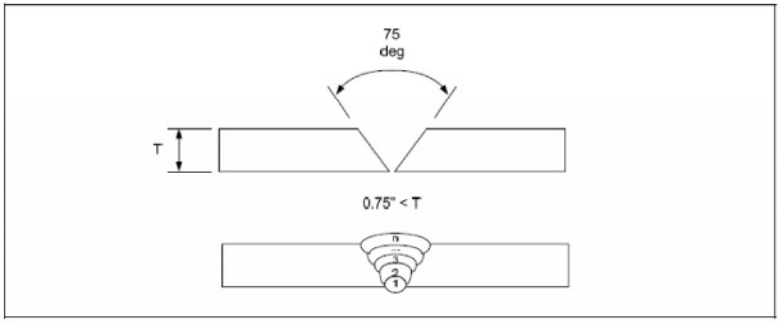
Bead Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to… n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 7 WPS No. API/12.75-D/0.75-T/65-Y

PROCEDURE SPECIFICATION NO. API/12.75-D/0.75-T/65-Y

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC. Pipe and fittings
Process	GTAW	and	SMAW
Material	API 5L, 65,000<SMYS		
Pipe outside diameter and wall thickness	12.75"<DIA, 0.75"<THICKNESS		
Joint design	BUTT JOINT 75 degree "SINGLE VEE"		
Filler metal and no. of beads	ER70S-6 (2 Beads)	E7016 (n Beads)	
Electrical or flame characteristics	DC-	DC+	
Position	FIX 5G	FIX 5G	
Direction of welding	VERT. UP	VERT. UP	
No. of welder	1 or 2	1 or 2	
Tim lapse between passes	180s max	180s max	
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE		
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY		
Preheat/stress relief	n/a		
Shielding gas and flow rate	Ar, 20 lpm	n/a	
Shielding flux	n/a	as electrode	
Speed of travel	3-6 in/min	2-6 in/min	
Plasma gas flow rate	n/a		
Plasma gas composition	n/a		
Plasma gas orifice size	n/a		
Sketches and tabulations attached	as below		

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

Bead Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to… n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

4. ตัวแปรในการเชื่อมที่เปลี่ยนไป (Essential Variables)

การนำ WPS ในข้อกำหนดนี้ไปใช้ หากมีตัวแปรในการเชื่อมเปลี่ยนไป ต้องพิจารณาถึงตัวแปรที่เปลี่ยนไปนั้น เป็นตัวแปรที่มีความสำคัญ (Essential Variables) หรือไม่ โดยเกณฑ์การพิจารณาตัวแปร ให้ยึดหลักเกณฑ์ตาม API 1104 Standard for Welding of Pipelines and Related Facilities หัวข้อ 5.4 Essential Variables

หากตัวแปรในการเชื่อมที่เปลี่ยนไป เป็นตัวแปรที่มีความสำคัญ (Essential Variables) จะไม่สามารถนำ WPS จากข้อกำหนดฉบับนี้ไปใช้งานได้ จะต้องทำการทดสอบ PQR ใหม่ก่อนที่จะนำไปใช้งาน

อนึ่งหากหากตัวแปรในการเชื่อมที่เปลี่ยนไป ไม่เป็นตัวแปรที่มีความสำคัญ (Essential Variables) สามารถนำ WPS จากข้อกำหนดฉบับนี้ไปใช้งานได้ทันที โดยไม่จำเป็นต้องทำการทดสอบ WPQT (Welding Procedure Qualification Testing) อีก

5. การทดสอบช่างเชื่อม (WQT: Welders Qualification Testing)

การทดสอบช่างเชื่อมให้ยึดหลักเกณฑ์ตาม API 1104 Standard for Welding of Pipelines and Related Facilities หัวข้อ 6 Qualification of Welders **<u>โดยค่าตัวแปรที่ใช้ในการเชื่อมจะต้องเป็นไปตามที่ระบุใน WPS เท่านั้น</u>**

ช่างเชื่อมที่ทดสอบไม่ผ่าน จะสามารถทำการทดสอบใหม่ได้อีกหนึ่งครั้ง กรณีที่ทดสอบไม่ผ่าน ช่างเชื่อมจะต้องเว้น ระยะในการทดสอบอีกครั้งอย่างน้อย 30 วัน

อายุของ WQT จะมีอายุ 1 ปี นับตั้งแต่วันที่ผ่านการทดสอบ ในกรณีทีช่างเชื่อมไม่ได้ผ่านการเชื่อมตาม WPS ดังกล่าวเกิน 6 เดือน จะต้องทำการทดสอบช่างเชื่อมใหม่

ในการทดสอบจะต้องทดสอบกับ มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี เบอร์โทรศัพท์ 662-470-9674, 662-470-9679 http://www.kingweld.kmutt.ac.th/index.htm

6. เกณฑ์การยอมรับคุณภาพของรอยเชื่อม (Acceptance Criteria)

เกณฑ์การยอมรับคุณภาพของรอยเชื่อมทั้งกรณีทดสอบช่างเชื่อม และกรณีงานเชื่อมจริง (Production Weld) ให้ยึดหลักเกณฑ์ตาม API 1104 Standard for Welding of Pipelines and Related Facilities หัวข้อ 9 Acceptance Standards for Nondestructive Testing

7. การเชื่อม (Weld Process) **และการเชื่อมซ่อม** (Weld Repair)

การเชื่อมรอยเชื่อมงานจริง จะต้องตั้งค่าตัวแปรที่ใช้ในการเชื่อมให้สอดคล้องกับค่าที่ระบุไว้ใน PQR โดยยอมให้มีการปรับค่าตัวแปรสำหรับงานเชื่อมตามค่าที่ระบุใน WPS เท่านั้น

รอยเชื่อมของงานเชื่อมจริง (Production Weld) ที่ไม่ผ่านเกณฑ์การยอมรับคุณภาพของรอยเชื่อม ให้สามารถทำการเชื่อมซ่อม (Welding Repair) ได้ ในการเชื่อมซ่อมอนุญาตให้ทำได้ไม่เกิน 2 ครั้ง ต่อรอยเชื่อม หากผลการณ์ตรวจสอบรอยเชื่อมไม่ผ่าน ให้ทำการตัดรอยเชื่อมดังกล่าวทิ้งและทำการเชื่อมใหม่

เกณฑ์การยอมรับคุณภาพของรอยเชื่อมให้ยึดหลักเกณฑ์ตาม API 1104 Standard for Welding of Pipelines and Related Facilities หัวข้อ 9 Acceptance Standards for Nondestructive Testing

วิธีการนำความไม่สมบูรณ์ออกจากรอยเชื่อม (Defect Removal) ข้อกำหนดนี้ให้ใช้วิธีการเจียร์ (Mechanical Grinding) ออกเท่านั้น วิธีการหลอม (Fusion Method) ไม่อนุญาตให้ใช้

ช่างเชื่อมที่จะทำการเชื่อมซ่อม ต้องผ่านการสอบช่างเชื่อม (WQT) ตาม WPS ด้วย

8. ข้อกำหนดงานเชื่อมสำหรับการเชื่อมซ่อม (WPS for Weld Repair)

ข้อกำหนดงานเชื่อมฉบับนี้ได้ออกแบบข้อกำหนดงานเชื่อม (Welding Procedure Specification: WPS) ไว้ 7 ชุด ครอบคลุมการใช้งานกับการเชื่อมซ่อมท่อทุกขนาดของ ปตท. ดังนี้

8.1.1st and 2nd Repair API/D-2.375/T-0.188/Y-42
(สำหรับท่อที่มีขนาดเล็กกว่า NPS 2" , thickness < 0.188", SMYS ≤ 42,000 psi.)

8.2.1st and 2nd Repair API/2.375-D-12.75/T-0.188/Y-42
(สำหรับท่อที่มีขนาด 2" ≤ NPS ≤ 12", thickness < 0.188", SMYS ≤ 42,000 psi.)

8.3.1st and 2nd Repair API/2.375-D-12.75/0.188-T-0.75/Y-42
(สำหรับท่อที่มีขนาด 2" ≤ NPS ≤ 12", 0.188" ≤ thickness ≤ 0.75", SMYS ≤ 42,000 psi.)

8.4.1st and 2nd Repair API/12.75-D/0.188-T-0.75/Y-42
(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.188" ≤ thickness ≤ 0.75", SMYS ≤ 42,000 psi.)

8.5.1st and 2nd Repair API/12.75-D/0.188-T-0.75/42-Y-65

(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.188" ≤ thickness ≤ 0.75", 42,000 psi. ≤ SMYS< 65,000)

8.6.1st and 2nd Repair API/12.75-D/0.188-T-0.75/65-Y

(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.188" ≤ thickness ≤ 0.75", SMYS = 65,000)

8.7.1st and 2nd Repair API/12.75-D/0.75-T/65-Y

(สำหรับท่อที่มีขนาดใหญ่กว่า 12", 0.75" ≤ thickness, SMYS = 65,000)

โดย WPS ข้างต้นสามารถนำไปใช้สำหรับการเชื่อมซ่อม ดังตารางที่ 2

ตารางที่ 2 Welding Procedure Specification: WPS ลำดับที่ 8-14 สำหรับการเชื่อมซ่อม

ลำดับที่	Repair WPS No.	ใช้เชื่อมซ่อมท่อที่ผ่านการเชื่อมตาม WPS No.	
		ลำดับที่	WPS No.
8.1	1st and 2nd Repair API/D-2.375/T-0.188/Y-42	1.1	API/D-2.375/T-0.188/Y-42
8.2	1st and 2nd Repair API/2.375-D-12.75/T-0.188/Y-42	1.2	API/2.375-D-12.75/T-0.188/Y-42
8.3	1st and 2nd Repair API/2.375-D-12.75/0.188-T-0.75/Y-42	1.3	API/2.375-D-12.75/0.188-T-0.75/Y-42
8.4	1st and 2nd Repair API/12.75-D/0.188-T-0.75/Y-42	1.4	API/12.75-D/0.188-T-0.75/Y-42
8.5	1st and 2nd Repair API/12.75-D/0.188-T-0.75/42-Y-65	1.5	API/12.75-D/0.188-T-0.75/42-Y-65
8.6	1st and 2nd Repair API/12.75-D/0.188-T-0.75/65-Y	1.6	API/12.75-D/0.188-T-0.75/65-Y
8.7	1st and 2nd Repair API/12.75-D/0.75-T/65-Y	1.7	API/12.75-D/0.75-T/65-Y

ค่าตัวแปรในการเชื่อม (Welding Parameters) ของ Repair WPS มีรายละเอียดดังต่อไปนี้

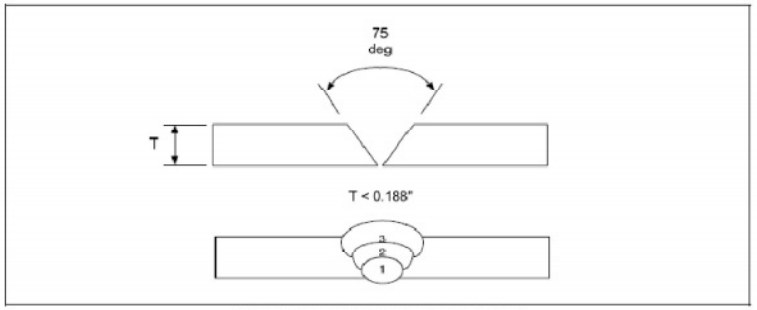
ลำดับที่ 8.1 WPS No. 1st and 2nd Repair API/D-2.375/T-0.188/Y-42

PROCEDURE SPECIFICATION NO. 1st and 2nd REPAIR API/D-2.375/T-0.188/Y-42

For ALLIANCE PLANT SERVICES Welding of PTT PLC. Pipe and fittings

Process	GTAW
Material	API 5L, SMYS<=42,000 (1st Repair Joint)
Pipe outside diameter and wall thickness	DIA <2.375", THICKNESS<0.188"
Joint design	BUTT JOINT 75 degree "SINGLE VEE"
Filler metal and no. of beads	ER70S-6
Electrical or flame characteristics	DC-
Position	FIX 5G
Direction of welding	VERT. UP
No. of welder	1
Tim lapse between passes	180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY
Shielding gas and flow rate	Ar, 20 lpm
Shielding flux	n/a
Speed of travel	3-6 in/min
Additional for repairing	
Method of exploration of the defects	From RT, UT or other NDT results or appropriated method
Method of defect removal	Mechanical grinding, Fusion methods are denied
Method of confirming defect removed	All weld removing, PT, MT or other appropriated method
Interpass inspection required	PT or MT
Sketches and tabulations attached	as below

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 and 3	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm

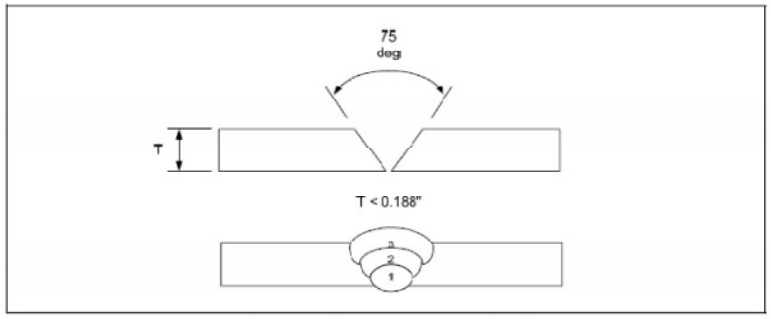
ลำดับที่ 8.2 WPS No. 1st and 2nd Repair API/2.375-D-12.75/T-0.188/Y-42

PROCEDURE SPECIFICATION NO. 1st and 2nd REPAIR API/2.375-D-12.75/T-0.188/Y-42

For ALLIANCE PLANT SERVICES Welding of PTT PLC. Pipe and fittings

Process	GTAW
Material	API 5L, SMYS<=42,000
Pipe outside diameter and wall thickness	2.375"<=DIA <=12.75", THICKNESS<0.188"
Joint design	BUTT JOINT 75 degree "SINGLE VEE"
Filler metal and no. of beads	ER70S-6 (2 Beads)
Electrical or flame characteristics	DC-
Position	FIX 5G
Direction of welding	VERT. UP
No. of welder	1
Tim lapse between passes	180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY
Shielding gas and flow rate	Ar, 20 lpm
Shielding flux	n/a
Speed of travel	3-6 in/min
Additional for repairing	
Method of exploration of the defects	From RT, UT or other NDT results or appropriated method
Method of defect removal	Mechanical grinding, Fusion methods are denied
Method of confirming defect removed	All weld removing, PT, MT or other appropriated method
Interpass inspection required	PT or MT
Sketches and tabulations attached	as below

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 and 3	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm

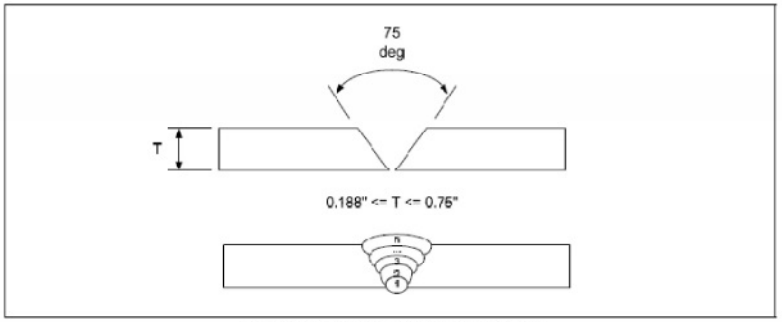
ลำดับที่ 8.3 WPS No. 1st and 2nd Repair API/2.375-D-12.75/0.188-T-0.75/Y-42

PROCEDURE SPECIFICATION NO. 1st and 2nd REPAIR API/2.375-D-12.75/0.188-T-0.75/Y-42

For ALLIANCE PLANT SERVICES Welding of PTT PLC. Pipe and fittings

Process	GTAW and	SMAW
Material	API 5L, SMYS<=42,000	
Pipe outside diameter and wall thickness	2.375"<=DIA <=12.75", 0.188"<=THICKNESS<=0.75"	
Joint design	BUTT JOINT 75 degree "SINGLE VEE"	
Filler metal and no. of beads	ER70S-6 (2 Beads)	E7016 (n Beads)
Electrical or flame characteristics	DC-	DC+
Position	FIX 5G	FIX 5G
Direction of welding	VERT. UP	VERT. UP
No. of welder	1 or 2	1 or 2
Tim lapse between passes	180s max	180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE	
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY	
Shielding gas and flow rate	Ar, 20 lpm	n/a
Shielding flux	n/a	as electrode
Speed of travel	3-6 in/min	2-6 in/min
Additional for repairing		
Method of exploration of the defects	From RT, UT or other NDT results or appropriated method	
Method of defect removal	Mechanical grinding, Fusion methods are denied	
Method of confirming defect removed	All weld removing, PT, MT or other appropriated method	
Interpass inspection required	PT or MT	
Sketches and tabulations attached	as below	

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

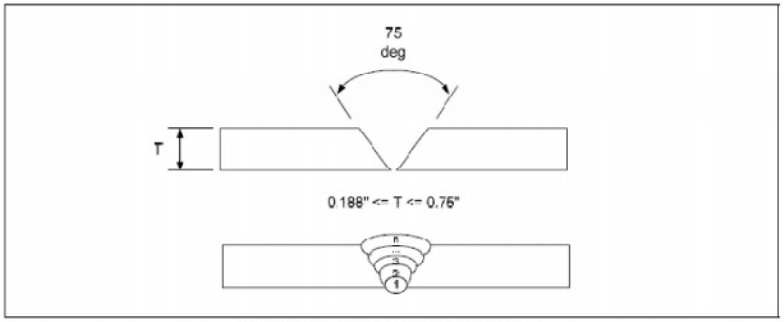
Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to... n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 8.4 WPS No. 1st and 2nd Repair API/12.75-D/0.188-T-0.75/Y-42

PROCEDURE SPECIFICATION NO. 1st and 2nd REPAIR API/12.75-D/0.188-T-0.75/Y-42

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC.	Pipe and fittings
Process	GTAW	and	SMAW	
Material	API 5L, SMYS<=42,000			
Pipe outside diameter and wall thickness	12.75"<DIA, 0.188"<=THICKNESS<=0.75"			
Joint design	BUTT JOINT 75 degree "SINGLE VEE"			
Filler metal and no. of beads	ER70S-6 (2 Beads)		E7016 (n Beads)	
Electrical or flame characteristics	DC-		DC+	
Position	FIX 5G		FIX 5G	
Direction of welding	VERT. UP		VERT. UP	
No. of welder	1 or 2		1 or 2	
Tim lapse between passes	180s max		180s max	
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE			
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY			
Shielding gas and flow rate	Ar, 20 lpm		n/a	
Shielding flux	n/a		as electrode	
Speed of travel	3-6 in/min		2-6 in/min	
Additional for repairing				
Method of exploration of the defects	From RT, UT or other NDT results or appropriated method			
Method of defect removal	Mechanical grinding, Fusion methods are denied			
Method of confirming defect removed	All weld removing, PT, MT or other appropriated method			
Interpass inspection required	PT or MT			
Sketches and tabulations attached	as below			

Tested	N. PHJRAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

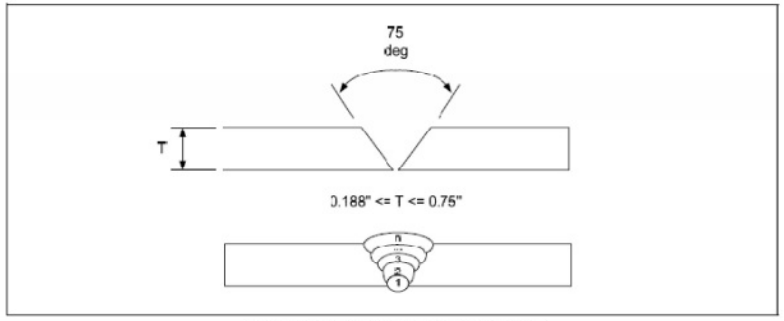
Layer Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to… n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 8.5 WPS No. 1st and 2nd Repair API/12.75-D/0.188-T-0.75/42-Y-65

