Innovation Development

Sino-Thai Engineering and Construction Public Company Limited (STEC), a subsidiary of STECON that operates the core business, places great importance on continuously promoting innovation and improving work processes across all aspects of its business operations. This includes the adoption of modern tools and equipment, as well as the application of advanced information technology systems that are appropriate for operational practices. Such initiatives aim to enhance operational efficiency, effectively respond to customer needs, and elevate work standards and the quality of project delivery to an international level, while taking into consideration the potential impacts on society and the environment.

To support these efforts, the Company has established the Quality and Innovation Management Department as the key unit responsible for driving and promoting innovation within the organization. The Manager of the Quality and Innovation Management Department is responsible for overseeing and advancing the Company's innovation initiatives to ensure that the development and application of technology and innovation in business operations are carried out effectively and aligned with the Company's strategic direction.

The innovations developed and implemented by the Company in its business operations include the following:

1. **Monorail structure in form of continuous beam construction (Petty Patent No. 19072)**

The development of innovative monorail structure in form of continuous beam construction for use in MRT Pink Line Project and MRT Yellow Line Project will reduce the cost of guideway beam construction by replacing former system designed as "single-span beam" (resulting in larger guideway beam) with "continuous beam" (resulting in smaller guideway beam), and smaller supporting columns can consequently be used, which helps saving construction cost. The Company has applied for a petty patent registration for such innovation, which is considered an innovation that plays an important role in knowledge development and technology in the construction industry of Thailand.

2. **Work process with Building Information Modeling (BIM Process)**

The development of work process with Building Information Modeling (BIM Process) offers standards or guidelines for BIM work in various projects, both in form of construction contract project (Build Only) and Engineering, Procurement, and Construction (EPC) project. In performing the work using BIM system, construction will be virtually simulated in three dimensions before actual construction. The appropriate development and deployment of BIM system can help minimizing errors that may occur before actual construction, and it is

also a tool to help resolving conflicts using 3D layout, and status of work process is also trackable.

3. Automatic GWB top grinding machine designed to flatten the upper surface of GWB wet joint connection.

Automatic GWB top grinding machine designed to flatten the upper surface of GWB wet joint connection has been developed to ensure work quality in meeting the standards. The device will replace machinery imported from overseas, and it is convenient to use, and helps reduce number of workers in specific activity, while increasing safety for workers.

<u>Benefits from Innovation development:</u> **Automatic GWB top grinding machine designed to flatten the upper surface of GWB wet joint connection**

(1) Increase efficiency of work due to adaptation of PLC and Sensor system with high accuracy.
(2) Compensation for the imported equipment at lower cost and used less area for installed the equipment.
(3) The general employees can work with this equipment on the safety rules.
(4) Reduce the number of employees and impacts in terms of environmental and resources use on the staff.
(5) Increase safety for staff who are working at high and reduce the fall ratio of materials to ground.
(6) Reduce the particle matter which impact to environment, employees, and public health, due to the dust collect system.

Top grinding equipment imported from Korea, estimated price 22 million Baht/unit. Expected use 2 units.	Grinding machine designed to grind concrete beam connection has been developed at price 306,873/unit. Expected use 12 units.	Reducing the cost from imported equipment amount 40.3 million Baht.

4. Concrete grooving machine

Concrete grooving machine is developed to reduce the height of concrete surface, reduce work hours, minimize potential damage on concrete surface, reduce dust, and it is convenient to use and helps increase safety for workers.

Benefits from Innovation development: Concrete grooving machine

(1) Reduce height grinding time by 88% from the original 180 minutes to 20 minutes, resulting in a reduction in labor and environmental impact.
(2) Reduce the chance of damaging the surface from grinding.
(3) No need for highly skilled operators as the machine has a mechanism to help control the movement.
(4) Reduce operator fatigue due to long time working outdoor area and working at high.
(5) Increases safety for workers and pedestrians from any falls.