PROCEDURE SPECIFICATION NO. 1st and 2nd REPAIR API/12.75-D/0.188-T-0.75/42-Y-65

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC.	Pipe and fittings
Process	GTAW	and	SMAW	
Material	API 5L, 42,000<=SMYS<=65,000			
Pipe outside diameter and wall thickness	12.75"<DIA, 0.188"<=THICKNESS<=0.75"			
Joint design	BUTT JOINT 75 degree "SINGLE VEE"			
Filler metal and no. of beads	ER70S-6 (2 Beads)		E7016 (n Beads)	
Electrical or flame characteristics	DC-		DC+	
Position	FIX 5G		FIX 5G	
Direction of welding	VERT. UP		VERT. UP	
No. of welder	1 or 2		1 or 2	
Tim lapse between passes	180s max		180s max	
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE			
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY			
Shielding gas and flow rate	Ar, 20 lpm		n/a	
Shielding flux	n/a		as electrode	
Speed of travel	3-6 in/min		2-6 in/min	
Additional for repairing				
Method of exploration of the defects	From RT, UT or other NDT results or appropriated method			
Method of defect removal	Mechanical grinding, Fusion methods are denied			
Method of confirming defect removed	All weld removing, PT, MT or other appropriated method			
Interpass inspection required	PT or MT			
Sketches and tabulations attached	as below			

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

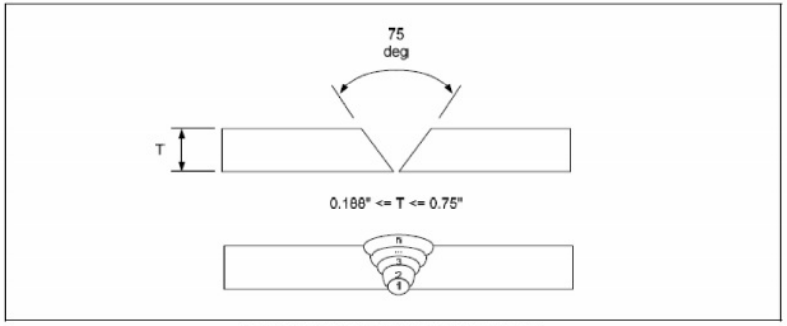
Bead Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to… n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 8.6 WPS No. 1st and 2nd Repair API/12.75-D/0.188-T-0.75/65-Y

PROCEDURE SPECIFICATION NO. 1st and 2nd REPAIR API/12.75-D/0.188-T-0.75/65-Y

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC. Pipe and fittings
Process	GTAW	and	SMAW
Material	API 5L, 65,000<SMYS		
Pipe outside diameter and wall thickness	12.75"<DIA, 0.188"<=THICKNESS<=0.75"		
Joint design	BUTT JOINT 75 degree "SINGLE VEE"		
Filler metal and no. of beads	ER70S-6 (2 Beads)		E7016 (n Beads)
Electrical or flame characteristics	DC-		DC+
Position	FIX 5G		FIX 5G
Direction of welding	VERT. UP		VERT. UP
No. of welder	1 or 2		1 or 2
Tim lapse between passes	180s max		180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE		
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY		
Shielding gas and flow rate	Ar, 20 lpm		n/a
Shielding flux	n/a		as electrode
Speed of travel	3-6 in/min		2-6 in/min
Additional for repairing			
Method of exploration of the defects	From RT, UT or other NDT results or appropriated method		
Method of defect removal	Mechanical grinding, Fusion methods are denied		
Method of confirming defect removed	All weld removing, PT, MT or other appropriated method		
Interpass inspection required	PT or MT		
Sketches and tabulations attached	as below		

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



ELECTRODE SIZE AND NUMBER OF BEADS

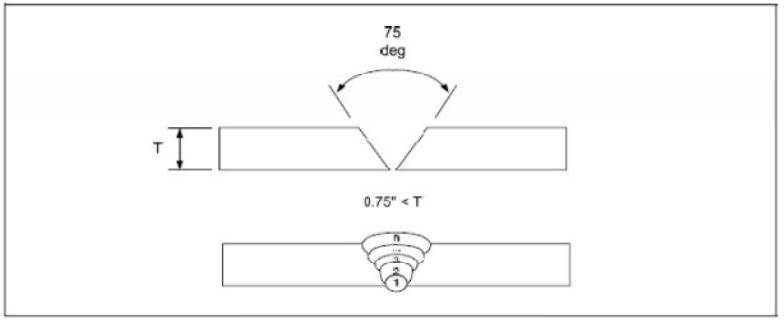
Bead Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1 (GTAW)	ER70S-6 (2.4mm)	18-24	100-150 (DCEN)	3-6 ipm
2 (GTAW)	ER70S-6 (2.4mm)	18-24	120-200 (DCEN)	3-6 ipm
3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to… n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ลำดับที่ 8.7 WPS No. 1st and 2nd Repair API/12.75-D/0.75-T/65-Y

PROCEDURE SPECIFICATION NO. 1st and 2nd REPAIR API/12.75-D/0.75-T/65-Y

For	ALLIANCE PLANT SERVICES	Welding of	PTT PLC. Pipe and fittings
Process	GTAW	and	SMAW
Material	API 5L, 65,000<SMYS		
Pipe outside diameter and wall thickness	12.75"<DIA, 0.75"<THICKNESS		
Joint design	BUTT JOINT 75 degree "SINGLE VEE"		
Filler metal and no. of beads	ER70S-6 (2 Beads)		E7016 (n Beads)
Electrical or flame characteristics	DC-		DC+
Position	FIX 5G		FIX 5G
Direction of welding	VERT. UP		VERT. UP
No. of welder	1 or 2		1 or 2
Tim lapse between passes	180s max		180s max
Type and removal of lineup clamp	EXTERNAL LINEUP CLAMP, REMOVE AFTER 25% ROOT COMPLETE		
Cleaning and/or grinding	SLAG REMOVE BY HAMMERING, BRUSHING THEN GRINDING IF NECESSARY		
Shielding gas and flow rate	Ar, 20 lpm		n/a
Shielding flux	n/a		as electrode
Speed of travel	3-6 in/min		2-6 in/min
Additional for repairing			
Method of exploration of the defects	From RT, UT or other NDT results or appropriated method		
Method of defect removal	Mechanical grinding, Fusion methods are denied		
Method of confirming defect removed	All weld removing, PT, MT or other appropriated method		
Interpass inspection required	PT or MT		
Sketches and tabulations attached	as below		

Tested	N. PHURAYA	Welder	A. PRONG-A-KART
Approved	N. KUNAWONG	Welding supervisor	P. THONGSIRI
Adopted	B.POOPAT	Chief engineer	S. PEANSUKMANEE



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3 (SMAW)	E7016 (4.0mm)	20-24	90-140 (DCEP)	2-5 ipm
4 to… n (SMAW)	E7016 (3.2mm)	20-24	90-120 (DCEP)	3-6 ipm

ภาคผนวก 14-4

เอกสาร Tie-in Procedure

Ref. No. TPA-EXT-N20-005-TRC-PTT-TR-0389
Received: 8 August 2022

PTT PUBLIC COMPANY LIMITED

โครงการวางระบบจำหน่ายก๊าซธรรมชาติ ไปยัง

กลุ่มลูกค้าเขตส่งเสริมอุตสาหกรรมนวนคร จ.นครราชสีมา

DOCUMENT NO. : **ED-C-2202.02-6807-005**

DOCUMENT TITLE : **TIE-IN PIT CALCULATION**

DOCUMENT REVIEW		
☑	E	Work may proceed.
☐	F	Work may proceed. Submit final document.
☐	G	Revise and resubmit. Work may proceed subject to incorporation of changes indicated.
☐	H	Revise and resubmit. Work may not proceed.
☐	I	Review not required. Work may proceed.
BY:		DATE:

[redacted]

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ต.บึงยี่โถ อ.ธัญบุรี จ.ปทุมธานี 12130

Contract No. ปตท.ธกก./2/58/65		Project No. 2202.02	TRC Project No. 2022-323	Page 1 of 67	
1	03/08/2022	[redacted]			Re-issued for Construction
0	12/05/2022				Issued for Construction
A	10/05/2022				Issued for Approval
Rev.	Date	Originator	Checked By	Approved By	Revision Status

TRC CONSTRUCTION PUBLIC COMPANY LIMITED
No. 8 Soi Sukhaphiban 5 Soi 32, Kwang Tha-rang, Bangkhen, Bangkok, 10220 Thailand
Tel. 0 2022 7777 ext. 4810 | Fax. 0 2022 7788

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1. SCOPE

1.1 Introduction

PTT Public Company Limited (PTT) intends to undertake the installation of 6" natural gas pipeline from the Provincial Gas Transmission Pipeline distribution to Customers in Nava Nakorn Industrial Zone, Nakhon Ratchasima Province.

1.2 Purpose

The purpose of this document is to analysis and design Steel structure of temporary structure for welding and installation pipe, valve and equipment.

1.3 Documentation Definitions

- OWNER PTT Public Company Limited (PTT).
- Contractor TRC Construction Public Company Limited (TRC).

1.4 Reference Document

- Principle of Foundation Engineering, Braja M. Das
- RPT-C-2202.02-6807-001 Soil Investigation Report
- D3-2202.02-6807-005 to 013 Pipeline Alignment Sheet
- S3-2202.02-6807-010-01 Tie-in Pit Type 1 (2.00x2.00)
- S3-2202.02-6807-010-02 Tie-in Pit Type 2 (4.00x4.00)

1.5 Code and Standard

- AISC ASD-89 American Institute of Steel Construction. (Steel structure Design)
- AWS American Welding Society
- ASTM American Society for Testing and Materials
- TIS Thai Industrial Standard

[redacted]

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2. MATERIALS AND PARAMETER

2.1 Concrete

Concrete strength shall be determined in accordance with ASTM C39.

Cement used in all concrete mixes shall be Portland cement in accordance with ASTM C150 type I

Concrete will be specified in accordance with intended use as noted below:

- Main structure, f'c	=	240	ksc.
- Sub structure, f'c	=	240	ksc.
- General purpose , f'c	=	240	ksc.
- Gutter and Drainage system, f'c	=	240	ksc.
- Road f'c	=	280	ksc

2.2 Reinforcing Bar

Round bars 9 mm and less shall meet the requirements of Thai Industrial Standard TIS.20-2559 Grade SR24, minimum yield strength, fy = 2,400 ksc.

Deformed bars 12 mm and greater shall be in accordance with TIS 24-2559 grade SD40, minimum specified yield strength, fy = 4,000 ksc.

The minimum concrete covering to reinforcement shall be:

Concrete exposed to underground	75	mm
Concrete formed but exposed to underground	50	mm
Columns	40	mm
Beams	40	mm
Slabs	25	mm
Stairs	25	mm

2.3 Structural Steel

The following materials, or approved equivalents are to be used for structural steel design.

Hot Rolled Structural Sections	SS400, SM400 or equivalent
Welded Plate Girder Sections	SS400 or equivalent
Structural plate, flats and rounds	SS400, SM400 or equivalent
Cast-in anchor bolts (normal)	A307 or equivalent
High strength structural bolts	A325 or equivalent
Structural Pipe	JIS G3444 STK400 or equivalent

Structural steel will be designed in accordance with the requirements of AISC Manual of Steel Construction. The structures will be designed to support the spe[redacted] adequate for the intended function of the structure.

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3. DESIGN LOAD AND LOAD COMBINATION

3.1 Dead Loads (DL)

- Self weight of structural steel members

3.2 Live load (LL)

- Active Earth Pressure = 2954 kg/m2

3.3 Load Combinations

- 1.00 DL +1.00 LL

[redacted]

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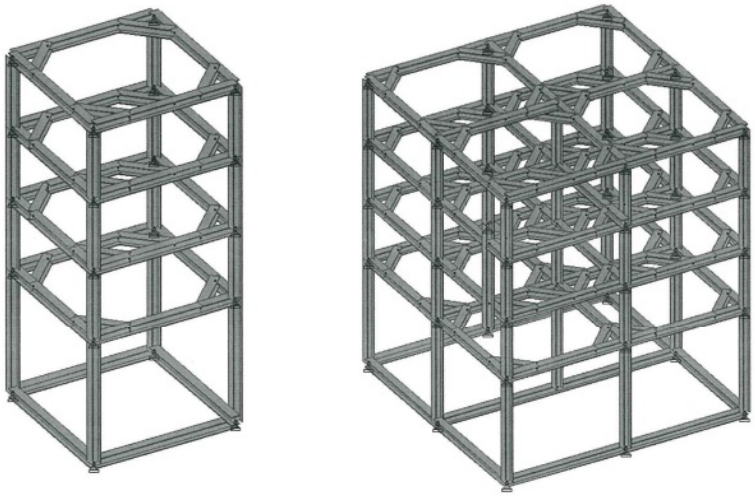
4. TIE IN BOX CALCULATION

4.1 Load and Model for design



3D Model Tie-in Pit 2.00Wx2.00Lx4.75D(MAX)

And 4.00Wx4.00Lx4.75D(MAX)

[redacted]

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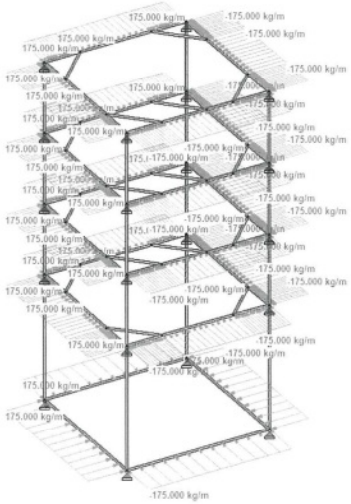

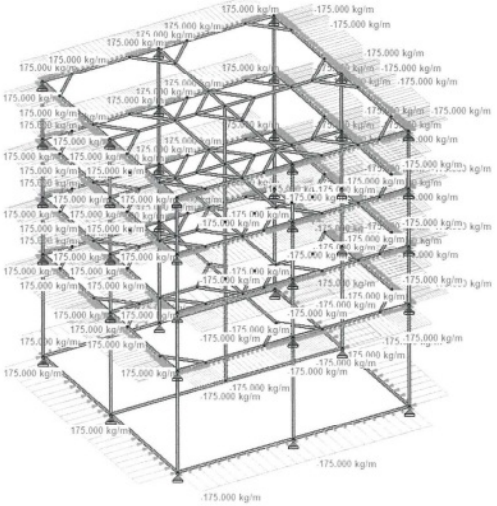

Figure 2 Dead Load (kg/m)

[redacted]

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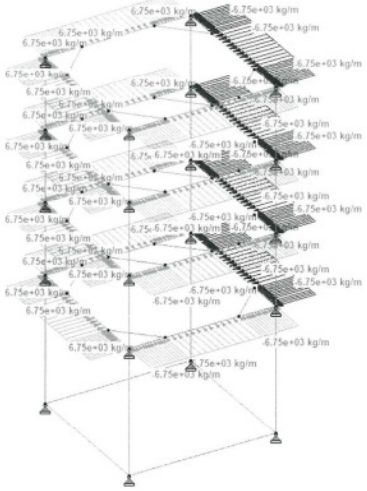

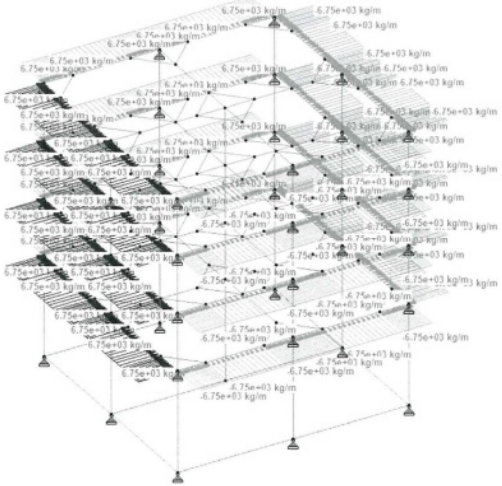

Figure 4 Live Load (kg/m)

[redacted]

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4.2 Analysis and Result

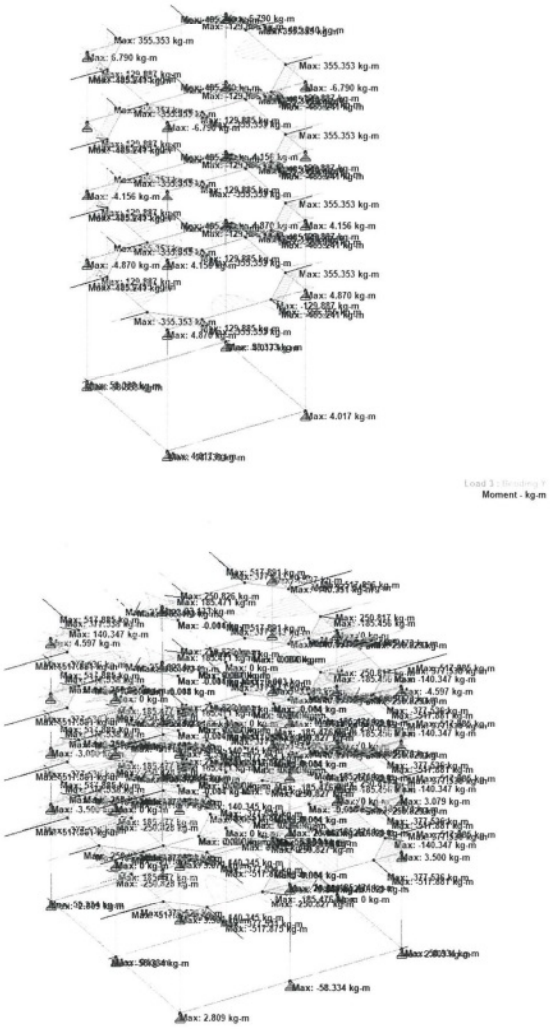

Figure 3 BMD, My (kg, m)

[redacted]

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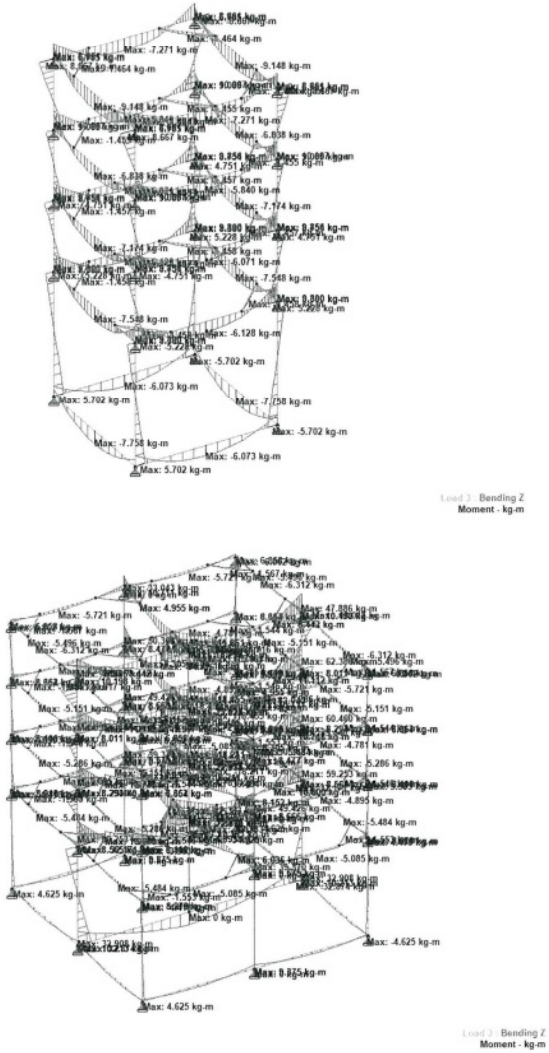

Figure 5 BMD, Mz (kg, m)

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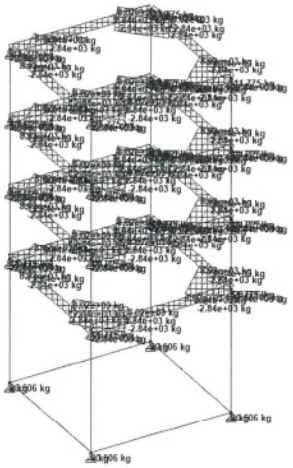

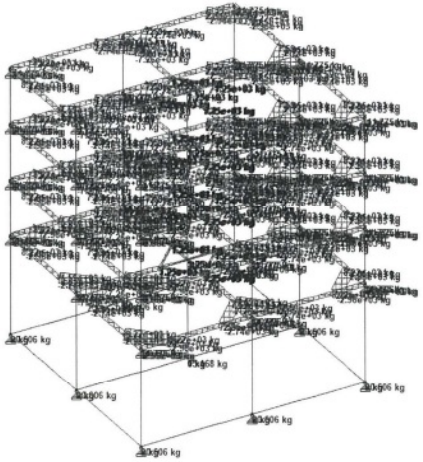

Figure 6 Axial force, Fx (kg)

[redacted]

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4.3 Design Result

4.3.1 Active Earth Pressure

TIE-IN PIT	Project: **NVNK**	Sheet	1 of 2
	Project no.:	Designer	KPR
	Subject: **Tie-in Pit Calculation**	Checker	BLK
		Approve	
		date	02/08/22