5. Concrete Bucket with Remote Control

This remote-control concrete bucket innovation was developed for use with concrete post pouring at a range not accessible to placing booms or concrete pouring at points that save labor costs in supervising concrete bucket opening-closing, making work processes more convenient, increasing safety and reducing fatigue in workers. A 1-cue concrete bucket is used with hydraulic transmission controlled by a direct current powered by a battery. Commands can be provided with wired and wireless remote controls.

<u>Benefits from Innovation development:</u> Concrete Bucket with Remote Control

(1) Replacement of imported machines with significantly lower construction costs.

(2) Simplicity of use without requirements for highly skilled workers. Only on-off buttons are used with limit switches and fuses for protecting the device's system.

(3) Increased safety for workers with no need for an employee to climb up to the bucket to open-close the concrete bucket, which has risks of workers falling or dropping equipment with severe effects on colleagues or people below. If accidents result in disability, disability will create problems and burdens on society.

(4) Reduced worker fatigue from exertions in opening and closing after changing to pressing control buttons.

(5) Results can be expanded to other work units in need because the equipment is not complicated, is readily available in the market, and prototypes are available for study in the Sino-Thai Learning Center building.

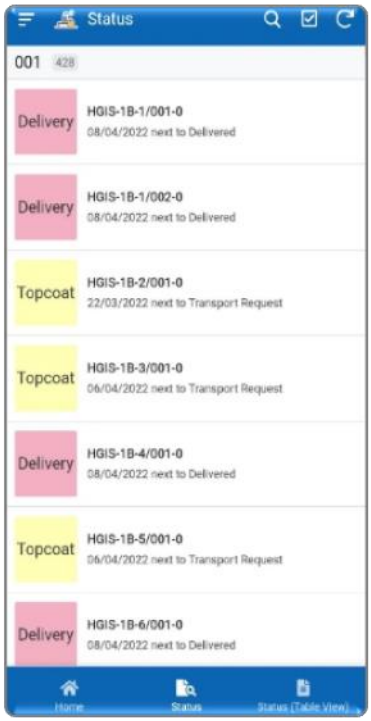
Concrete skip 1016 F round, radio remote controller, 1000L Imported from Abroad Price: 13,300.00 € (approximately 500,000 baht)	Price of the Developed Concrete Bucket with Remote Control: 56,184 baht	Machine Import Expenses Reduced: 443,816 baht

6. Application Smart Data Traveling

Application Smart Data Traveling was developed to inspect the status of workpieces in various production processes of the Rayong Steel Frame Management Center by using telephones to scan QR codes at workpieces to review the workpiece's status or records. The

application has a system for giving warnings about leftover work at each station and workpiece coordinates can be checked. This Application Smart Data Traveling system is an online system used to replace an old paper system for identifying workpiece status, which required human workers to record and send documents from the work site to the office, causing data travel time loss and risk of erroneous or lost data.

The innovation has been continually developed. Data from the innovation was analyzed to control production line management at each station with a dashboard along with expanding results to recipients at the destination when scanning to accept workpieces or when receiving comments on satisfaction toward that workpiece.



Benefits from Innovation development: Application Smart Data Traveling

(1) The Company reduced the number of workers and subsequent resource and environmental impacts from manpower use by reducing 9 document messengers (9 Shop).

(2) The Company reduced steps in the process by having no need for document delivery steps after changing to an online system.

(3) The Company reduced steps in the process by having no need to use people to key data on paper in an Excel file. The Company changed from keying data to downloading files.

(4) The Company reduced waiting for data updates of normal work piece status. Normally, the Company updates at 3:00 pm. The Company changed to real-time updates.

(5) The Company reduced risk of data errors or losses by scanning QR codes and having persons in each duty and responsibility simply click “Update Status”.

(6) The Company can trace work piece data in each step, date, time, coordinates, persons responsible, and test statuses.

(7) More document storage space saved.

(8) The Company can use data to make real-time decisions in a dashboard format in production line management.

(9) The Company reduced paper in processes by seven sheets per work piece. Since starting (March – December 2023), the Company had 57,621 work pieces in five projects. In total, the Company reduced paper use by 403,347 sheets.