CALCULATION FOR TEMPORARY BORED PIT

Structural Steel Properties

All Structural Steel are grade A36

Yeiid Strength of Steel Structure,fy	=	*4,000*	*Kg/cm2*
Allowable Bending Stress,fb	=	*2,400*	*Kg/cm2*
Allowable Shear Stress,fv	=	*1,600*	*Kg/cm2*

Soil Properties

unit weigth of soil,(g)	=	*1.86*	*t/m3*
Average =(1.81+1.83+1.85+1.88+1.94)/5			
Undrain Shear strength(Su)	=	*27.15*	*t/m2*
Average =(23.8+23.8+25.2+35.8)/4			
Angle of Friction (f),Sand	=	*33.00*	

Design Surcharge (q)

Traffic	=	*2.00*	*t/m2*

Soil Data

Elev. +0.00													*Elevation*
-0.45	g_1	=	*1.81*	*t/m3*	*f*	=	*33.00*	*degree*	*H1* =	**0.45**			***Silty Sand ,SM***
-1.00	g_2	=	*1.83*	*t/m3*	*Su*	=	*12.80*	*t/m2*	*H2* =	**0.55**			
-2.00	g_3	=	*1.85*	*t/m3*	*Su*	=	*23.80*	*t/m2*	*H3* =	**1.0**			***Clay of low to medium plasticity, silty clay, CL***
-3.00	g_4	=	*1.88*	t/m3	Su	=	*25.20*	t/m2	H4 =	**1.0**			
Elev. -4.000	g_5	=	*1.94*	*t/m3*	*Su*	=	*35.80*	*t/m2*	*H4* =	**1.0**			

[redacted]

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TIE-IN PIT	Project: NVNK	Sheet	2 of 2
	Project no.:	Designer	
	Subject: Tie-in Pit Calculation	Checker	
		Approve	
		date	02/08/22

Soil Properties

Average unit weigth of soil,(γ)

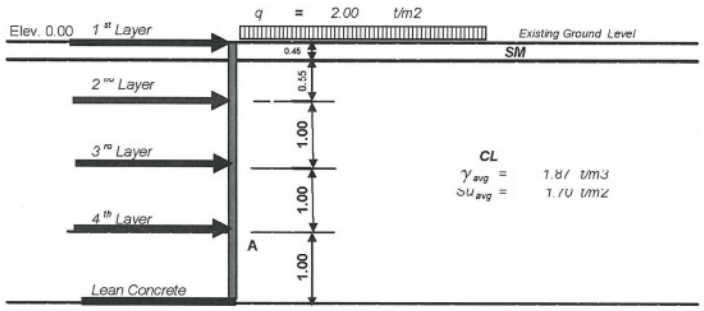
$\gamma_{(Ave)} = 1/H\ [\ \gamma_1.H_1 + \gamma_2.H_2 + \gamma_3.H_3 + \gamma_4.H_4.\gamma_5.H_5]$ = 1.87 t/m3

*Average Undrain Shear strength(**Su**)*

$Su_{Ave} = 1/H\ [0.5*(\ \gamma_{sand}*H_{sand}*K\ )*H_{sand}*\tan(\theta)+\sum SuH_{clay}]$ = 1.70 t/m2

Angle of Friction (ϕ),Sand = 33.00

SECTION OF BRACED CUT



Active Earth Pressure

1. For Clay

$\gamma.H/Su$ = > 4.00

✦ *Braced Cut in Soft to meduim Clay*

Case I= Active Pressure,Pa = $(\gamma.H. - 4.Su) + q$
= 2.000 t/m2

Case II= Active Pressure,Pa = $(0.30.\gamma.H)+q$
= 2.000 t/m2

2. For Sand

Active Pressure,Pa = $(0.65*\gamma*H*Ka)+q$
= 2.16 t/m2

So use Active Pressure, Pa = 2.954 t/m2

[redacted]

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4.3.2 Main structure H 125x125x6.5x9 for Tie-in Pit size 2.00Wx2.00Lx4.75D

Bentley **2.00WX2.00L**

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CONNECTED User: Naphakan Kelawandee

Job No	Sheet No 1	Rev	
Part			
Ref			
By	Date 08-Apr-22	Chd	
File Box C1-4 no plate add br	Date/Time 03-Aug-2022 14:57		

Job Information

	Engineer	Checked	Approved
Name:			
Date:	08-Apr-22		

Project ID	
Project Name	

Structure Type	SPACE FRAME

Number of Nodes	52	Highest Node	1345
Number of Elements	84	Highest Beam	187

Number of Basic Load Cases	2
Number of Combination Load Cases	1

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	LOAD CASE 1 DL
Primary	2	LOAD CASE 2 LL
Combination	3	COMBINATION LOAD CASE 3

Section Properties

Prop	Section	Area (m^2)	I_{yy} (m^4)	I_{zz} (m^4)	J (m^4)	Material
1	H125X125X6.5X9	0.003	0.000	0.000	0.000	STEEL

Primary Load Cases

Number	Name	Type
1	LOAD CASE 1 DL	Dead
2	LOAD CASE 2 LL	Live

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
3	COMBINATION LOAD CASE 3	1	LOAD CASE 1 DL	1.00
		2	LOAD CASE 2 LL	1.00

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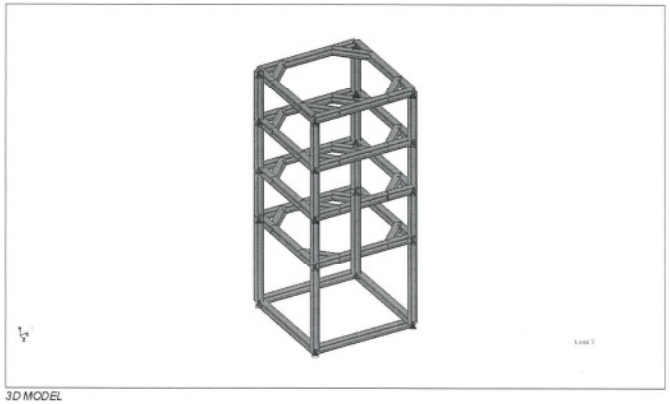
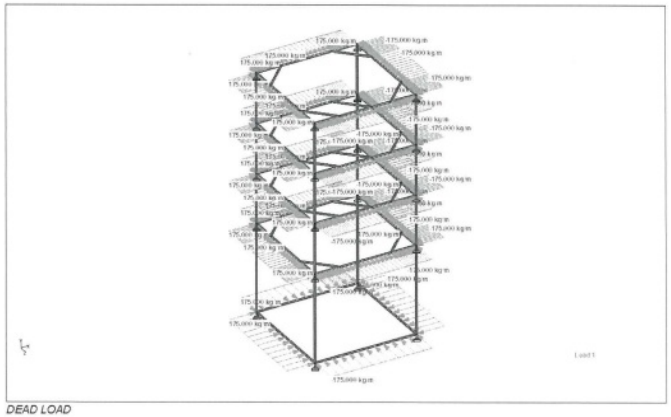
Job Title	Job No	Sheet No 2	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	



3D MODEL



DEAD LOAD

Print Time/Date: 03/08/2022 15:03 STAAD.Pro CONNECT Edition 22.10.00.153 [For Evaluation Use Only] Print Run 2 of 16

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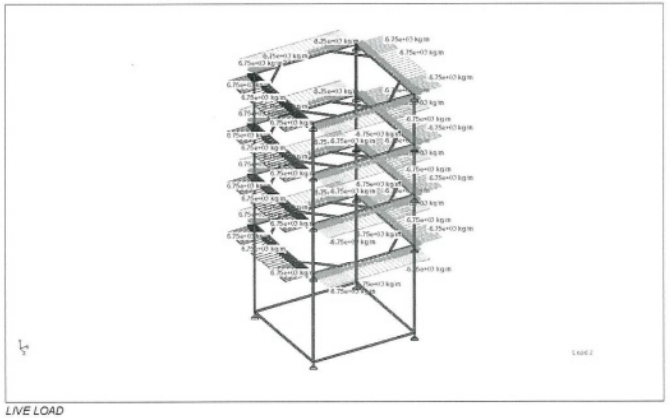
Job Title	Job No	Sheet No 3	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	



LIVE LOAD

Print Time/Date: 03/08/2022 15:03 STAAD.Pro CONNECT Edition 22.10.00.153 [For Evaluation Use Only] Print Run 3 of 16

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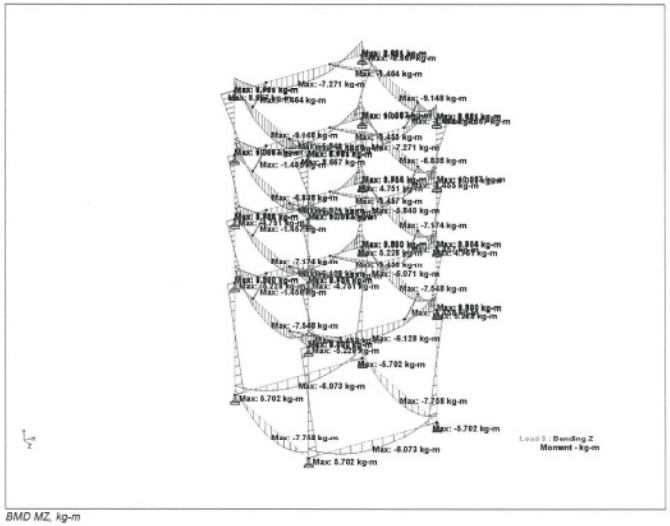
Job Title	Job No	Sheet No 6	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1-4 no plate add br	Date/Time 03-Aug-2022 14:57	



BMD MZ, kg-m

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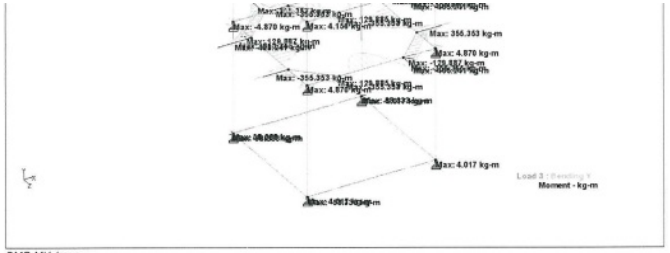
		Spectrometric Method[12,23]
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method[12,25]
107	Toxaphene	Ultrasonic Extraction, Gas Chromatographic Method[10,22]
108	TPH (C_5-C_8)	1) Purge and Trap, Gas Chromatographic Method[12,21]



BMD MY, kg-m

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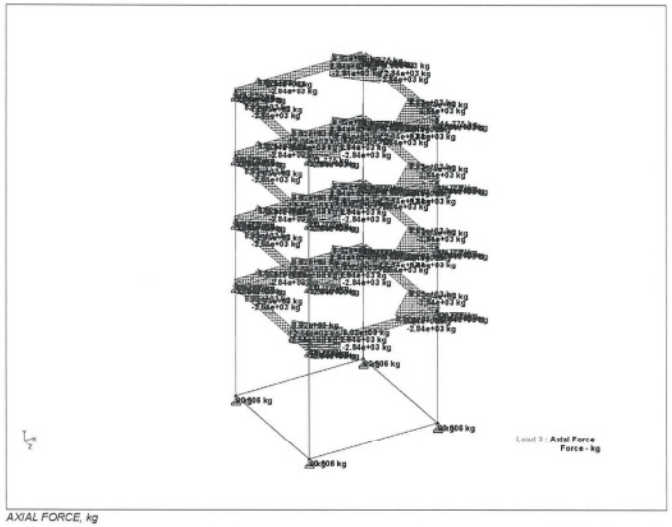
Job Title	Job No	Sheet No 8	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	



AXIAL FORCE, kg

Node Displacement Summary

	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)
Max X	1310	3:COMBINATIC	0.003	-0.001	-0.001	0.004	-0.000	-0.001	-0.000
Min X	1311	3:COMBINATIC	-0.003	-0.001	-0.001	0.004	-0.000	0.001	0.000
Max Y	1	1:LOAD CASE	0	0	0	0	-0.000	0.000	-0.000
Min Y	1310	1:LOAD CASE	0.000	-0.001	-0.000	0.001	-0.000	-0.000	-0.000
Max Z	1313	3:COMBINATIC	0.001	-0.000	0.003	0.004	0.000	-0.001	-0.000
Min Z	1312	3:COMBINATIC	0.001	-0.000	-0.003	0.004	-0.000	0.001	-0.000
Max rX	1317	1:LOAD CASE	-0.000	-0.000	0.000	0.000	0.000	0.000	0.000
Min rX	1316	1:LOAD CASE	-0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000
Max rY	1311	3:COMBINATIC	-0.003	-0.001	-0.001	0.004	-0.000	0.001	0.000
Min rY	1313	3:COMBINATIC	0.001	-0.000	0.003	0.004	0.000	-0.001	-0.000
Max rZ	1316	1:LOAD CASE	-0.000	-0.001	0.000	0.001	0.000	-0.000	0.000
Min rZ	1314	1:LOAD CASE	0.000	-0.001	0.000	0.001	0.000	0.000	-0.000
Max Rst	1311	3:COMBINATIC	-0.003	-0.001	-0.001	0.004	-0.000	0.001	0.000

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Beam End Displacement Summary

Displacements shown in italic indicate the presence of an offset

	Beam	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)
Max X	128	1310	3:COMBINATIC	0.003	-0.001	-0.001	0.004
Min X	4	1323	3:COMBINATIC	-0.003	-0.000	0.001	0.004
Max Y	1	1	1:LOAD CASE	0	0	0	0
Min Y	114	1314	1:LOAD CASE	0.000	-0.001	0.000	0.001
Max Z	2	1321	3:COMBINATIC	0.001	-0.000	0.003	0.004
Min Z	1	1320	3:COMBINATIC	0.001	-0.000	-0.003	0.004
Max Rst	115	1315	3:COMBINATIC	-0.003	-0.001	0.001	0.004

Beam Force Detail Summary

Sign convention as diagrams:- positive above line, negative below line except Fx where positive is compression. Distance d is given from beam end A.

				Axial	Shear		Torsion	Bending	
	Beam	L/C	d (m)	Fx (kg)	Fy (kg)	Fz (kg)	Mx (kg m)	My (kg m)	Mz (kg m)
Max Fx	139	3:COMBINATIC	0	8.02E+3	8.318	-0.000	0.003	-129.886	0.005
Min Fx	4	3:COMBINATIC	0	-2.84E+3	31.872	-1.25E+3	-0.012	116.873	9.089
Max Fy	112	1:LOAD CASE	0	-71.651	31.885	31.697	0.006	-2.954	8.661
Min Fy	134	1:LOAD CASE	0.500	-71.651	-31.885	-31.697	-0.006	-2.953	8.661
Max Fz	131	3:COMBINATIC	1.000	2.84E+3	-11.775	3.46E+3	-0.000	485.240	-4.328
Min Fz	130	3:COMBINATIC	1.000	2.84E+3	-11.775	-3.46E+3	0.000	-485.241	-4.328
Max Mx	3	1:LOAD CASE	0	-71.651	31.872	31.697	0.012	-2.953	9.089
Min Mx	4	1:LOAD CASE	0	-71.652	31.872	-31.697	-0.012	2.953	9.089
Max My	131	3:COMBINATIC	1.000	2.84E+3	-11.775	3.46E+3	-0.000	485.240	-4.328
Min My	130	3:COMBINATIC	1.000	2.84E+3	-11.775	-3.46E+3	0.000	-485.241	-4.328
Max Mz	1	1:LOAD CASE	0	-71.651	31.881	31.697	0.012	-2.954	10.087
Min Mz	132	1:LOAD CASE	0.500	71.652	0.000	0.000	-0.000	9.613	-9.148

Steel Design (Track 0) Checks

```
ALL UNITS ARE - KG   METE (UNLESS OTHERWISE Noted)

MEMBER      TABLE        RESULT/   CRITICAL COND/     RATIO/      LOADING/
                          FX            MY              MZ        LOCATION
=================================================================================

     1  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                            PASS     AISC- H2-1          0.463          3
                       2835.35 T      -355.35           -2.91         0.50

     2  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                            PASS     AISC- H2-1          0.463          3
                       2835.35 T       355.35           -2.91         0.50

     3  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                            PASS     AISC- H2-1          0.463          3
                       2835.35 T      -355.35           -3.90         0.50
```


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Job Title	Job No	Sheet No 10	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
4 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	355.35	-3.90	0.50
9 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	-355.35	-3.14	0.50
10 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	355.35	-3.14	0.50
11 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	-355.35	-4.24	0.50
12 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	355.35	-4.24	0.50
17 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	-355.35	-3.20	0.50
18 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	355.35	-3.20	0.50
19 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.464	3
		2835.35 T	-355.35	-4.61	0.50
20 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.464	3
		2835.35 T	355.35	-4.61	0.50
33 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		20.61 C	4.02	5.70	1.75
34 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		20.61 C	-4.02	5.70	1.75
35 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		20.61 C	-4.02	-5.70	1.75
36 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		20.61 C	4.02	-5.70	1.75

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Job Title	Job No	Sheet No 11	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
75 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.007	1
		11.78 C	4.16	-4.75	0.00
76 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		11.78 C	4.87	-5.23	0.00
77 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.007	1
		11.78 C	-4.16	-4.75	0.00
78 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		11.78 C	-4.87	-5.23	0.00
79 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.007	1
		11.78 C	-4.16	4.75	0.00
80 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		11.78 C	-4.87	5.23	0.00
81 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.007	1
		11.78 C	4.16	4.75	0.00
82 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.008	1
		11.78 C	4.87	5.23	0.00
99 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.012	1
		11.78 T	-6.79	8.67	1.00
100 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.012	1
		11.78 T	-6.79	-8.67	1.00
101 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.012	1
		11.78 T	6.79	8.67	1.00
102 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.012	1
		11.78 T	6.79	-8.67	1.00
112 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	-355.35	-4.34	0.50

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Client

Job No	Sheet No 12	Rev
Part		
Ref		
By	Date 08-Apr-22	Chd
File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
113 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.463	3
		2835.35 T	355.35	-4.34	0.50
114 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.464	3
		2835.35 T	-355.35	-6.21	0.50
115 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.464	3
		2835.35 T	355.35	-6.21	0.50
128 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.464	3
		2835.35 T	-355.35	-6.21	0.00
129 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.464	3
		2835.35 T	355.35	-6.21	0.00
130 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.35 C	-485.24	-4.33	0.00
131 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.36 C	485.24	-4.33	0.00
132 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.616	3
		2835.35 C	-485.24	-6.20	0.00
133 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.616	3
		2835.36 C	485.24	-6.20	0.00
134 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.463	3
		2835.35 T	-355.35	-4.34	0.00
135 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.463	3
		2835.35 T	355.35	-4.34	0.00
136 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.88	-1.46	0.35
137 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.89	-1.46	0.35

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Job Title

Client

Job No	Sheet No 13	Rev
Part		
Ref		
By	Date 08-Apr-22	Chd
File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
138 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	-129.89	-1.46	0.35
139 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.60 C	-129.89	-1.46	0.35
140 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.463	3
		2835.35 T	-355.35	-3.90	0.00
141 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.463	3
		2835.35 T	355.35	-3.90	0.00
142 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.614	3
		2835.35 C	-485.24	-2.90	0.00
143 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.614	3
		2835.36 C	485.24	-2.90	0.00
144 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.35 C	-485.24	-3.89	0.00
145 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.36 C	485.24	-3.89	0.00
146 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.463	3
		2835.35 T	-355.35	-2.91	0.00
147 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.463	3
		2835.35 T	355.35	-2.91	0.00
148 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.88	-1.46	0.35
149 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.89	-1.46	0.35
150 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	-129.89	-1.46	0.35

[redacted]

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Job No	Sheet No 14	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
151 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.60 C	-129.89	-1.46	0.35
152 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	-355.35	-4.24	0.00
153 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	355.35	-4.24	0.00
154 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.35 C	-485.24	-3.13	0.00
155 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.36 C	485.24	-3.13	0.00
156 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.35 C	-485.24	-4.23	0.00
157 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.36 C	485.24	-4.23	0.00
158 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	-355.35	-3.14	0.00
159 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	355.35	-3.14	0.00
160 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.88	-1.46	0.35
161 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.89	-1.46	0.35
162 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	-129.89	-1.46	0.35
163 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.60 C	-129.89	-1.46	0.35

[redacted]

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Job No	Sheet No 15	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
164 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.464	3
		2835.35 T	-355.35	-4.61	0.00
165 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.464	3
		2835.35 T	355.35	-4.61	0.00
166 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.35 C	-485.24	-3.18	0.00
167 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.36 C	485.24	-3.18	0.00
168 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.35 C	-485.24	-4.60	0.00
169 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.615	3
		2835.36 C	485.24	-4.60	0.00
170 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	-355.35	-3.20	0.00
171 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.463	3
		2835.35 T	355.35	-3.20	0.00
172 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.88	-1.46	0.35
173 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	129.89	-1.46	0.35
174 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.59 C	-129.89	-1.46	0.35
175 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.323	3
		8019.60 C	-129.89	-1.46	0.35
184 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.068	1
		0.00 T	58.33	5.70	0.00

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Job No	Sheet No 16	Rev
Part		
Ref		
By	Date 08-Apr-22	Chd
File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 14:57	

Job Title

Client

Steel Design (Track 0) Checks Cont...

```
ALL UNITS ARE - KG   METE (UNLESS OTHERWISE Noted)

MEMBER     TABLE       RESULT/   CRITICAL COND/     RATIO/     LOADING/
                         FX          MY              MZ       LOCATION
=======================================================================

  185  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                         PASS     AISC- H1-3         0.068         1
                       0.00 T       -58.33           5.70        0.00

  186  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                         PASS     AISC- H1-3         0.068         1
                       0.00 T       -58.33           4.02        0.00

  187  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                         PASS     AISC- H1-3         0.068         1
                       0.00 T        58.33           4.02        0.00
```

Failed Members

There is no data of this type.

Print Time/Date: 03/08/2022 15:03 STAAD.Pro CONNECT Edition 22.10.00.153 [For Evaluation Use Only] Print Run 16 of 16

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TRC

4.3.3 Main structure H 125x125x6.5x9 for Tie-in Pit size 4.00Wx4.00Lx4.75D

Bentley **4.00WX4.00L**

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Job No	Sheet No 1	Rev
Part		
Ref		
By	Date 08-Apr-22	Chd
File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Job Title

Client

Job Information

	Engineer	Checked	Approved
Name:			
Date:	08-Apr-22		

Project ID	
Project Name	

Structure Type	SPACE FRAME

Number of Nodes	141	Highest Node	1488
Number of Elements	254	Highest Beam	445

Number of Basic Load Cases	2
Number of Combination Load Cases	1

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	LOAD CASE 1 DL
Primary	2	LOAD CASE 2 LL
Combination	3	COMBINATION LOAD CASE 3

Section Properties

Prop	Section	Area (m^2)	I_{yy} (m^4)	I_{zz} (m^4)	J (m^4)	Material
1	H125X125X6.5X9	0.003	0.000	0.000	0.000	STEEL

Primary Load Cases

Number	Name	Type
1	LOAD CASE 1 DL	Dead
2	LOAD CASE 2 LL	Live

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
3	COMBINATION LOAD CASE 3	1	LOAD CASE 1 DL	1.00
		2	LOAD CASE 2 LL	1.00

Print Time/Date: 03/08/2022 15:11 STAAD.Pro CONNECT Edition 22.10.00.153 [For Evaluation Use Only] Print Run 1 of 29

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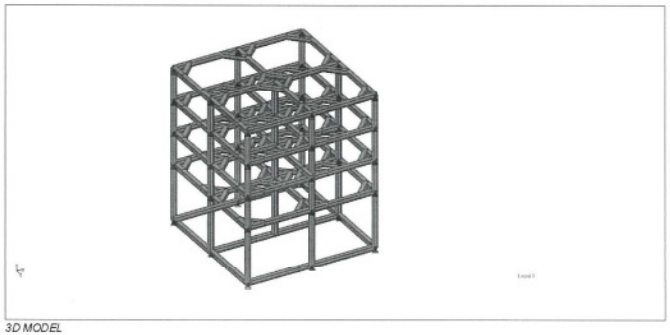
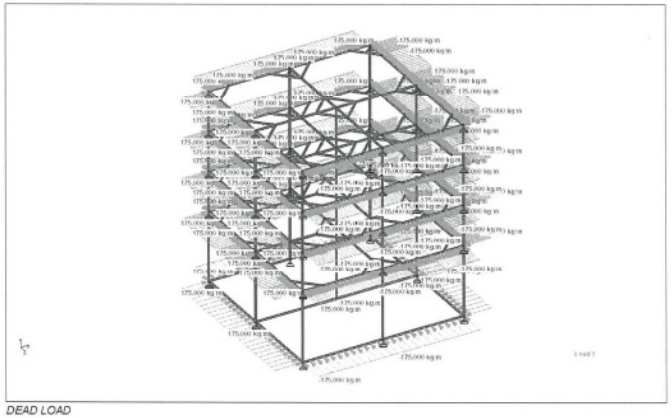
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	



3D MODEL



DEAD LOAD

Print Time/Date: 03/08/2022 15:11 STAAD.Pro CONNECT Edition 22.10.00.153 [For Evaluation Use Only] Print Run 2 of 29

[redacted]

TRC

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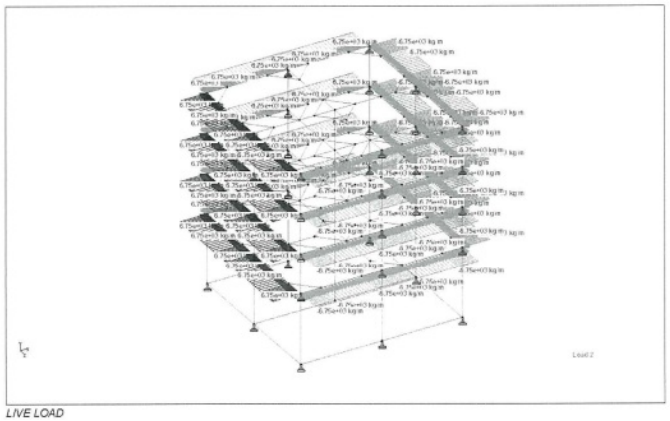
Job Title	Job No	Sheet No 3	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	



LIVE LOAD

Print Time/Date: 03/08/2022 15:11 STAAD.Pro CONNECT Edition 22.10.00.153 [For Evaluation Use Only] Print Run 3 of 29

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TRC

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Bentley 4.00WX4.00L

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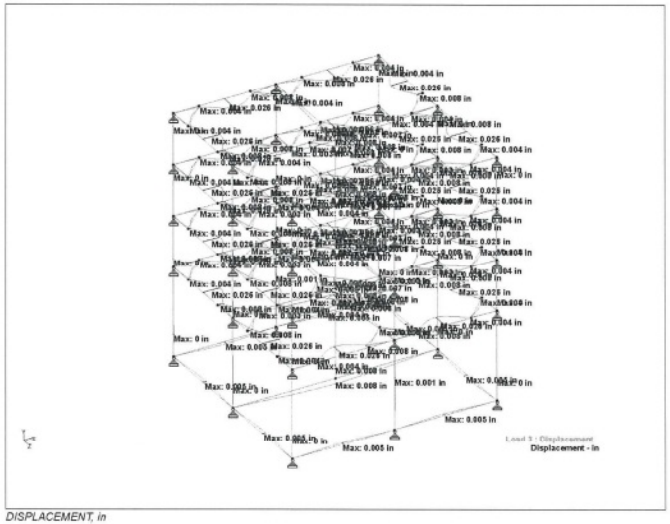
Job Title	Job No	Sheet No 4	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	



DISPLACEMENT, in

[redacted]

TRC

124/305 ม.1 ถ.พระองค์เจ้าสาย
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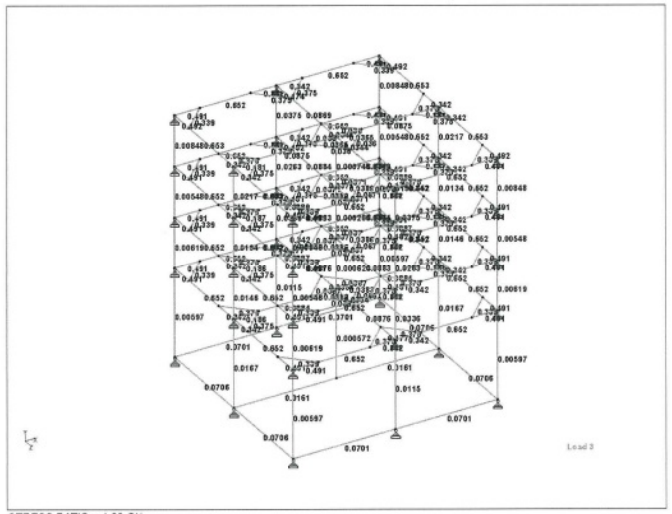
Job Title	Job No	Sheet No 5	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	



STRESS RATIO < 1.00 OK

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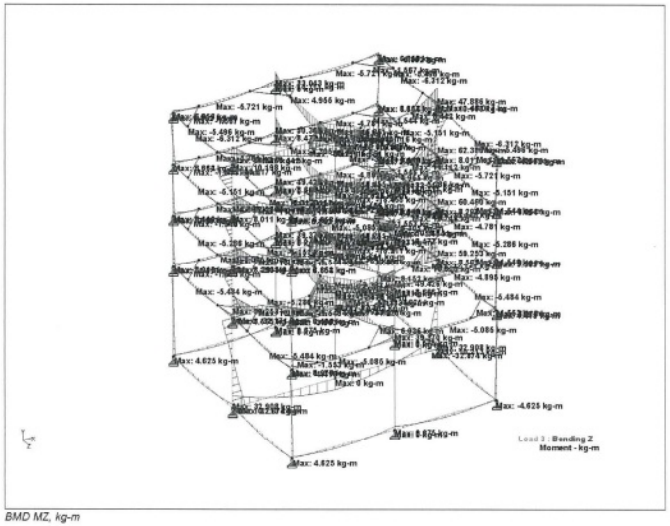
Job Title	Job No	Sheet No 6	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	



BMD MZ, kg-m

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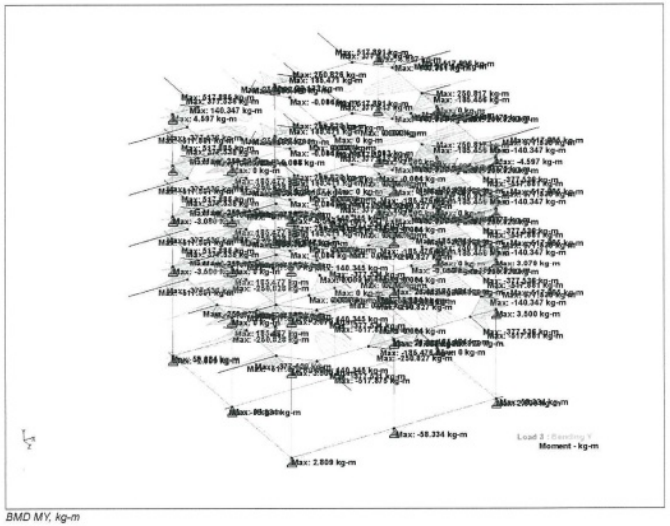
Job Title	Job No	Sheet No 7	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	



BMD MY, kg-m

Print Time/Date: 03/08/2022 15:11 STAAD.Pro CONNECT Edition 22.10.00.153 [For Evaluation Use Only] Print Run 7 of 29

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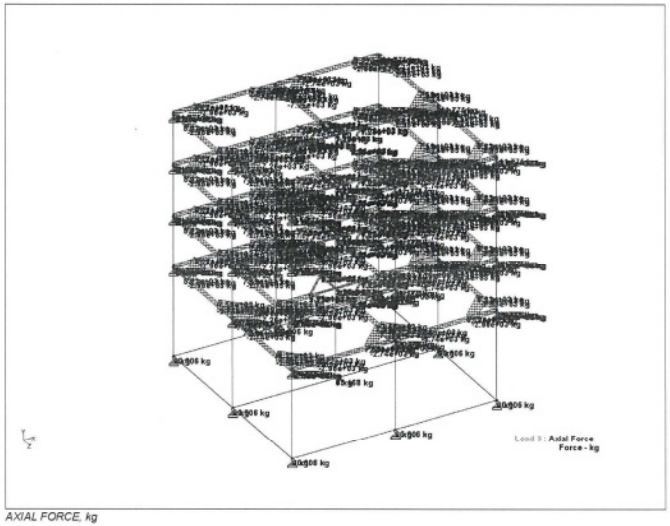
Job No	Sheet No 8	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	



AXIAL FORCE, kg

Node Displacement Summary

	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)
Max X	1344	3:COMBINATIC	0.008	-0.000	-0.001	0.008	-0.000	-0.001	-0.000
Min X	1376	3:COMBINATIC	-0.008	-0.000	-0.001	0.008	-0.000	0.001	0.000
Max Y	1470	2:LOAD CASE	0.000	0.000	0.000	0.000	0.000	0.000	-0.000
Min Y	1485	1:LOAD CASE	-0.000	-0.008	0.000	0.008	-0.000	-0.000	-0.000
Max Z	1442	3:COMBINATIC	0.001	-0.000	0.008	0.008	0.000	-0.001	-0.000
Min Z	1441	3:COMBINATIC	0.001	-0.000	-0.008	0.008	-0.000	0.001	-0.000
Max rX	1442	1:LOAD CASE	0.000	-0.000	0.000	0.000	0.000	-0.000	-0.000
Min rX	1441	1:LOAD CASE	0.000	-0.000	-0.000	0.000	-0.000	0.000	-0.000
Max rY	1441	3:COMBINATIC	0.001	-0.000	-0.008	0.008	-0.000	0.001	-0.000
Min rY	1442	3:COMBINATIC	0.001	-0.000	0.008	0.008	0.000	-0.001	-0.000
Max rZ	1378	1:LOAD CASE	-0.000	-0.003	0.000	0.003	-0.000	0.000	0.000
Min rZ	1343	1:LOAD CASE	0.000	-0.003	0.000	0.003	-0.000	-0.000	-0.000
Max Rst	1344	3:COMBINATIC	0.008	-0.000	-0.001	0.008	-0.000	-0.001	-0.000

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Job No	Sheet No 9	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Beam End Displacement Summary

Displacements shown in italic indicate the presence of an offset

	Beam	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)
Max X	43	1400	3:COMBINATIC	0.008	-0.000	0.001	0.008
Min X	44	1405	3:COMBINATIC	-0.008	-0.000	0.001	0.008
Max Y	5	5	1:LOAD CASE	0	0	0	0
Min Y	89	1295	1:LOAD CASE	0	-0.008	0	0.008
Max Z	42	1452	3:COMBINATIC	0.001	-0.000	0.008	0.008
Min Z	41	1451	3:COMBINATIC	0.001	-0.000	-0.008	0.008
Max Rst	121	1442	3:COMBINATIC	0.001	-0.000	0.008	0.008

Beam Force Detail Summary

Sign convention as diagrams:- positive above line, negative below line except Fx where positive is compression. Distance d is given from beam end A.

				Axial	Shear		Torsion	Bending	
	Beam	L/C	d (m)	Fx (kg)	Fy (kg)	Fz (kg)	Mx (kg'm)	My (kg'm)	Mz (kg'm)
Max Fx	240	3:COMBINATIC	0	8.22E+3	8.342	0.004	0.002	-140.351	-0.089
Min Fx	85	3:COMBINATIC	0	-7.26E+3	95.018	-0.011	0.000	0.001	39.370
Max Fy	91	1:LOAD CASE	0	-183.529	126.568	-0.000	0.000	-0.000	62.386
Min Fy	264	1:LOAD CASE	0.500	-183.528	-126.567	0.000	-0.000	-0.000	62.386
Max Fz	348	3:COMBINATIC	1.000	2.85E+3	-8.063	3.54E+3	0.075	517.891	-4.342
Min Fz	321	3:COMBINATIC	0	2.85E+3	6.703	-3.54E+3	-0.057	517.896	-4.544
Max Mx	43	1:LOAD CASE	0	-69.277	21.071	43.164	0.085	-6.045	8.011
Min Mx	44	1:LOAD CASE	0	-69.275	21.071	-43.164	-0.085	6.046	8.011
Max My	237	3:COMBINATIC	0	2.85E+3	5.951	-3.54E+3	-0.066	517.896	-5.561
Min My	190	3:COMBINATIC	0	2.85E+3	5.951	3.54E+3	0.066	-517.881	-5.561
Max Mz	91	1:LOAD CASE	0	-183.529	126.568	-0.000	0.000	-0.000	62.386
Min Mz	110	1:LOAD CASE	1.000	-11.775	82.901	-0.000	0.000	-0.000	-48.017

Steel Design (Track 0) Checks

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ALL UNITS ARE - KG   METE (UNLESS OTHERWISE Noted)

MEMBER      TABLE        RESULT/      CRITICAL COND/      RATIO/      LOADING/
                          FX            MY                 MZ          LOCATION
=================================================================================

     5  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                          PASS     AISC- H2-1          0.491          3
                     2960.48 T      -377.53           -3.12         0.50

     6  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                          PASS     AISC- H2-1          0.491          3
                     2960.52 T       377.54           -3.12         0.50

     7  ST   H125X125X6.5X9          (JAPANESE SECTIONS)
                          PASS     AISC- H2-1          0.491          3
                     2960.49 T      -377.54           -4.03         0.50
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Job Title	Job No	Sheet No 10	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
8 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.54 T	377.54	-4.03	0.50
13 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.48 T	-377.53	-3.29	0.50
14 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.52 T	377.54	-3.29	0.50
15 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.49 T	-377.54	-4.21	0.50
16 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.54 T	377.54	-4.21	0.50
21 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.48 T	-377.53	-3.34	0.50
22 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.52 T	377.54	-3.34	0.50
23 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.49 T	-377.54	-4.49	0.50
24 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.54 T	377.54	-4.49	0.50
37 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		20.61 C	2.81	4.63	1.75
38 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		20.61 C	-2.81	4.63	1.75
39 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		20.61 C	-2.81	-4.63	1.75
40 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		20.61 C	2.81	-4.63	1.75

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Job Title	Job No	Sheet No 11	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
41 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.39 T	-250.83	-0.29	0.50
42 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.36 T	250.83	-0.29	0.50
43 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	0.42	0.50
44 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.32 T	250.82	0.42	0.50
45 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.39 T	-250.83	-0.29	0.50
46 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.36 T	250.83	-0.29	0.50
47 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	0.38	0.50
48 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.32 T	250.82	0.38	0.50
49 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.39 T	-250.83	-0.70	0.50
50 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.36 T	250.83	-0.70	0.50
51 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	0.39	0.50
52 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.32 T	250.82	0.39	0.50
58 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.017	1
		20.61 C	0.00	32.87	1.75

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Job Title	Job No	Sheet No 12	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
60 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.017	1
		20.61 C	0.00	-32.87	1.75
61 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.026	1
		11.78 C	23.17	-0.00	0.00
63 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.005	1
		11.78 C	3.08	-3.90	0.00
64 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		11.78 C	3.50	-4.42	0.00
65 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.005	1
		11.78 C	-3.08	3.90	0.00
66 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		11.78 C	-3.50	4.42	0.00
67 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.005	1
		11.78 C	3.08	3.90	0.00
68 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		11.78 C	3.50	4.42	0.00
69 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.013	1
		11.78 C	0.00	-29.44	0.00
70 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.015	1
		11.78 C	0.00	-32.17	0.00
71 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.026	1
		11.78 C	-23.17	-0.00	0.00
72 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.034	1
		11.78 C	-29.63	-0.00	0.00
73 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.013	1
		11.78 C	0.00	29.44	0.00

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Job Title	Job No	Sheet No 13	Rev
	Part		
	Ref		
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Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
74 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.015	1
		11.78 C	0.00	32.17	0.00
83 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.182	3
		7262.54 T	0.00	50.37	0.00
84 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.181	3
		7262.54 T	0.00	49.43	0.00
85 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.177	3
		7262.54 T	0.00	39.37	0.00
87 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.04 C	-0.00	-19.64	0.00
88 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.04 C	-0.00	-19.28	0.00
89 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.035	3
		1246.04 C	-0.00	-15.78	0.00
91 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.187	3
		7262.51 T	-0.00	62.39	0.00
92 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.039	3
		1246.05 C	-0.00	-23.62	0.00
93 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.186	3
		7262.51 T	-0.00	60.46	0.00
94 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.039	3
		1246.05 C	-0.00	-22.93	0.00
95 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.186	3
		7262.51 T	-0.00	59.25	0.00
96 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.038	3
		1246.05 C	-0.00	-22.38	0.00