7. Application Joint Inspection

Application Joint Inspection has been developed for pipe welding inspection, covering key processes such as assembly, material verification (Heat No.), Preheat procedures, welding, and welding wire issuance control. This application ensures data accuracy by filtering and organizing information according to the project specifications. It enables the identification of essential details, including:

- The material type and size of the inspected joint
- The required Welding Procedure Specification (WPS)
- Authorized personnel for welding tasks
- The quantity of welding wire issued and returned
- Verification of pipe thickness to determine if Preheat is required
- The positioning of the pipe within the blueprint

By implementing this application, the complexity of inspection and record-keeping is significantly reduced, making the process more convenient and accurate. The system pre-filters correct data based on specifications, minimizing the risk of errors and reducing the time required for data recording. Previously, inspections relied on attached documents and summarized specifications for every joint, which increased the likelihood of mistakes and consumed considerable time.

Request Welding Consumable

Fit-Up Inspection

Input Fit-up Data

Weld Inspection

Input Weld Data

Final Inspection

<u>Benefits from Innovation development:</u> **Application Joint Inspection**

(1) Reduction in Inspector Working Time: The inspection time per joint has been reduced from 5 minutes to 3 minutes, resulting in a total time savings of 6 hours and 34 minutes per day (calculated based on an average of 188 joints inspected per day).

(2) Reduction in Key Operator Data Entry Time: The data entry time has been reduced from 9 hours and 6 minutes per day (calculated based on an average of 188 joints inspected per day) to just 30 minutes per day.

(3) Reduction in Daily Welding Report Submission Time: Previously, the submission process took approximately 15 minutes per day (depending on distance, based on the Thai Oil project), but it has now been transformed into a real-time system.

(4) Minimized Risk of Data Errors or Loss: The system verifies data accuracy before recording, reducing the likelihood of errors. All information is stored digitally, preventing data loss.

(5) Enhanced On-Site Work Flexibility: The application can be used via smartphones, eliminating the need for extensive paperwork.

(6) Support for Retrospective Inspections: Users can review past inspection records, including dates, times, responsible personnel, and inspection details.

(7) Support for Digital Data Export: The system allows data to be exported as a database, enabling seamless integration with other software applications.

Reduction in Paper Costs • Reduced paper usage by 22,126 sheets • Saved paper costs of 6,637 THB per year	**Reduction in the inspection time** • Reduce the inspection time for inspectors from 5 minutes per joint to 3 minutes per joint. • Reduce the data entry time for the Key Operator from 9 hours and 6 minutes per day (based on 188 joints) to 30 minutes per day.

8. Organic Waste Shredding Machine into Fertilizer “Mor Pan Suk” – Reducing Food Waste and GHG Emissions Toward Sustainability

At present, organic waste from food residues represents a significant environmental challenge. The decomposition of food waste generates methane, a potent greenhouse gas that contributes to global warming. In addition, inadequate waste management may adversely affect employee hygiene, create breeding grounds for disease vectors, and cause operational damage to project sites.

An analysis of organic waste within the project revealed that food waste generated from employee consumption was relatively high, with primary sources including the site office, dining areas, and residential camps. In response, the Company developed an innovative concept to design an “Organic Waste Shredding Machine into Fertilizer” to reduce food waste

volumes, minimize greenhouse gas emissions, and lower waste disposal costs by utilizing leftover construction materials. This initiative supports the Company's commitment to sustainable development.

<u>Benefits of the Innovation Development</u>: Organic Waste Shredding Machine into Fertilizer "Mor Pan Suk"

(1) Reduced organic waste management costs for construction projects by lowering transportation and disposal expenses.

(2) Mitigated odor pollution and reduced breeding grounds for disease vectors, promoting a clean, hygienic, and healthier working environment for employees.

(3) Encouraged employee participation and social responsibility in line with the Company's sustainability policy in the social dimension by distributing organic fertilizer to local communities and educational institutions, thereby supporting tangible community and social development.