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Job Title	Job No	Sheet No 14	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
103 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.008	1
		11.78 T	-4.60	6.86	1.00
104 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.008	1
		11.78 T	4.60	6.86	1.00
105 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.008	1
		11.78 T	-4.60	-6.86	1.00
106 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.008	1
		11.78 T	4.60	-6.86	1.00
107 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.037	1
		11.78 T	-33.13	0.00	1.00
108 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.037	1
		11.78 T	33.13	0.00	1.00
109 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.022	1
		11.78 T	-0.00	48.02	1.00
110 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.022	1
		11.78 T	-0.00	-48.02	1.00
111 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.001	1
		30.74 C	0.00	-0.00	0.00
116 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.48 T	-377.53	-4.27	0.50
117 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.52 T	377.54	-4.27	0.50
118 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.492	3
		2960.49 T	-377.54	-5.50	0.50
119 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.492	3
		2960.54 T	377.54	-5.50	0.50

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Job Title	Job No	Sheet No 15	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
120 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.39 T	-250.83	-0.76	0.50
121 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.36 T	250.83	-0.76	0.50
122 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	0.13	0.50
123 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.32 T	250.82	0.13	0.50
124 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.174	3
		7262.54 T	0.00	33.04	0.00
125 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.034	3
		1246.04 C	0.00	-13.65	0.12
126 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.181	3
		7262.51 T	-0.00	47.89	0.00
127 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.05 C	-0.00	-18.30	0.00
184 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	517.89	-4.34	0.00
185 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.23 C	0.01	-34.72	1.00
186 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.38 T	-250.82	0.13	0.00
190 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.653	3
		2850.96 C	-517.88	-5.56	0.00
192 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	140.35	-1.57	0.35

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Job Title	Job No	Sheet No 16	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

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MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
193 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.64 C	185.46	0.19	0.71
196 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	517.89	-3.17	0.00
197 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.089	3
		3008.23 C	0.01	-37.72	1.00
198 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.38 T	-250.82	0.42	0.00
202 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.96 C	-517.88	-4.08	0.00
204 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	140.35	-1.54	0.35
205 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.64 C	185.46	0.20	0.71
208 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	517.89	-3.34	0.00
209 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.089	3
		3008.23 C	0.01	-37.39	1.00
210 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.38 T	-250.82	0.38	0.00
214 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.96 C	-517.88	-4.26	0.00
216 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	140.35	-1.55	0.35
217 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.64 C	185.46	0.19	0.71

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Job Title	Job No	Sheet No 17	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
220 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	517.89	-3.41	0.00
221 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.23 C	0.01	-36.72	1.00
222 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.38 T	-250.82	0.39	0.00
226 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.96 C	-517.88	-4.54	0.00
228 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	140.35	-1.55	0.35
229 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.64 C	185.46	0.19	0.71
234 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.33 T	250.82	0.13	0.00
235 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.56 T	377.54	-4.27	0.00
236 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.181	3
		7262.48 T	-0.00	47.89	0.50
237 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.653	3
		2850.96 C	517.90	-5.56	0.00
240 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.70 C	-140.35	-1.57	0.35
241 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.58 C	-185.46	0.19	0.71
242 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.92 C	-517.88	-4.34	0.00

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Job No	Sheet No 18	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1-4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

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MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
243	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.492	3
		2960.48 T	-377.53	-5.50	0.00
246	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.653	3
		2850.94 C	-517.87	-5.56	1.00
249	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.492	3
		2960.53 T	377.54	-5.50	0.00
250	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.491	3
		2960.51 T	-377.54	-4.27	0.00
251	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.653	3
		2850.94 C	517.88	-5.56	1.00
252	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.48	0.19	0.00
253	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.57 C	140.34	-1.57	0.35
258	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.56 C	-185.47	0.19	0.00
259	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	-140.35	-1.57	0.35
262	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.342	3
		2741.33 T	250.82	0.42	0.00
263	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.491	3
		2960.56 T	377.54	-3.12	0.00
264	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.187	3
		7262.48 T	-0.00	62.39	0.50
265	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.96 C	517.90	-4.08	0.00

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Job No	Sheet No 19	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1-4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
266	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.92 C	-517.88	-3.17	0.00
267	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.491	3
		2960.48 T	-377.53	-4.03	0.00
270	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	-517.87	-4.08	1.00
273	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.491	3
		2960.53 T	377.54	-4.03	0.00
274	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- E2-1	0.491	3
		2960.51 T	-377.54	-3.12	0.00
275	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	517.88	-4.08	1.00
278	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.70 C	-140.35	-1.54	0.35
279	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.58 C	-185.46	0.20	0.71
280	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.48	0.20	0.00
281	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.57 C	140.34	-1.54	0.35
286	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.56 C	-185.47	0.20	0.00
287	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	-140.35	-1.54	0.35
290	ST H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.33 T	250.82	0.38	0.00

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Job No	Sheet No 20	Rev
Part		
Ref		
By	Date 08-Apr-22	Chd
File Box C1-4 no plate add br	Date/Time 03-Aug-2022 15:07	

Job Title

Client

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
291 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.56 T	377.54	-3.29	0.00
292 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.186	3
		7262.48 T	-0.00	60.46	0.50
293 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.96 C	517.90	-4.26	0.00
294 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.92 C	-517.88	-3.34	0.00
295 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.48 T	-377.53	-4.21	0.00
298 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	-517.87	-4.26	1.00
301 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.53 T	377.54	-4.21	0.00
302 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.51 T	-377.54	-3.29	0.00
303 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	517.88	-4.26	1.00
306 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.70 C	-140.35	-1.55	0.35
307 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.58 C	-185.46	0.19	0.71
308 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.48	0.19	0.00
309 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.57 C	140.34	-1.55	0.35

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Job No	Sheet No 21	Rev
Part		
Ref		
By	Date 08-Apr-22	Chd
File Box C1-4 no plate add br	Date/Time 03-Aug-2022 15:07	

Job Title

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Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
314 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.56 C	-185.47	0.19	0.00
315 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	-140.35	-1.55	0.35
318 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.33 T	250.82	0.39	0.00
319 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.56 T	377.54	-3.34	0.00
320 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.186	3
		7262.48 T	-0.00	59.25	0.50
321 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.96 C	517.90	-4.54	0.00
322 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.92 C	-517.88	-3.41	0.00
323 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.48 T	-377.53	-4.49	0.00
326 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	-517.87	-4.54	1.00
329 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.53 T	377.54	-4.49	0.00
330 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.491	3
		2960.51 T	-377.54	-3.34	0.00
331 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	517.88	-4.54	1.00
334 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.70 C	-140.35	-1.55	0.35

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Job Title	Job No	Sheet No 22	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
335 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.58 C	-185.46	0.19	0.71
336 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.48	0.19	0.00
337 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.57 C	140.34	-1.55	0.35
342 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.56 C	-185.47	0.19	0.00
343 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.339	3
		8218.63 C	-140.35	-1.55	0.35
344 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	-0.76	0.00
345 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.34 T	250.82	-0.76	0.00
346 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.03 C	-0.00	-18.30	0.50
347 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	-517.88	-4.34	1.00
348 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	517.89	-4.34	1.00
349 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.20 C	0.01	-34.72	0.00
350 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.087	3
		3008.20 C	0.01	-33.39	1.00
351 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.087	3
		3008.26 C	0.01	-33.39	0.00

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124/305 ม.1 ถ.พระองค์เจ้าสาย
ต.บึงยี่โถ อ.ธัญบุรี จ.ปทุมธานี 12130

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Job Title	Job No	Sheet No 23	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
352 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.174	3
		7262.53 T	0.00	33.04	0.50
353 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.034	3
		1246.07 C	0.00	-13.65	0.33
354 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.57 C	-185.47	0.18	0.71
355 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.47	0.18	0.71
356 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.036	3
		1246.03 C	-0.00	-15.86	0.41
357 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.036	3
		1245.99 C	-0.00	-15.86	0.41
358 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.036	3
		1246.10 C	-0.00	-15.84	0.24
359 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.036	3
		1246.06 C	-0.00	-15.84	0.24
360 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.61 C	-185.48	0.18	0.00
361 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.65 C	185.47	0.18	0.00
362 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	-0.29	0.00
363 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.34 T	250.82	-0.29	0.00
364 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.039	3
		1246.03 C	-0.00	-23.62	0.50

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Job Title	Job No	Sheet No 24	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1-4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
365 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	-517.88	-3.17	1.00
366 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	517.89	-3.17	1.00
367 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.089	3
		3008.20 C	0.01	-37.72	0.00
368 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.20 C	0.01	-36.64	1.00
369 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.26 C	0.01	-36.64	0.00
370 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.182	3
		7262.53 T	0.00	50.37	0.50
371 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.07 C	-0.00	-19.64	0.50
372 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.57 C	-185.47	0.19	0.71
373 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.47	0.19	0.71
374 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.03 C	-0.00	-18.45	0.41
375 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1245.99 C	-0.00	-18.45	0.41
376 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.10 C	-0.00	-18.45	0.29
377 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.06 C	-0.00	-18.45	0.29

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Job Title	Job No	Sheet No 25	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1-4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
378 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.61 C	-185.48	0.19	0.00
379 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.65 C	185.47	0.19	0.00
380 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	-0.29	0.00
381 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.34 T	250.82	-0.29	0.00
382 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.039	3
		1246.03 C	-0.00	-22.93	0.50
383 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	-517.88	-3.34	1.00
384 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	517.89	-3.34	1.00
385 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.089	3
		3008.20 C	0.01	-37.39	0.00
386 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.20 C	0.01	-36.40	1.00
387 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.26 C	0.01	-36.40	0.00
388 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.181	3
		7262.53 T	0.00	49.43	0.50
389 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.07 C	-0.00	-19.28	0.50
390 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.57 C	-185.47	0.19	0.71

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Job Title	Job No	Sheet No 26	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
391 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.47	0.19	0.71
392 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.03 C	-0.00	-18.21	0.41
393 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1245.99 C	-0.00	-18.21	0.41
394 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.10 C	-0.00	-18.21	0.29
395 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.06 C	-0.00	-18.21	0.29
396 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.61 C	-185.48	0.19	0.00
397 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.65 C	185.47	0.19	0.00
398 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.37 T	-250.83	-0.70	0.00
399 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.342	3
		2741.34 T	250.82	-0.70	0.00
400 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.038	3
		1246.03 C	-0.00	-22.38	0.50
401 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.93 C	-517.88	-3.41	1.00
402 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.652	3
		2850.94 C	517.89	-3.41	1.00
403 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.20 C	0.01	-36.72	0.00

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Job Title	Job No	Sheet No 27	Rev
	Part		
	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
404 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.20 C	0.01	-34.93	1.00
405 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.088	3
		3008.26 C	0.01	-34.93	0.00
406 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.177	3
		7262.53 T	0.00	39.37	0.50
407 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.035	3
		1246.07 C	-0.00	-15.78	0.50
408 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.57 C	-185.47	0.18	0.71
409 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.62 C	185.47	0.18	0.71
410 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.03 C	-0.00	-17.36	0.41
411 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1245.99 C	-0.00	-17.36	0.41
412 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.10 C	-0.00	-17.38	0.24
413 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.037	3
		1246.06 C	-0.00	-17.38	0.24
414 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.61 C	-185.48	0.18	0.00
415 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-2	0.375	3
		7585.65 C	185.47	0.18	0.00
416 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.000	1
		12.92 T	-0.00	-0.00	0.00

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Job No	Sheet No 28	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
419 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.005	1
		11.78 C	-3.08	-3.90	0.00
420 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.006	1
		11.78 C	-3.50	-4.42	0.00
423 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.001	1
		26.04 T	0.00	-0.00	0.00
424 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.001	1
		28.44 T	-0.00	-0.00	0.00
432 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.070	1
		0.00 T	-58.33	9.37	2.00
433 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.070	1
		0.00 T	58.33	9.37	2.00
434 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.071	1
		0.00 T	-58.33	10.21	2.00
435 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.071	1
		0.00 T	58.33	10.21	2.00
436 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.016	1
		0.00 T	-0.00	32.91	0.00
437 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.016	1
		0.00 T	-0.00	32.91	2.00
438 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.071	1
		0.00 T	-58.33	10.21	0.00
439 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.071	1
		0.00 T	58.33	10.21	0.00
440 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.070	1
		0.00 T	-58.33	9.37	0.00

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Job No	Sheet No 29	Rev	
Part			
Job Title	Ref		
	By	Date 08-Apr-22	Chd
Client	File Box C1 -4 no plate add br	Date/Time 03-Aug-2022 15:07	

Steel Design (Track 0) Checks Cont...

ALL UNITS ARE - KG METE (UNLESS OTHERWISE Noted)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
441 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.034	1
		11.78 C	29.63	0.00	1.00
442 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.012	1
		20.61 T	-9.85	0.00	1.75
443 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H1-3	0.070	1
		0.00 T	58.33	9.37	0.00
445 ST	H125X125X6.5X9		(JAPANESE SECTIONS)		
		PASS	AISC- H2-1	0.012	1
		20.61 T	9.85	0.00	1.75

Failed Members

There is no data of this type.

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4.4 Design Thickness of plate

Steel Plate Thickness	Project: NavaNakorn	Sheet	1 of 1
	Project no.:	Designer	KPR
	Subject: Steel Plate Thinckness	Checker	BLK
		Approve	
		date	03/08/2022

CALCULATION FOR STEEL PLATE THICKNESS

From Equation

S = M/Fb

M	=	Moment, Kg-m		
Fb	=	Allowable Flexure Stress = 0.60Fy, ksc.		
Fy	=	Yield Stress, A36	= 2400	ksc.
S	=	Section of Modulus = I/C		
I	=	Moment of Inertia = 1/12 bt^3		
C	=	Distance to neutrual axis = t/2		

Steel Plate Size

b	=	Width	=	1000	mm
h	=	Length	=	2000	mm
t	=	Thickness			

1. Maximum Moment

$M = \frac{WL^2}{8}$, W = 4500 kg/m2 ; from ative pressure

L = 1 m

= 562.5 kg-m

2. Flexure Equation

Fb = 0.6 Fy kcs

= 1440 kcs

3. Use Flexure Equation Solve for thickness

S	=	M/Fb
I/C	=	M/Fb
bt^3/12 / t/2	=	M/Fb
bt^3/12 / t/2	=	M/Fb
bt^2/6	=	M/Fb
t^2	=	6M/Fb*b
t	=	sqrt(6M/Fb*b)
	=	15.30931089 mm

SO use Steel Plate Thickness 16 mm

[redacted]

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5. APPENDICES

APPENDIX A: SOIL INVESTIGATION REPORT

APPENDIX B: THEORY FOR REFERENCE

APPENDIX C: ENGINEER LICENSE

[redacted]

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124/305 ม.1 ถ.พระองค์เจ้าสาย
ต.บึงยี่โถ อ.ธัญบุรี จ.ปทุมธานี 12130

APPENDIX A: SOIL INVESTIGATION REPORT

ตารางสรุปผลทดสอบ

BOULTER STEWART LTD.
บริษัท โบลเตอร์ สจ๊วต จำกัด

หลุมเจาะ : BH-01

เจ้าของงาน : บริษัท ทีอาร์ซี คอนสตรัคชั่น จำกัด (มหาชน) **โครงการที่ :** BSL-22-19414

โครงการ : วางระบบจำหน่ายก๊าซธรรมชาติไปยัง กลุ่มลูกค้าเขตส่งเสริมอุตสาหกรรมนวนคร จังหวัดนครราชสีมา **วันที่เริ่มเจาะ :** 10 มี.ค. 65

สถานที่ : GATE STATION อุตสาหกรรมนวนคร จังหวัดนครราชสีมา **วันที่เจาะเสร็จ :** 10 มี.ค. 65

ตำแหน่งเจาะ N : 14.894085 **E :** 101.901455 **ระดับผิวดิน :** - **เมตร.** **วันที่ทดสอบ LAB. :** 14-19/3/2022

ค่าระดับน้ำ ณ.วันที่เจาะ : -1.00 **เมตร.** **ความลึกหลุมเจาะ :** 8.50 **เมตร.** **เจาะสำรวจโดย :** จักพัฒน์

วัสดุกับ ตัวอย่างที่	ความลึก (ม.) จาก	ถึง	RECOVER. ซม.	จำแนกประเภทดิน [USCS]	ขนาดคละ (% ร่อนผ่านตะแกรง) #4	#10	#40	#200	ความชื้นธรรมชาติ (%)	ATTERBERG LIMITS AND INDICES LL (%)	PL (%)	PI (%)	LI	ความหนาแน่นรวม (ตัน/ม.³)	Su (1/2 qu) (ตัน/ม.²) PP	UC Qu/2	SPT-N VALUE [จำนวนครั้ง/ฟุต]
SS -1	0.00	0.45	15	CL	97	93	87	71	17	30	17	13	0.00	1.93			11
SS -2	0.50	0.95	16	CL	96	92	85	69	12	-		-	-	1.92			11
SS -3	1.00	1.45	15	CL	94	90	85	61	10	30	15	15	-0.33	1.86			6
SS -4	1.50	1.95	17	CL	95	91	86	67	11	-		-	-	1.90			7
ST -1	2.00	2.30	30	CL	98	96	93	59	14	35	12	23	0.09	1.99		31.38	
SS -5	2.50	2.95	25	CL	100	103	257	824	14	31	18	13	-0.31	1.97			16
SS -6	3.00	3.45	29	CL	100	100	100	92	14	-		-	-	1.99			20
ST -2	4.00	4.30	30	CL	91	90	89	61	19	35	20	15	-0.07	2.00		2.32	
SS -7	4.50	4.95	20	CL	99	98	97	69	21	37	21	16	0.00	1.96			16
SS -8	6.00	6.45	30	CL	100	100	99	95	15	33	19	14	-0.29	1.98			20
SS -9	7.50	7.80	25	SC	100	100	79	44	18	-		-	-	2.05			73
SS -10	8.50	8.50	NR	-	-	-	-	-	-	-		-	-	-			50 /0
SS -11	8.50	8.50	NR	Rock	-	-	-	-	-	-		-	-	-			

USCS = UNIFIED SOIL CLASSIFICATION SYSTEM PI = PLASTICITY INDEX Su = UNCONFINED SHEAR STRENGTH
LL = LIQUID LIMIT LI = LIQUIDITY INDEX UC = UNCONFINED COMPRESSION TEST
PL = PLASTIC LIMIT SPT = STANDARD PENETRATION TEST PP = POCKET [redacted]

TRC

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ตารางสรุปผลทดสอบ

BOULTER STEWART LTD.
บริษัท โบลเตอร์ สจ๊วต จำกัด

หลุมเจาะ : BH-02

เจ้าของงาน : บริษัท ทีอาร์ซี คอนสตรัคชั่น จำกัด (มหาชน) **โครงการที่ :** BSL-22-19414

โครงการ : วางระบบจำหน่ายก๊าซธรรมชาติไปยัง กลุ่มลูกค้าเขตส่งเสริมอุตสาหกรรมนวนคร จังหวัดนครราชสีมา **วันที่เริ่มเจาะ :** 9 มี.ค. 65

สถานที่ : GATE STATION อุตสาหกรรมนวนคร จังหวัดนครราชสีมา **วันที่เจาะเสร็จ :** 9 มี.ค. 65

ตำแหน่งเจาะ N : 14.893977 **E :** 101.901637 **ระดับผิวดิน :** - **เมตร.** **วันที่ทดสอบ LAB. :** 14-19/3/2022

ค่าระดับน้ำ ณ.วันที่เจาะ : -3.00 **เมตร.** **ความลึกหลุมเจาะ :** 8.00 **เมตร.** **เจาะสำรวจโดย :** จักพัฒน์

วัสดุกับ ตัวอย่างที่	ความลึก (ม.) จาก	ถึง	RECOVER. ซม.	จำแนกประเภทดิน [USCS]	ขนาดคละ (% ร่อนผ่านตะแกรง) #4	#10	#40	#200	ความชื้นธรรมชาติ (%)	ATTERBERG LIMITS AND INDICES LL (%)	PL (%)	PI (%)	LI	ความหนาแน่นรวม (ตัน/ม.³)	Su (1/2 qu) (ตัน/ม.²) PP	UC Qu/2	SPT-N VALUE [จำนวนครั้ง/ฟุต]
SS -1	0.00	0.45	15	CL	93	89	83	65	14	38	18	20	-0.20	1.89			8
SS -2	0.50	0.95	17	CL	92	86	77	58	10	-		-	-	1.91			15
SS -3	1.00	1.45	25	CL	97	93	86	53	15	35	19	16	-0.25	1.99			32
SS -4	1.50	1.95	11	CL	98	95	88	71	10	-		-	-	1.90			8
ST -1	2.00	2.30	30	CL	100	98	95	51	12	31	13	18	-0.06	2.00		30.44	
SS -5	2.50	2.95	21	CL	100	100	99	87	14	38	20	18	-0.33	1.90			11
SS -6	3.00	3.45	20	CL	100	100	100	89	12	-		-	-	1.95			10
ST -2	4.00	4.30	30	CL	100	100	100	88	10	37	18	19	-0.42	1.99		7.24	
SS -7	4.50	4.95	30	CL	100	100	100	70	22	31	16	15	0.40	1.99			24
SS -8	6.00	6.45	25	CL	100	100	99	56	13	-		-	-	1.95			19
SS -9	7.50	7.65	15	SC	99	98	97	43	13	30	15	15	-0.13	2.02			68 /15
SS -10	8.00	8.00	NR	-	-	-	-	-	-	-		-	-	-			50 /0
SS -11	8.00	8.00	NR	Rock	-	-	-	-	-	-		-	-	-			

USCS = UNIFIED SOIL CLASSIFICATION SYSTEM PI = PLASTICITY INDEX Su = UNCONFINED SHEAR STRENGTH
LL = LIQUID LIMIT LI = LIQUIDITY INDEX UC = UNCONFINED COMPRESSION TEST
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[redacted]

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APPENDIX B: THEORY FOR REFERENCE

Using the procedure just described for strut loads observed from the Berlin subway cut, Munich subway cut, and New York subway cut, Peck (1969) provided the envelope of apparent-lateral-pressure diagrams for design of cuts in *sand*. This envelope is illustrated in Figure 10.5, in which

$$\sigma_a = 0.65\gamma H K_a \tag{10.1}$$

where

γ = unit weight
H = height of the cut
K_a = Rankine active pressure coefficient = $\tan^2(45 - \phi'/2)$
ϕ' = effective friction angle of sand

Cuts in Clay

In a similar manner, Peck (1969) also provided the envelopes of apparent-lateral-pressure diagrams for cuts in *soft to medium clay* and in *stiff clay*. The pressure envelope for soft to medium clay is shown in Figure 10.6 and is applicable to the condition

$$\frac{\gamma H}{c} > 4$$

where c = undrained cohesion ($\phi = 0$).

The pressure, σ_a, is the larger of

$$\sigma_a = \gamma H\left[1 - \left(\frac{4c}{\gamma H}\right)\right]$$

and

$$\sigma_a = 0.3\gamma H \tag{10.2}$$

where γ = unit weight of clay.

The pressure envelope for cuts in stiff clay is shown in Figure 10.7, in which

$$\sigma_a = 0.2\gamma H \text{ to } 0.4\gamma H \qquad \text{(with an average of } 0.3\gamma H\text{)} \tag{10.3}$$

is applicable to the condition $\gamma H/c \leq 4$.

[redacted]

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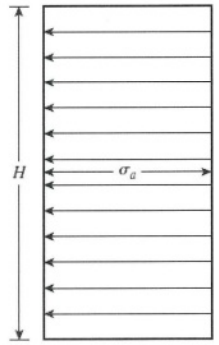

Figure 10.5 Peck's (1969) apparent-pressure envelope for cuts in sand

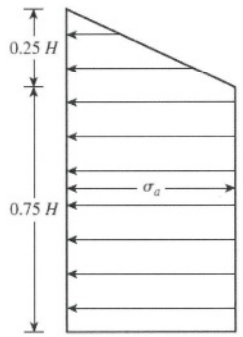

Figure 10.6 Peck's (1969) apparent-pressure envelope for cuts in soft to medium clay

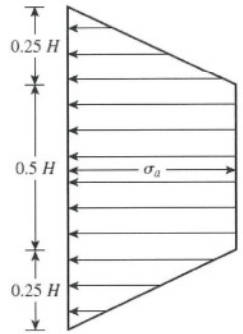

Figure 10.7 Peck's (1969) apparent-pressure envelope for cuts in stiff clay

When using the pressure envelopes just described, keep the following points in mind:

1. They apply to excavations having depths greater than about 6 m.
2. They are based on the assumption that the water table is below the bottom of the cut.
3. Sand is assumed to be drained with zero pore water pressure.
4. Clay is assumed to be undrained and pore water pressure is not considered.

[redacted]

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Section of Modulus

Section Modulus Equations and Calculators Common Shapes

Strength of Materials | Beam Deflection and Stress

Section modulus is a geometric property for a given cross-section used in the design of beams or flexural members. Other geometric properties used in design include area for tension, radius of gyration for compression, and moment of inertia for stiffness. Any relationship between these properties is highly dependent on the shape in question. Equations for the section moduli of common shapes are given below. There are two types of section moduli, the elastic section modulus (S) and the plastic section modulus (Z).

For general design, the elastic section modulus is used, applying up to the yield point for most metals and other common materials.

The elastic section modulus is defined as S = I / y, where I is the second moment of area (or moment of inertia) and y is the distance from the neutral axis to any given fiber. It is often reported using y = c, where c is the distance from the neutral axis to the most extreme fiber , as seen in the table below. It is also often used to determine the yield moment (M_y) such that $M_y = S \times \sigma_y$, where σ_y is the yield strength of the material.

[redacted]

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Area Moment of Inertia Section Properties Rectangle Calculator

Engineering Calculators | Section Properties Menu
Engineering Metals and Materials | Strength of Materials

Area Moment of Inertia Section Properties Rectangle Calculator

Area Moment of Inertia Section Properties of Rectangular Feature Calculator and Equations. This engineering calculator will determine the section modulus for the given cross-section. This engineering data is often used in the design of structural beams or structural flexural members.

Description	Equation
Area Moment of Inertia Section Properties = I	$\frac{bd^3}{12}$
Section Modulus = Z = I/y	$\frac{bd^2}{6}$
Radius of Gyration	$\frac{d}{\sqrt{12}}$
A = area	A = bd
y = Distance to neutral axis	y = d/2

Ref. Engineers Edge, LLC. (2022).Area Moment of Inertia Section Properties Rectangle Calculator, 3 August 2022.

From. https://www.engineersedge.com/calculators/section_square_case_6.htm

[redacted]

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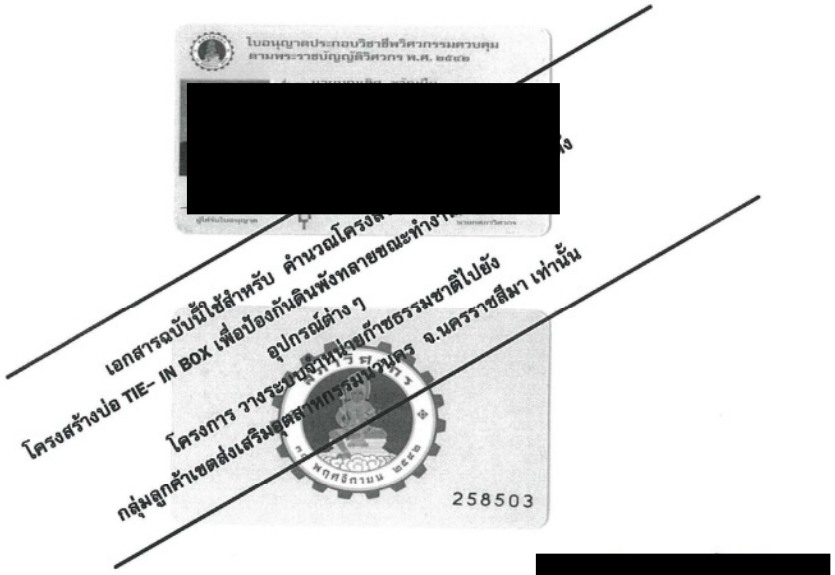
APPENDIX C: ENGINEER LICENSE



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ภาคผนวก 14-5
เอกสารขั้นตอนการปฏิบัติงานเกี่ยวกับการระงับเหตุฉุกเฉิน
(Emergency Safety Plan Procedure)

Ref. No. TPA-EXT-N20-005-TRC-PTT-TR-0282
Received: 20 May 2022

PTT PUBLIC COMPANY LIMITED

โครงการวางระบบจำหน่ายก๊าซธรรมชาติ ไปยัง
กลุ่มลูกค้าเขตส่งเสริมอุตสาหกรรมนวนคร จ.นครราชสีมา

DOCUMENT NO. : **PR-X-2202.02-6807-005**

DOCUMENT TITLE : **EMERGENCY RESPONSE MANAGEMENT PROCEDURE**

DOCUMENT REVIEW		
☑	E	Work may proceed.
☐	F	Work may proceed. Submit final document.
☐	G	Revise and resubmit. Work may proceed subject to incorporation of changes indicated.
☐	H	Revise and resubmit. Work may not proceed.
☐	I	Review not required. Work may proceed.
BY:		DATE:

Contract No. ปตท.ธกก./2/58/65		Project No. 2202.02	TRC Project No. 2022-323		Page 1 of 35
		[redacted]			
0	18/05/2022				Issued for Construction
C	13/05/2022				Re-issued for Approval
B	09/05/2022				Re-issued for Approval
A	21/04/2022				Issued for Approval
Rev.	Date	Originator	Checked By	Approved By	Revision Status

TRC CONSTRUCTION PUBLIC COMPANY LIMITED
No. 8 Soi Sukhaphiban 5 Soi 32, Kwang Tha-rang, Bangkhen, Bangkok, 10220 Thailand
Tel. 0 2022 7777 ext. 4810 | Fax. 0 2022 7788

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1. PURPOSE

The purpose of this procedure is to provide detailed guidance to all Emergency Response Members to effectively control an emergency situation effectively throughout the project. Specific requirements, roles and responsibilities, and action plans are documented in this plan to minimize the damages of an emergency incident.

This procedure defines the Project requirements for emergency preparedness, response, training and awareness required for dealing with emergencies effectively on the Project.

This procedure covers all types of emergencies including, but not limited to incidents and accidents involving:

- Fatality or major injury to personnel
- Medical cases requiring resources not readily available at the work location
- Major gas leak, fire/explosion
- Adverse weather conditions
- Property/equipment damage
- Environmental pollution or damage

This document shall be distributed and/or communicated, via safety inductions and tool box talks, to all Managers, Supervisors, Foremen, Employees, Visitors and Sub-contractors on site.

2. DEFINITIONS

- **ACCIDENT**

  An unplanned event which occurs without prior warning at a place. An undesired event, which results in harm to people, the environment, damage to property or causes loss of production.

- **NEAR-MISS EVENT**

  An event or chain of events which, under different circumstances, could have caused injury, damage or loss to people, assets, the environment or third parties.

- **EMERGENCY**

  An emergency is an event which by nature requires immediate action, which poses a threat to the safety of workers, the public, the environment or property at a facility or site and which can be brought under control using the resources and procedures for emergency response in place for the facility or site.

  Management of an emergency is defined as “the planned, efficient use and control of resources to mitigate any consequences resultant from an emergency”.

- **EMPLOYEE**

  Employee is any person engaged in activities for the benefit of the Contractor and who receives payment, even on a temporary basis, from either the Contractor or from a Sub-Contractor/Vendor.

- **EMPLOYMENT**

  Means all work, or any activities, performed in carrying out an assignment at the request of the Contractor or sub-contractor, including related activities not specifically covered by the assignment or request.

- **EXPOSURE HOURS**

  Exposure hours represent the total hours of employment including overtime and training but excluding leave, sickness and other absence. Only those hours worked under direct control by the Contractor are relevant and considered as exposure hours and are considered as work related.

- **INCIDENT**

  An occurrence or event, either human-caused or natural phenomena, that requires action by emergency service personnel to prevent or minimize loss of life or damage to property and /or natural resources.

- **FATALITY**

  A Fatality is a death resulting from a work-related injury, regardless of the time intervening between injury and death.

- **WORK RELATED INJURY**

  Any effect to a person as a direct result of the work environment. This includes physical harm, injury or health.

- **ERT**

  Emergency Response Team.

- **ERC**

  Emergency Response Coordinator.

3. INDIVIDUAL ROLES AND RESPONSIBILITIES

3.1 The Construction Manager

Is responsible as the Emergency Response Coordinator (ERC) for:

- Ensuring effective coordination between Emergency Services and the emergency site
- Ensuring continuous coverage of the communication system.
- Informing nominated members of the Emergency Response Team (ERT) of the emergency event.
- Coordinating overall emergency response actions.
- Ensuring accident investigations are carried out, reported and recommendations for avoidance of future occurrences are implemented.
- If, for any reason, the Construction Manager is unavailable the HSE Manager will assume the responsibilities of the ERC.

3.2 HSE Manager

Is responsibility to ensure that Emergency Plans/Procedures are in place and well-coordinated and communicated to all employees. Emergency drills/exercises should be conducted to ascertain and evaluate the awareness of each individual during an emergency. The HSE Manager shall also be responsible for the following:

- Develop an emergency plan/procedure for the site
- Ensure that Emergency Team personnel are trained.
- Instruct employees on the emergency actions
- Deputy Emergency Response Coordinator (ERC), in case of the Construction Manager is unavailable.
- Verbal notification of the emergency to the OWNER/Consultant immediately and follow up with a detailed report.
- Immediately notify the ERC, the Administration Manager, HSE Supervisor and Security Supervisor.
- Carry out an investigation of the causes of the emergency, assessment of the emergency response and issue reports with recommendations.

3.3 Project Manager/ Project Engineer

Will provide support to the Emergency Response Coordinator (ERC) and will be responsible for monitoring employee compliance to emergency instructions and to this plan.

- Deployment of additional resources to assist.
- Notification of the emergency to the Contractor's Project Manager

Provide any additional logistical support, advice and information as required.

- Initiate Incident Investigation and ensure timely follow up.
- If for any reason the Project Manager is not available, the ERC and Construction
- Manager will jointly or individually take on the responsibilities of the Project
- Manager.

3.4 Safety Officer(s)

- Notify Contractors ambulance and medical team and direct them to the scene of the emergency.
- Mobilize immediately to the scene of the emergency and assist/co-ordinate the activities to stabilize the situation.
- Barrier off the scene of the emergency and maintain the control of the area until after an investigation is carried out.
- Co-ordinate the Contractors medical team in giving assistance to injured parties and medevac them to hospital as required.
- Assist/co-ordinate local emergency services in accessing the area and addressing the situation.
- Act as a site liaison to the ERC and all related personnel.

3.5 Site Administration

- Acting as a liaison between the site and the site office; i.e. be a focal point for the ERT and contact to local emergency services.
- Arranging any other assistance, vehicles and materials as may be requested by the ERT.

3.6 Construction Supervisors/Foremen

- The safety of his crew, the public, equipment, property, materials and the environment.
- Evacuating all persons out of the emergency area.
- Notifying the Construction Manager and HSE Manager.
- Co-ordinating crew first-aider and fire warden to assist as necessary.
- Carrying out a muster check on his crew.
- Securing the area and standing by for the ERT and/or emergency services to arrive.
- Participate in the investigation of the incident.

3.7 All Project personnel

- Familiarization with the emergency instructions and its courses of action
- Provide full cooperation and support

4. EXECUTION

4.1 Emergency Response Plan

4.1.1 Aim and authority

The aim of the procedure is to define the detail control, co-ordination and response to any emergency occurrence within the site office and construction areas which is, or could be, a threat to life and property or the environment. Consideration of most elements of a threat / emergency need to be reviewed as appropriate before any action is put in place. This procedure covers all OWNER, Consultant, Contractor, Subcontractor staff and Visitors.

4.1.2 Emergency Response Management Team

For most emergencies the Control Centre will be based in the site Office. Other areas will be used dependent on the type of emergency taking place.

4.1.3 Emergency Assembly Point

An Emergency Assembly Point shall be located inside a construction site that safe for employees to vacate the site area. All project personnel shall be informed for designated Emergency Assembly Point during the safety induction. For specific construction activities outside the site boundary, an Emergency Assembly Point shall be defined for each work area.

4.1.4 General Evacuation and Shelter Requirements

a) Construction and relevant areas have been assigned to all departments and documented on a site plan. The specific site plan may be created and posted at working area as areas are developed:

b) Evacuation routes to the Emergency Assembly Points are identified and posted throughout the construction areas, so that in the event of an emergency evacuation, employees can easily determine the nearest Emergency Assembly Point.

c) In the event of a fire, any employee is authorized to activate the alarms. These alarms are designed to start evacuation to the outside Emergency Assembly Point. Where it is impractical to post up the site plan, the Assembly Point shall be determined in pre-start Tool Box Talks. Intentionally initiating a false alarm will result in disciplinary action.

d) When an alarm to evacuate or take shelter is sounded all employees must:

- If operating equipment, turn their machines off by normal stopping procedure, or hit the Emergency Stop Button when available.
- Evacuate to the designated Emergency Assembly Point after stop/secure machine in safe condition.

e) The supervisor or Emergency Response Team member performs a count of all employees in the Emergency Assembly Point. If any employee is not at the designated area, the supervisor or his designee waits for the safety officer to arrive for the head count check. At this time, the following information is provided to the safety officer:

- Whether all employees are there or accounted for (e.g., sick, etc.).
- Name of any missing individual.
- General physical description of any missing individual.
- Where the individual was last seen.
- Names of individuals who are present in the Emergency Assembly Point, but were not designated to report there. Another supervisor may be reporting this person as missing and might possibly send someone on an unnecessary search. The program is reviewed with any employee reporting to the wrong Emergency Assembly Point.

f) Under no circumstances is anyone allowed to stay in, or re-enter an area of the construction site that is under a fire emergency evacuation. This is important when someone is presumed missing. The supervisor or EMERGENCY RESPONSE TEAM member must ensure that no one enters the construction site to search for missing individuals. The safety officer determines who is missing and report this information to the HSE Manager immediately. The HSE Manager or safety officer relay the following information to the fire department responding to the call:

1. Missing employee's name and physical description.
2. When and where the employee was last seen.

No one is allowed to return to the area until the highest-ranking management representative on site has ensured that there is no longer danger present. This decision is based on input from any expert emergency responders, and/or the HSE Manager to ensure that all danger has passed.

4.1.5 Emergency Response Analysis

When considering the emergency events that could possibly impact the construction site like the Project and necessitate an emergency response the following list of identified loss exposures was put together:

1. Accident/ injury to employees of Contractor or visitor.
2. Vehicle accidents
3. Blasting explosions - explosives stored and used for construction
4. Fire - Fuel depots and systems, Warehouse, Workshops, Equipment including tire fires, and office areas.
5. Chemical spill /Leak

6. Bomb threat
7. Armed robbery
8. Civil unrest
9. Severe weather
10. Rain Storm
11. Earthquake,
12. Utilities failure.
13. Environmental Incidents - chemicals, fuel, oils and waste
14. Evacuation of buildings/ areas

This list was compiled using the knowledge of emergency personnel and onsite management people. The Construction Manager and HSE Manager then considered and evaluated the risks to highlight the emergency events that should be formatted into the response plan procedure.

Safety instructions are created and distributed across site and to the Emergency Response Coordinator and explain the contents of procedure to understand his role and responsibility.

4.1.6 Identification of requirements

The following functions are requested to counter effects of a threatening event:

- **Control**
  Decisions for actions are made by the Emergency Response Coordinator if and when a quick decision / action are required. The Emergency Response Team carries the responsibility for co-coordinating actions including other organizations in accordance with the needs of the situation. The HSE Manager will assist and advise the Emergency Response Coordinator as necessary.
- **Support Co-ordination**
  This gives the Safety officer or any member of the Emergency Response Management Team for the authority to co-operate and direct personnel and to require any vehicle or equipment necessary in accordance with requirements imposed by the threat.
- **Warning and Information**
  Warning information is the provision of advice to the team that an event is likely to occur. This information relates to either the development of the event, the event itself, or the effects of an event.
- **Emergency Exits**
  1. All exits must be clearly marked and cleared from any obstruction.
  2. Any doors that may be mistaken for an exit must also be clearly marked as Not an Exit or otherwise identified; for example, Storage Areas.

  3. If an exit door cannot be seen by all users, the route to the exit must be clearly marked. Exit signs with arrows directing people to the nearest exit, strategically placed along the main aisles are required whenever direction to the nearest exit is not immediately apparent.
  4. Exits cannot be locked shut so that occupant of the building/area cannot escape.
  5. All exits must empty out of the facility into an area where public access can be obtained. Do not send people into a fenced area unless there is a gate that can be opened, allowing everyone to get to the safe area.
  6. Aisles leading to an exit door should be clearly marked.
  7. Emergency aisles should be in the straightest path possible to the exit.