Reduce food waste disposal costs	Reduce equipment acquisition costs
Reduced food waste disposal costs by 30.4%, from THB 2.50/kg to THB 1.74/kg (equivalent to THB 0.76/kg savings), based on an average of 30 kg of food waste per day.	The production cost of the machine is THB 35,000 per unit, compared with a similar machine available in the market priced at THB 55,000 per unit, resulting in savings of THB 20,000 per unit.

9. CCTV Pipe Inspection Vehicle (CCTV Pipe Inspection System)

Under Contract No. 3 of the Thonburi Wastewater Collection and Treatment System Construction Project, video inspections of installed pipelines are required to verify internal conditions in accordance with project specifications. The total inspection length is approximately 41,201 meters. Previously, the project outsourced CCTV inspections at a service rate of THB 70 per meter, resulting in relatively high operational costs. In addition, scheduling external contractors to align with tidal conditions posed significant operational constraints. Consequently, the project developed an in-house CCTV Pipe Inspection Vehicle to reduce costs, enhance operational flexibility, and enable more effective project scheduling aligned with actual site conditions.

<u>Benefits of the Innovation:</u> CCTV Pipe Inspection Vehicle

(1) Reduced operational costs by 97%, from THB 2,884,070 for outsourced services to only THB 59,155 for equipment development.

(2) Streamlined work processes from the original sequence of “video recording – file download – inspection” to “video recording and real-time inspection”, reducing process redundancy and enabling faster decision-making.
(3) Increased daily operational capacity and shortened the overall project duration.
(4) Reduced manpower requirements by 1 person, from 4 persons to 3 persons, lowering labor costs and improving human resource efficiency.
(5) Extended inspection control distance from 150 meters to 200 meters, expanding inspection coverage.
(6) Reduced reliance on external contractors and enhanced operational flexibility, allowing in-house inspections and adaptive scheduling based on tidal conditions without contractor waiting time.
(7) Improved work safety by reducing repetitive equipment handling and minimizing redundant operations in high-risk areas.

Reduce contractor service costs	Reduce manpower requirement
Reduced contractor service costs from THB 2,884,070 (based on a service rate of THB 70 per meter for a total distance of 41,201 meters) to THB 59,115, representing the equipment development cost. As a result, total cost savings amounted to THB 2,824,955.	The innovation optimized workforce allocation, reducing manpower from four to three personnel.

10. Handrail Pipe Notching Machine

The Den Chai–Chiang Rai–Chiang Khong Double-Track Railway Project required the production of a large number of handrails, necessitating standardized pipe notching to ensure rapid assembly and high-quality welding. To improve efficiency, a Handrail Pipe Notching Machine was developed to replace traditional gas cutting methods, reduce grinding requirements, shorten welding time, and improve joint precision. The project required the production of 9,012 handrail panels, comprising a total of 189,252 pipe ends requiring notching. Using conventional methods, only 3–5 panels per day could be assembled, which would not meet the project timeline. The innovation was therefore introduced to significantly increase daily productivity.

<u>Benefits of the Innovation:</u> Handrail Pipe Notching Machine

(1) Reduced processing time by 330 minutes per 200 pipe ends. With 189,252 pipe ends, the total time savings amounted to 312,267 minutes, equivalent to 651 working days (based on 8 hours per day).

(2) Reduced overall production costs, including savings of THB 542,206.98 on cutting blades and THB 292,744.46 on labor costs, resulting in total cost savings of THB 834,951.44.

(3) Reduced grinding and welding time compared with gas cutting methods, while also lowering CO_2 emissions from fuel-based cutting processes.

(4) Improved joint precision and ensured consistent, high-quality workmanship meeting technical standards.

Reduce processing time	Reduce production cost
Reduced processing time by 330 minutes per 200 pipe ends. With 189,252 pipe ends, the total time savings amounted to 312,267 minutes, equivalent to 651 working days (based on 8 hours per day).	Reduced overall production costs, including savings of THB 542,206.98 on cutting blades and THB 292,744.46 on labor costs, resulting in total cost savings of THB 834,951.44.