4.1.7 Training

a) The HSE Manager ensures that all employees covered by this program receive proper training. The Safety Officer conducts the training. Training is conducted annually at minimum.

b) All employees receive the following training:
   - General Information
   - Usage of Alarms
   - Evacuation Route and Safe Areas
   - Evacuation Requirements
   - Emergency Equipment Locations
   - Fire and/or Chemical Hazards

c) Emergency Response Team (ERT) members receive training on all items identified above. In addition, they also receive training in:
   - Fire extinguisher use.
   - Information which needs to be communicated to the Safety Officer
   - How to sound an emergency alarm.
   - Notification of Emergency Response Personnel

An evacuation drill is conducted annually, at minimum, to ensure that all employees know their role in the event of an actual emergency. The local fire department is notified of the drill time in advance and asked to participate. A follow-up meeting is conducted with the supervisors to discuss and resolve any problems discovered during the drill, such as alarms not heard in specific areas, employees reporting to the wrong safe area, etc. Supervisors discuss these issues and results with their area employees.

d) All training is documented, and records are maintained for the length of the employee's employment.

4.1.8 Procedure for Contacting Emergency Responders

a) No matter what assistance is sought from an outside emergency service, the following information is provided during the call:

- Caller's name.
- Company name and location.
- Type of emergency and/or assistance needed.
- What gate or driveway to enter.

b) It is important to remain on the line until instructed otherwise.

c) A list of emergency numbers is provided to all employees authorized to contact outside emergency responders. This list includes:

- Local Fire Department
- Local Paramedics, Ambulance, or Emergency Rescue Unit
- Local Police Department
- Nearest Hospital

d) Any employee, who is not authorized to call for outside assistance, but needs to report an emergency situation, is instructed to dial a designated Emergency Response Team member, the HSE Manager, or Safety Officer.

4.2 Injury to Persons

4.2.1 Scope & Purpose

Injuries to persons may occur on the construction site or elsewhere. The main aim in responding to an accident where injuries occurred is to preserve life and render prompt and effective assistance.

4.2.2 Priorities

a) The first priority is to be directed towards saving lives.

b) After all injured persons have been safely treated, efforts should be directed towards preserving company property.

c) At the discretion of the Project Management, tasking may be directed towards restoring the accident site to its normal working condition, only after all risks to personnel have been negated and investigations commenced.

4.2.3 First Aid Material

Project Site shall provide pharmaceutical and drug use in first aid in sufficient amounts. At least the following items;

a) Scissors

b) Glass for medicine mixture and for medicine tablet

c) Brooch

d) Water cup

e) Cotton buds for applying medicine mixture

f) Thermometer

g) Blunt tip spatula

h) Elastic Bandage

i) Triangular Bandage

j) Tourniquet

k) Cotton ball, medical gauze pads, gauze bandage and flexible adhesive medicine bandage

l) First aid eyedropper

m) Analgesic Balm

n) Iodine tincture or povidone-iodine

o) Povidone-iodine for wound cleaning

p) Oral Rehydration Salts

q) Calamine lotion

r) Antihistamine

s) Itch Relief Lotion

t) Mixture Stomachica

u) Fever relief medicine

v) Medicine for burn wound treatment

w) Antacid

x) Aromatic Spirit Ammonia

y) Rubbing alcohol

z) Ophthalmic ointment

aa) Eye wash cup

bb) Boric acid solution

cc) Eye drops.

4.3 Alarms

Project site areas, offices and temporally facilities will have the alarm to be used for notifying all personnel for emergency situation. After evacuation and emergency situation is under control, the Supervisor/Manager at the Assembly Point shall update the “all clear” condition to ERT.

a) Raising the Alarm
In the event of an accident involving injury to a person, the alarm should be raised by one of the following means;

- Report directly to Supervisor
- Report directly to Construction Manager/ HSE Manager
- Report directly to Safety Officer

b) When raising the alarm, reporting person must clearly give the following information;
- His/her name and location
- The location of the injured person/persons
- The number of persons injured
- The extent of the injuries, if known
- What known hazards are in the area

4.4 Action for Injured Person

4.4.1 Action by first person on scene

In the event of injuries to persons, the first person on the scene should take the following action:

a) If a hazard exists consider your own safety then if possible remove the hazard or the injured person.

"DO NOT MOVE THE INJURED PERSON UNLESS ABSOLUTELY NECESSARY"

b) Assess the patient by checking for Airway, Breathing, Pulse and obvious injuries.

c) Raise the alarm

d) Make the injured person as comfortable as possible

- Treat the obvious injuries
- Reassure the injured person
- Tell him / her that help is on the way

4.4.2 Action by safety officer

On receipt of a call advising of an injured person gather as much information as possible depending on the severity of the injuries and notify the following personnel:

- Medical/Emergency Rescue
- Emergency Response Coordinator or Alternate
- Safety Officer

4.4.3 Proceed to the accident scene with the ambulance.

- On arrival assess the situation and if further assistance is required mobilize the Emergency Response Team if not already done.
- Commence treatment of the injured person / persons.

- The Safety Officer, upon receipt of a call for assistance, will immediately make their way to the accident scene or the First Aid Area, or as requested by the staff in attendance.

4.4.4 Action by Emergency Response Coordinator

- Respond with the Emergency Response Team to the accident location.
- Liaise with First Aid/Nurse as to assistance required.
- Control the accident scene using Emergency Response Team personnel and others

4.5 Medical Evacuation

Safety Officer / Emergency Response Coordinator

If the Medical Evacuation is necessary, the Emergency Response Coordinator will:

1. Ensure the receiving hospital is notified of the details for the Medical Evacuation.
2. Arrange for the transportation of the patient from the First Aid Area to the hospital.
3. Arrange for medical staff for life support and critical care to accompany patient, if possible.
4. Ensure all relevant documents are dispatched with the patient.
5. Ensure appropriate medical monitoring equipment, medication and therapy equipment is available to accompany the patient, if possible.
6. If possible, speak directly to the receiving facility's Medical Officer.

4.6 Vehicle Accidents

4.6.1 Scope and Purpose

Accidents involving light vehicles and construction trucks occurred on the job performing at the construction site area or on the way assigned to do the company's business. The main aim in responding to an accident is to establish if injury has occurred and to preserve life and render prompt and effective assistance.

4.6.2 Priorities

a) The first priority is to be directed towards saving lives.

b) After all injured persons have been safely treated, efforts should be directed towards preserving company property and protecting the environment and community.

c) At the discretion of the Project Management, tasking may by directed towards restoring the accident site to its normal working condition, only after all risks to personnel have been negated and investigations have commenced and police approval has been obtained.

4.6.3 Alarms

Raising the Alarm In the event of an accident involving a motor vehicle or construction equipment at the construction site the alarm should be raised by one of the following means;

- Report directly to Supervisor
- Report directly to Construction Manager/HSE Manager
- Report directly to Safety Officer

When raising the alarm, reporting person must clearly give the following information:

- His/her name and location
- The location of the injured person/persons
- The number of persons injured
- The extent of the injuries, if known
- What known hazards are in the area
- Continually support the First Aid/Nurse as required.

4.7 Injury to persons at vehicle accident scene

4.7.1 Action by first person on scene

In the event of injuries to persons, the first person on the scene should take the following action:

a) If a hazard exists consider your own safety then if possible remove the hazard or the injured person.

"DO NOT MOVE THE INJURED PERSON UNLESS ABSOLUTELY NECESSARY"

b) Assess the patient checking for Airway, Breathing, Pulse and obvious injuries.

c) Raise the emergency alarm

d) Make the injured person as comfortable as possible

- Treat the obvious injuries
- Reassure the injured person
- Tell him / her that help is on the way

4.7.2 Action to be taken by safety officer

- Log time of call.
- Type of emergency.
- Number of personnel injured.
- Notify Doctor of situation.
- Notify Emergency Response Coordinator or alternate.
- Safety Officer to proceed to accident scene with ambulance, if required.

4.7.3 Action by Emergency Response Team

At the accident scene, the Emergency Response Team will assist the Safety Officer in treating and recovering the injured persons. The Emergency Response Team will secure the accident site after injured persons have been transferred out from accident site.

4.8 Vehicle Accident on roadway

Police, Safety Officer and Emergency Response Team Leader will be notified depending on seriousness. Any vehicle accident on a public road shall be reported immediately to the Thai Police.

The damaged vehicle is not to be moved until Local Police have requested it to be moved.

The Crew's Supervisor / Safety officer shall implement any traffic control that may be require until the police arrives.

Seriously injured persons should be immediately transported to the Hospital.

The outgoing Safety Officer should be in line contact with construction site at all times and return as soon as possible.

4.8.1 Action to be taken by Safety officer

On receipt of an emergency call for vehicle accident outside the project site, Safety Officer will:

- Log time of call.
- Type of emergency/location.
- Number of people injured.
- Notify Construction Manager/HSE Manager, if required.
- Arrange ambulance or construction site vehicle with adequate medical equipment for injured persons transportation

4.9 Emergency for Chemical Incident

4.9.1 Chemical Spill

In the event if a chemical spill occurs, the ERT with the advice of the Environmental Specialist will conduct an initial evaluation of the situation, secure the area and contact the following personnel:

- Construction Manager or his alternate
- HSE Manager
- Safety Officer
- Relevant persons e.g. material coordinator, site administrator

4.9.2 Initial evaluation

The ERT will evaluate this situation to decide if any Thai Authority need to notify.

Ascertain the source of the spill.

4.9.3 Incident Management

The Environmental Specialist will then:

- Remove non-essential personnel from hazard area and restrict entry.
- Barricade the area.
- Approach the incident scene with care, from up-slope and upwind if possible.
- Contain the source of the spill.
- Ensure the spill does not come into contact with any other secondary reagents or chemicals,
- Issue protective clothing, Mask, Rubber Gloves and Disposable Overalls to personnel involved in the cleanup.
- Ensure maintenance personnel are aware of the correct procedure and wearing the correct safety apparel before commencing any maintenance.
- Set up decontamination area where contaminated clothing can be removed and contaminated tools and equipment can be de-contaminated. Contaminated clothing is to be gathered and placed in an empty box for burning or disposed of.
- Providing the debrief and the conclusion of the incident and report to HSE Manager and Construction Manager

4.9.4 Procedure for Chemical Spillage Clean up

- Minimize loss from original container (plug or seal any leak)
- Contain spilled liquid with bund space, earth or contamination kit pillows.
- Recover liquid into a suitable holding vessel
- Absorb residual liquid with dirt, sand or an inert material
- Ensure no further spillage will occur and solution is contained in bounded area.
- All contaminated materials shall be disposed of by an authorized Third Party

NOTE: AFTER ATTENDING TO A SPILLAGE, WASH HANDS WITH SOAP AND WATER BEFORE EATING OR SMOKING.

4.9.5 Procedure for Dry Spillage Clean up

- Sweep or shovel up and place materials in marked/labeled containers
- Avoid creating dust
- Dispose of in a manner as directed.

All decontamination of sites and equipment should be supervised by the Environmental Specialist.

4.9.6 Environmental

The Environmental Specialist is to be contacted as soon as practical. They will check the degree of contamination due to the spill and advise remedial actions as required. Other sampling may be conducted at the discretion of the Environmental Specialist.

4.9.7 Safety Precautions

- All necessary PPE will be available for the ERT and related personnel.
- Ample ventilation is of paramount importance.
- Wear coats, boots, gloves, safety glasses and a face shield are to be used.
- In handling spillages ensure the spill is contained and diluted to control fumes. Refer to Safety Datasheet before applying water to spillages to prevent injury from chemical reaction.
- After dilution, it can be neutralized by a number of methods and these will be advised by the environmental specialist.
- In the event of a spill always contact area supervisor immediately.
- Always know the whereabouts of the closest emergency shower and eye wash station and ensure that they are operative.

4.9.8 General practice when handling chemical

- Never eat, drink, or smoke while handling chemical.
- Observe all signs and follow instructions.
- Know the phone number to contact in case of emergency.

4.9.9 General Treatment of Victims – First Aid

- If eye contact occurs with acid then immediately wash with large amounts of flowing water for at least 15 minutes.
- If skin contact occurs the victim should immediately be placed under the emergency shower and clothing removed whilst under the shower. Do not remove goggles for at least 15 minutes. Shower the victim constantly and do not apply lotions or oils. When shower not available skin area should be rinsed with clean water continuously until the ERT arrives.
- If symptoms of shock, such as rapid pulse, sweating or collapse should occur, the victim should be placed in a coma position and keep warm until the first aid officer arrives.
- In the event of a person being overcome by vapour they should be removed immediately from the area to fresh air. If breathing has stopped commence CPR (Cardio-Pulmonary Resuscitation) and notify ERT.
  Persons who have swallowed chemical and are still conscious they should be made to drink copious water and seek medical attention immediately.

4.10 Material Safety Data Sheets (MSDS)

Medical Safety Data Sheets are held at the Warehouse and Safety Offices. Areas using chemicals on site have MSDS in their areas. In the event of a chemical spill the area Supervisor should follow the MSDS for the particular instruction. Training should be given to employees of work areas where chemicals are used in understanding MSDS information.

4.11 Fires – General Procedures

4.11.1 Scope & Purpose

Fires have the potential to harm personnel and to cause significant damage and disruption to the Project. The impact of such an occurrence can be dramatically reduced if personnel on site have a comprehensive knowledge of the procedures that must be followed in the event of a fire outbreak. This section of the Emergency Response Management Plan pertaining to fires is divided into two parts, they are:

4.11.2 General Procedures

This part lists in specific details the roles and responsibilities of all personnel who may be affected by the outbreak of fire in their work area. The information outlined within this part of the plan should be studied and disseminated prior to the occurrence of an incident.

4.11.3 Immediate Action Section

This part provides a ready reference that is to be used by personnel that may be involved in the control and containment of fire within the work place. All personnel should receive instruction on how Immediate Action to be carried out. This documents and instruction will be in the language understood by the crews.

4.11.4 Priorities

a) The first priority is to be directed towards saving lives.
b) After all personnel have been accounted for efforts may be directed towards preserving company property, the environment and the community.
c) At the discretion of Management, tasking may be directed towards restoring the property to a normal working condition, only after all risks to personnel have been negated.

4.12 Alarms

Raising the Alarm

In the event of an incident involving fire, the alarm may be raised by one of the following means;

a) Verbally notifying people in the immediate vicinity
b) Report directly to Supervisor and Safety Officer
c) Report directly to Construction Manager/HSE Manager
d) When raising the alarm, reporting person must clearly give the following information;
e) Reporting person name and location
f) The location of the fire
g) The extent of the fire
h) What known hazards are in the area
i) Are any persons injured or trapped?

4.13 Action to be taken

4.13.1 Action by First person on scene

a) When a fire is detected, employees who have been trained in the use of a fire extinguisher attempt, within reason, to extinguish the fire. If the fire cannot be extinguished by using one fire extinguisher, a supervisor or Emergency Response Team member must be notified immediately. The following steps must be taken:
b) Immediately advise all other workers in the area that there is a fire.
c) Raise the emergency alarm.
d) The supervisor or Emergency Response Team member initiates the call to the local fire department.
e) If the fire becomes too large or the evacuation warning sounds, go to your nearest Emergency Assembly Point. Close all doors and windows when leaving rooms.
f) Do not enter or re-enter a burning building or structure.
g) The supervisor or department head makes the decision to evacuate a department.
h) The highest-ranking management representative on site makes the decision to evacuate the entire facility.
i) The evacuation procedure for the department and/or facility must be followed.
j) No employee is allowed to re-enter the department and/or facility until the highest-ranking management representative has issued the All Clear. This decision is made based on the advice of the fire department handling the call.

4.13.2 Action by Safety officer

a) On receipt of a fire call, the Safety Officer shall gather as much information as possible. Safety Officer will then notify the following personnel:

- Emergency Response Coordinator or alternate
- Safety Coordinator

b) The Safety Officer will then proceed to the affected area with the Emergency Response Team

NOTE: During emergency situation, the First Aid Area should be manned at all times (where possible) by trained staff.

c) On arrival at the scene the Safety Officer will carry out tasking as per the Emergency Response Coordinator's instructions.

d) Safety Officer on receipt of a call for assistance will immediately make their way to either the incident scene or the First Aid Area.

e) Local Emergency Rescue/ Ambulance shall be called if necessary.

4.13.3 Emergency Response Team Response

In the event of a fire, Emergency Response Team members will be notified by phone. They are to immediately make their way to the site and carry out tasking as directed by the Emergency Response Coordinator. The HSE Manager will check to confirm that the local fire department is on the way to the fire.

4.13.4 Action by Supervisor

a) The actions required by the Supervisor will vary, depending on the nature of the incident. All Supervisors should familiarize themselves with the specifics of tasking as laid out in the Immediate Action Section of this procedure.

b) Supervisors should remember that they may be the first point of call for any incident and therefore should familiarize themselves with the process to respond to emergency alarm.

c) If a Fire Alarm is received by the Supervisor they should gain as much information as possible and immediately contact for fire station, local emergency rescue and hospital as necessary. The Supervisor will as soon as possible notify the ERT of the incident.

d) If the incident is within the Construction areas directly under the responsibility of the Construction, the Construction Supervisor will act as the senior officer until relieved by a person of higher authority. Elements of the response that involve the commitment of the Emergency Response Team shall at all times remain the responsibility of the Emergency Response Coordinator on the scene.

e) If the incident occurs outside of the Construction responsibility, they should stand by and be prepared to commit manning or other resources if requested by the person controlling the incident.

f) Construction Supervisors should familiarize themselves with elements of the Immediate Action which pertain to their areas of responsibility.

4.13.5 Action by Emergency Response Coordinator

a) Respond with the Emergency Response Team.

b) Liaise with the senior person present regarding evacuation status, and nature of tasking required of the Emergency Response Team.

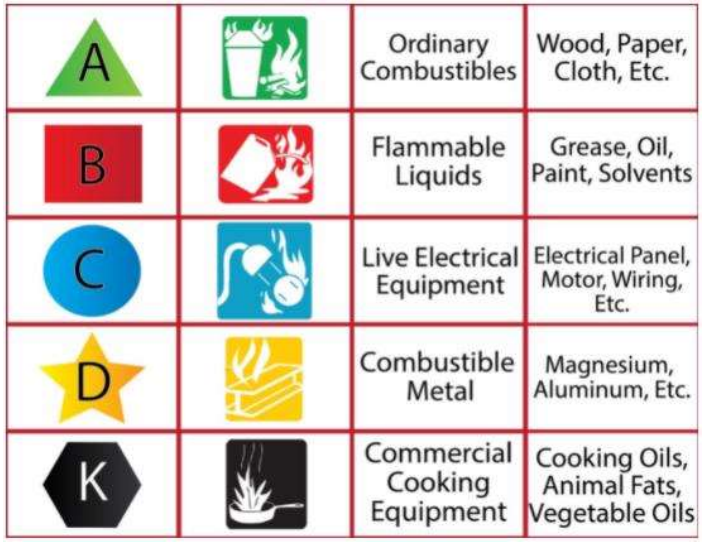
c) Carry out tasking as required using available resources and Emergency services.

d) Continually liaise with the senior person on the scene and keep them informed of the situation.

4.14 General Fires

General Considerations

The term General Fires relates to any possible fire situation that could occur on site, therefore it is imperative that all employees on site have a thorough working knowledge of classes of fire and the appropriate extinguishers to be used.



Type A: Ordinary Combustibles

Fire starts from ordinary flammable fuel such as wood, fabric, paper, trash, plastics that can be found commonly in residences. This type of fire can also be extinguished by water.

Type B: Flammable Liquids

The fire starts from flammable substances that have basis of crude oils, Kerosene, Benzene and flammable gas such as Butane or Propane. This type of fire can be seen in fuel production industry such as gasoline, lubricating oils, some types of color production. Fuel type B can be prolonged in flames when surrounded by Oxygen; therefore, to extinct the fire, Oxygen must be eliminated.

Type C: Electrical Equipment

The fire caused by electric appliances where electricity current still present or electricity is active such as motors, electronic appliances, and power adaptors. Active electric appliances can generate high heat and if damaged, it can cause Type C fire. To extinct the fire, the electric appliances must be firstly turned off.

Type D: Combustible Metals

The fire starts from flammable metals such as Titanium, Magnesium, Aluminium and Potassium. These types of fuel can be found in operation rooms, laboratories, as well as industries that relate to metals where the flames cannot be extinct by water.

Type K: Combustible Cooking

This type of fire starts from cooking oils and animal fats as well as liquid that uses in cooking, therefore, they can be found in kitchens and restaurants.

4.14.1 Procedure for controlling general fires

Advise all other workers in the immediate vicinity that there is a fire.

Attempt to extinguish the fire using the appropriate extinguishing agent.

Raise the alarm, by phone or radio channel, and clearly give the following information.

- His/her name and Location
- The Location of the fire
- The extent of the fire
- What known hazards or reagents are in the area
- Are any persons injured or trapped
  - a) If the fire becomes too large or the evacuation warning sounds, go to your nearest Emergency Assembly Point.
  - b) Close all doors and windows when leaving rooms.
  - c) Do not enter or re-enter a burning building or structure.
  - d) Remain at the Emergency Assembly Point until the all clear is given.

4.14.2 Action by Safety officer

a) On receipt of a fire call, gather as much information as possible.

b) Notify the following personnel;

- Emergency Response Coordinator or alternate
- Area Supervisor
- Safety Officer
- Project Manager

c) Proceed to the affected area with the Emergency Response Team. Any response should include the Water Truck and Ambulance

d) On arrival the Safety Officer/ Nurse will liaise with the Construction Manager/HSE Manager, and carry out tasking as per the Construction Manager/HSE Manager instructions.

The First Aid Area should be manned at all times (where possible) during Emergency Situation by trained staff.

4.14.3 Action by Emergency Response Coordinator

a) Respond with the Emergency Response Team to the fire.

b) Consider Uphill and Upwind approach

c) Liaise with Senior person present regarding status of evacuation and nature of fire

d) Ensure personnel at Emergency Assembly Points are in no danger

e) Combat the incident using Emergency Response Team Standard Procedures

f) Continually liaise with the senior person on the scene and keep them informed of the situation.

4.15 Electrical Fires

General Considerations

It should be remembered that by definition an “Electrical Fire” is any fire that involves live electrical equipment. This hazard may well be present at any fire within the workplace, and should be considered when selecting a fire extinguisher to combat a fire. Large fires involving High Voltage equipment require careful consideration as to the means of extinguishing. It is critical that an extinguishing medium rated as non-electrically conductive is used on live electrical equipment.

4.15.1 Electrical Fires Procedure

Advise all other workers in the vicinity that there is a fire.

Before attempting to extinguish the fire using an extinguisher that is rated electrically nonconductive, i.e. Carbon Dioxide or Dry Chemical Powder

Raise the alarm, by phone or radio channel, and clearly give the following information.

- His/her name and Location The location of the fire
- The extent of the fire
- What known hazards or reagents are in the area
- Are any persons injured or trapped
- Advice that Live Electrical Equipment is involved
- If the fire becomes too large or the Evacuation warning sounds go to your nearest designated Emergency Assembly Point
- Close all doors and windows when leaving rooms
- Do not enter or re-enter a burning building or structure
- Remain at the Emergency Assembly Point until the all clear is given

DO NOT USE WATER OR FOAM ON LIVE ELECTRICAL EQUIPMENT; YOU WILL BE PLACING YOURSELF AT RISK.

4.15.2 Action by Area Supervisor

- Ensure that the Safety Officer/ambulance has been advised and the Emergency Response Team has responded.
- Ensure that the Evacuation warning has been activated, if required.
- Ensure that the appropriate area Evacuation are carried out, including a head count of all personnel.
- Liaise with area owner and arrange for the power to be isolated from the area affected.
- Liaise with the Construction Manager/HSE Manager regarding Evacuation Status, Missing Personnel, and Specific Hazards etc.
- Work with the Emergency Response Coordinator to safely control the incident

4.15.3 Action by Safety Officer

On receipt of a call advising Electrical Fire gather as much information as possible

Notify the Following Personnel:

- Emergency Response Coordinator of alternate
- Area Supervisor
- Electrician
- Safety Officer
- Construction Manager
- Project Manager
- Contact the Electrical Section and inform them of the incident
- Proceed to the affected area with the Emergency Response Team. Any response should include the Water Truck and Ambulance

- On arrival the Safety Officer will liaise with the Emergency Response Coordinator and carry out tasking as per the Emergency Response Coordinators instructions.

4.15.4 Action by Emergency Response Coordinator

- Respond with the Emergency Response Team to the affected area
- Liaise with the Area Supervisor regarding status of Evacuation and nature of fire
- Ensure that personnel at the Emergency Assembly Points are in no danger
- Liaise with the Area Supervisor to arrange for power to be isolated from the affected area. If required to isolate all power, all related parties must be notified.
- Control the incident using Emergency Response Procedures
- Continually liaise with the senior person on the scene and keep them informed of the situation.

DO NOT USE WATER OR FOAM ON LIVE ELECTRICAL EQUIPMENT; YOU WILL BE PLACING YOURSELF AT RISK.

4.16 Heavy Equipment Fires

Combatting Tire Fires, Explosions and Potential Explosions

<u>Basic Principles</u>

1. Minimum safe distance: Debris from tire explosions is known to have been thrown 300m. It is suggested that this distance be used as a minimum for the setting up of roadblocks. It is possible that material could be thrown further.
2. Don't expose personnel: all unnecessary personnel should be kept away from the area. Persons combating the fire should not be exposed directly to any possible blast.
3. The situation is unpredictable. Often it will not be known when a tire is likely to explode and whether other tires are likely to follow it.
4. Isolate the vehicle for 24 hours after removal of the source of heat thought likely to lead to an explosion. An emergency crew should remain in attendance during this period. Contractor must be trained to park a suspect vehicle only in designated areas around the construction area which have been chosen.

4.17 Evacuation General Procedures

4.17.1 Scope and Purpose

There are several possible conditions that may lead to the need to evacuate an area or an entire site. These could include, but are not limited to:

- Fire
- Explosion
- Major Chemical spill

It is imperative that Contractor, Subcontractor and visitors understand the evacuation procedures for areas in which they are working or visiting. These procedures should be discussed during site general induction, visitor induction and at regular safety meetings.

4.17.2 Priorities

The first priority is to be directed towards saving lives, company property, the environment and the community. It is important that when evacuating an area, it should be made without delay, giving occupants the best chance of safely clearing the area.

After all personnel are in safe condition, efforts then should be directed towards preserving company property.

At the discretion of Management, tasking may be directed towards restoring the property to a normal working condition after all risks to personnel have been negated and an investigation commenced.

4.17.3 Evacuation Guidelines

When evacuating work the following points will assist in getting people to designated emergency assembly point safely.

- Be familiar with the emergency assembly points associated with the work. When working in an unfamiliar area, find out location of the relevant emergency assembly point, and the evacuation procedures for the area.
- Know the location of the firefighting equipment in the work and how to manually activate suppression systems.
- Conditions within a fire effected building can deteriorate rapidly, be decisive when there is a need to evacuate; don't hesitate even if conditions still appear to be good.
- When evacuating work, try to close doors and windows, this will help to prevent fire from spreading quickly. Where possible shut down any electrical appliances.
- When evacuating move at a quick pace. Fire can produce thick smoke, therefore, if evacuation needs to move through smoke, try to move by staying low where the freshest air is close to the floor.

- To pass through doors, feel the door to see if it is hot, open doors slowly and look around to see if there is fire behind it. Remember to close all doors after passing through.
- Never re-enter an area that has been evacuated until the all clear has been given.
- At the emergency assembly point report to Supervisor, Fire Warden, or Department Head. Advise if any persons are missing.

4.17.4 Evacuation Procedures

General Considerations

It may be necessary to evacuate the construction Area for a number of reasons;

- Gas Leak
- Fire
- Explosion, or the risk of an explosion
- Chemical or Oil/Fuel spills
- Fire in surrounding grass/scrub
- Electrical storms and lightning.

Fires, gas leaks, and chemical spills have the potential to create life threatening conditions. All evacuations should be expedient to the nominated emergency assembly point.

- Raise the alarm via phone advice Safety Officer that the construction area is to be evacuated.
- Determine which emergency assembly point is to be used, through consultation, if possible, with the Senior Supervisor.
- Advise all personnel working in the construction Area to evacuate.
- Ensure that the evacuation call has been made and walk through the site to contact personnel.
- Ensure that the evacuation alarm has been activated.
- All personnel working within or visiting are to evacuate the building/construction site.
- All personnel working within the Explosives area are to evacuate to the designated emergency assembly point.
- Supervisors or the person finding the emergency situation will activate the evacuation alarm.
- Shut down any operating machinery/equipment if it safe to do so.
- Select the emergency assembly point to be used, consider using an emergency assembly point that is upwind of the emergency area
- All personnel working are to evacuate to the emergency assembly point.

- All personnel are to remain at the emergency assembly point until advised of all clear.
- If possible switch off all electrical equipment when leaving work areas.
- Close all doors and windows if possible.
- Follow the instructions of the fire warden.
- Ensure that Safety Officer have been advised of the Construction Area evacuation.
- Ensure that a head count is carried out of all personnel at the emergency assembly point and advise the Emergency Response Coordinator of any missing personnel.
- Ensure that the Superintendent and Construction Manager have been informed.

Advise employees in the area as quickly as possible to evacuate.

ONLY TRY TO EXTINGUISH A SMALL FIRE IF THERE IS ABSOLUTELY NO IMMEDIATE DANGER.

4.17.5 Safety Officer

On receipt of a call advising Area evacuation, gather as much information as possible, identify which emergency assembly point is to be used. Notify the following;

- Emergency Response Coordinator or alternate
- Safety Officer

Proceed to the designated emergency assembly point with the Emergency Response Team. Response to include the water truck and ambulance.

On arrival liaise with the Construction Manager/HSE Manager and Shift Supervisor.

Notify the Emergency Response Coordinator or alternate.

Carry out tasking as per Emergency Response Coordinator's instructions

4.17.6 Emergency Response Coordinator

Respond with the Emergency Response Team to the designated construction Area emergency assembly point.

Liaise with the Supervisor regarding evacuation status and nature of tasking required.

Continually liaise with the senior person on the scene and keep them informed of the situation.

4.17.7 Supervisor

Ensure the Safety Officer has been advised of the evacuation.

Ensure the evacuation alarm has been sounded.

Ensure the related managers have been advised.

Ensure all personnel have evacuated the building by doing a quick search, if possible. (Do not place yourself at risk trying to search the building).

Ensure a head count is carried out of all personnel at the emergency assembly point and advise the Emergency Response Coordinator of any missing personnel.

4.18 Environmental Incidents

4.18.1 What is a reportable environmental incident

- Chemical spills.
- Spills of fuel or oil.
- Non-contained fires within operational areas.
- Uncontrolled gas emissions.

Note: All oil or chemical spills that occur with an Occupational Health and Safety incident must also be reported as Environmental incidents.

4.18.2 Environmental Incident Definitions

Low/ Minor Severity Incidents - On Property within Spill Containment System or On Property into Disturbed Area

- Within immediately identifiable small area
- No lasting effect on environment or humans
- Negligible amount released that can be cleaned up by site personnel without use of special equipment or external expertise
- No need for remediation (other than cleans up)
- Can be dealt with by mine systems for removal of material

Medium Severity Incidents - On Property into Undisturbed Area or Off Property

- Quantity and extent of material is identifiable and is in a limited area (confined)
- Release of non-negligible quantities of an acutely hazardous material
- Environmental effects are significant but reversible
- Contamination of someone else's property
- Possible or probable breach of regulation
- Potential for media coverage or public controversy regardless of extent of incident

High Severity Incidents - Off Property or Into Watercourse; All High Severity Incidents should have a corrective action implemented as a priority

- Quantity or extent of affected area large, not limited or not identified
- Actual or potential significant long-term environmental effect

- Release of an acutely hazardous material in significant quantity
- Potential threat to human life and /or fish or wildlife kills
- Major breach of regulation
- Significant potential for media or public controversy
- Use of off-site expertise required for remediation

4.18.3 Chemical Spills

FUEL AND OIL SPILLAGE

To minimize the possibility and effects of any potential spillages of oil or diesel in which contamination of fresh water occurs on site.

USE AND LOCATION

Primarily areas associated with Warehouse and Construction area; however accidental spillage could occur on any area of operations.

DANGER

- **Health Hazard Data**

  All spillages have fire/explosion/health/environmental risks. Prompt controls are required to prevent damage to life and equipment.

- **Specific Data/Precautions**

  Reference must be made to the chemical information manual and/or manufacturer's guidelines for extra data and precautions.

PROCEDURES

- **Notification**

  Large oil and diesel spillage requires immediate notification. Security Control will be notified and Security will contact the Environmental Specialist

- **Personnel Responsible**

  Environmental Specialist with the assistance of Safety Officer and operations personnel involved will be responsible for the control, removal and clean-up of any accidental spillage.

5. EMERGENCY EQUIPMENT

Crews shall be supplied with first aid kits, fire extinguishers and absorbent materials.

Other emergency equipment may include:

- Flares
- Road cones
- Signs and flashing lights
- Reflective vests
- Plastic trash bags
- Disposable gloves

6. SAFETY

All operations or actions taken in response to emergencies, including equipment, vehicles and materials used, shall be in accordance to Thailand laws and regulations, Project Procedures and OWNER requirements.

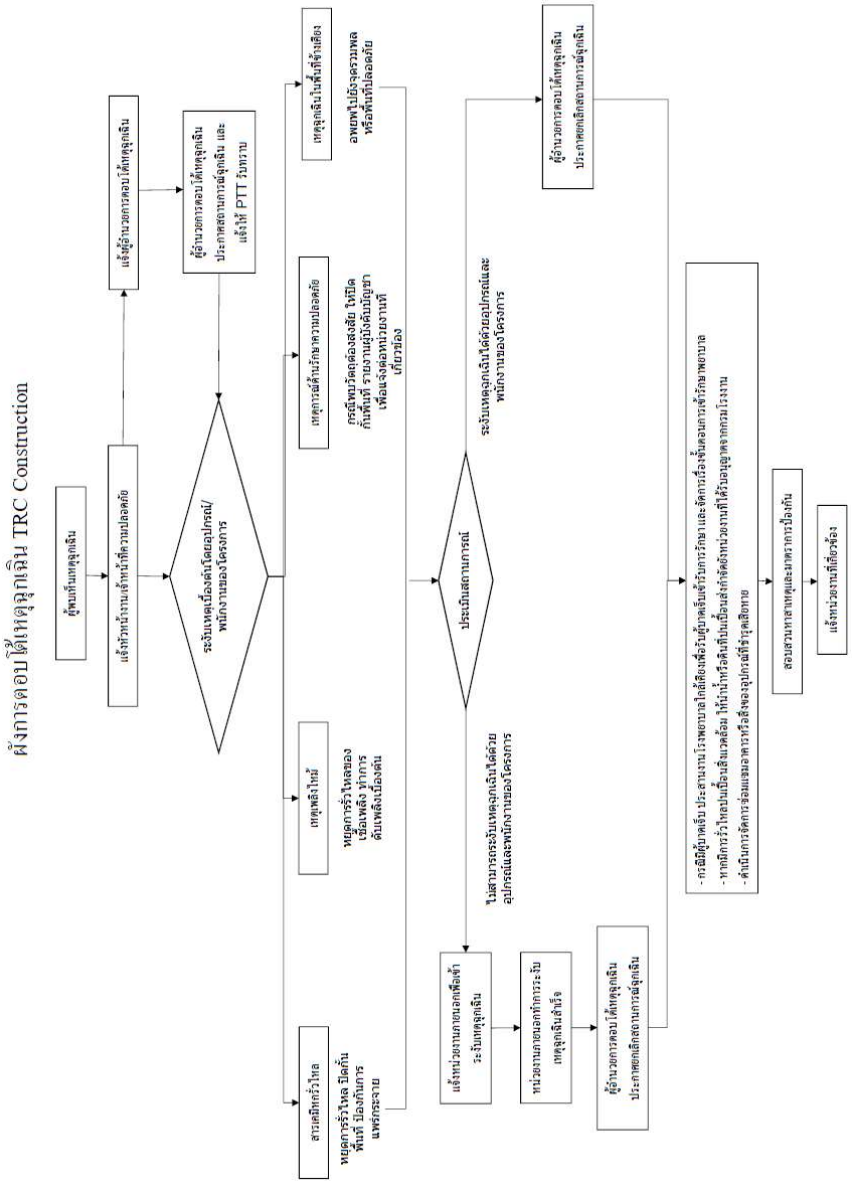
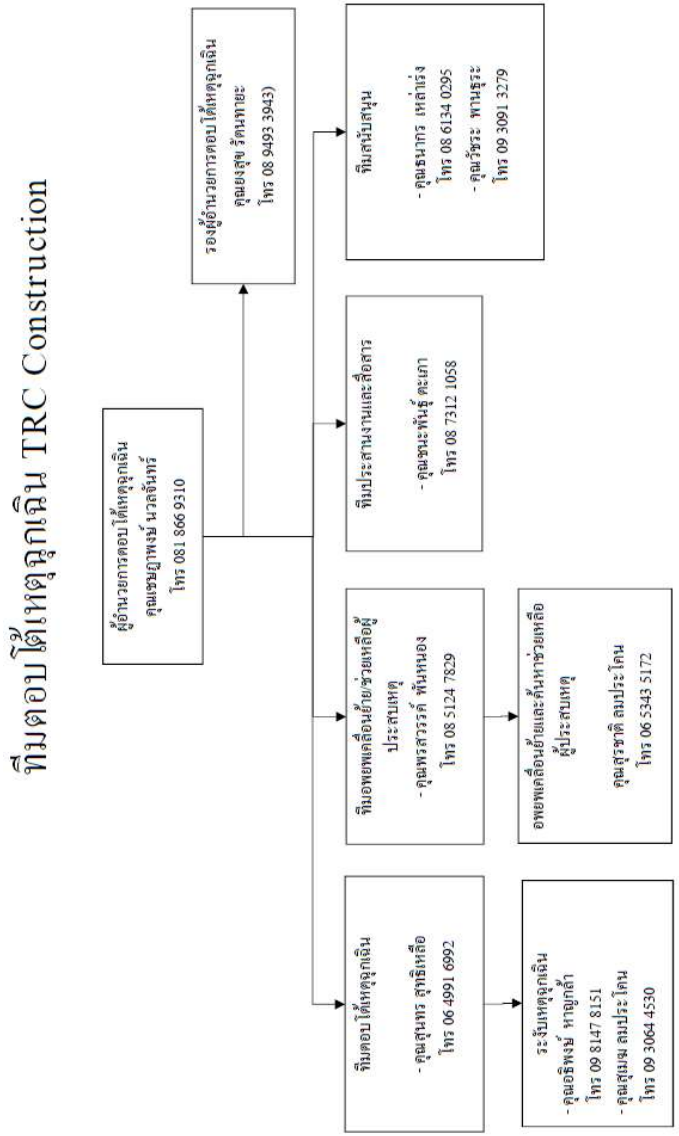
7. QUALITY CONTROL

This Procedure will be audited in accordance with the Project Quality Plan.

8. EMERGENCY NUMBER (หมายเลขโทรศัพท์ติดต่อฉุกเฉิน)

Place/ Person (หน่วยงาน/ตำแหน่ง)	Name (ชื่อ)	Contact Number (หมายเลขโทรศัพท์)
Hospital (โรงพยาบาล)	โรงพยาบาลสูงเนิน	044-286-023 044-417-100
Police Station (สถานีตำรวจ)	สถานีตำรวจภูธรสูงเนิน	064-454-9053
Fire Station (สถานีดับเพลิง)	กองอำนวยการป้องกันและบรรเทาสาธารณภัยอำเภอสูงเนิน	044-984-061 - วิทยุสื่อสาร .155125
PTT Project Manager (PTT ผู้จัดการโครงการ)	Mr. Aegvit P.	08 9969 6909
PTT Project Engineer (PTT วิศวกรโครงการ)	Mr. Teerut S. (นายธีรุตน์ สุกไสว)	08 9816 5081
PTT Project Engineer (PTT วิศวกรโครงการ)	Mr. Kachon M (นายขชล มุสิจรัล)	09 0971 5833
TRC Project Manager (TRC ผู้จัดการโครงการ)	Mr. Sayan S. (นายสายัน สายโสภา)	08 1833 0596
TRC Construction Manager (TRC ผู้จัดการงานก่อสร้าง)	Mr. Chesadapong N. (นายเชษฐาพงษ์ นวลจันทร์)	08 1866 9310
TRC HSE Manager (TRC ผู้จัดการคุณภาพ,ความปลอดภัย, อาชีวอนามัย และสิ่งแวดล้อม)	Mr. Yongsuk R. (นายยงสุข รัตนทายะ)	08 9493 3943
TRC Safety Officer (TRC เจ้าหน้าที่ความปลอดภัย)	Ms. Sunthorn S. (นายสุนทร สุทธิเหลือ)	08 4991 6992
TRC Community and Authority Relation (TRC เจ้าหน้าที่ชุมชนสัมพันธ์)	Mr. Chanaphun T. (นายชนะพันธุ์ ตะเภา)	08 7312 1058

Attachment 1: Flow Chart for Emergency Response



Attachment 2: TRC Emergency Response Team