

On the fast track

by **PENTA Industrial Corp, USA**

For nearly 15 years PENTA Industrial Corporation has provided engineering design and construction services for dry bulk material and engineered product distribution terminals at locations across the US and internationally. Projects include greenfield facilities and modernisation and expansions of existing terminals, including ship-to-storage and rail-to-storage solutions. So what are the secrets to a successful design-build strategy for fast-track engineering, procurement and construction project delivery?

Cement producers must constantly adjust to changing conditions to meet customer demands.

Conditions can change rapidly and the manufacturer must respond quickly to get their product to the target market area ahead of the competition.

One such current example is demand for bulk sand and cement to support shale oil production in the energy sector. This market has been rapidly expanding, especially in the north and west regions of the USA with sand and cement producers scrambling to meet demand. Manufacturing had its own set of challenges, but how to address product delivery to the market created another set of issues.

A significant add-on cost to the manufactured product is the logistical expense for distribution to the customer. Keeping distribution costs as low as possible for dry bulk materials such as cement, lime and sand is a critical component of maintaining a competitive advantage. The manufacturer's distribution network consists of:

- bulk product transport from point of manufacture to the targeted market area(s)
- terminal(s) to receive and store bulk shipments and then transfer the product for final localised delivery to the customer(s).

For transport of dry bulk materials over long distances, shipment via rail is the most economical method typically available to the manufacturer in the USA for delivering their product to the terminal at targeted market area(s). Safe, rapid, no-spill, no-dusting unloading of bulk rail car shipments into product storage is important for efficient unit-train logistics. The transfer of product from bulk storage

to the customer's transport must again be a safe, accurate, rapid, no-spill and dustless process. The customer's transport must be ticketed and off-the-scale as quickly as possible to serve the next transport in the queue.

Cost and schedule

Owners are interested in low-cost designs for rail-to-truck distribution terminals that can be constructed and commissioned at lower cost with compressed schedules. The use of modular designs and prefabricated, fully shop-assembled systems to the greatest extent possible reduces field installation cost and time. Standardised designs and prefabricated systems significantly reduce both engineering and procurement time, which allows project ground-breaking to begin earlier. The economical designs coupled with achieving rapid facility turnover satisfy the two primary concerns of the owner – cost and schedule.

Low-cost secondary systems such as direct rail-to-truck loading that can handle multiple types of speciality

products can be designed, installed and made operational quickly in advance of the main terminal construction. These secondary systems can also be used as a back-up to the main terminal if the need arises.

Feasibility study and capex

Fundamentally, every project should begin with a feasibility study, which is written as a formal report. It should evaluate one or more potential terminal sites, multiple product storage arrangements, plus storage filling and withdraw system options based on the owner's specific logistical and product throughput requirements. Owner input on specific equipment preferences is used as a basis for pricing. Designs always focus on safe ease of equipment access and serviceability for maintenance and operation. Selection of the type of conveying and transfer equipment and the product storage design has significant impact on engineering and procurement cost and schedule.

Another major consideration is the



North American case studies

North American western region

PENTA is sometimes tasked to build a fast-track solution for bulk rail transport and road tanker deliveries at the same time. For one North American customer situated in the western region, PENTA designed, procured and constructed a secondary rail-to-truck loading system while the main terminal was under construction. The secondary system, including rail car unloading, truck loading, truck scale, operator's station and new rail siding, was completed and fully operational within 3.5 months, prior to availability of site utilities. Power and compressed air supply needs were met with portable modular systems configured by PENTA. The main terminal consisting of rail car unloading, bulk storage, office/control building and truck loading system was completed within 10 months using extensive prefabrication and modular designs. The secondary system also handles alternate materials and can be used as a back-up.

North American midwest region

In this second example, PENTA again needed to supply a fast-track approach for an owner to receive bulk cement shipments via rail and load customer tanker trucks. PENTA designed, procured and constructed a secondary rail-to-truck loading system while a main terminal was under construction. The secondary system, including new rail siding, main substation, compressor station, rail car unloading, truck loading, truck scale and operators station, was completed and fully operational within four months. The main terminal comprised rail siding modifications, rail car unloading, bulk storage, office/control building and truck loading system and was completed within six months using extensive prefabrication and modular designs. Again the secondary system was made available to handle alternative materials and as a back-up system.



of the feasibility study. Any revisions to these key project documents may impact project schedule and cost. It is critically important to come out of the starting gate with major design decisions confirmed to avoid delays. Basic project protocols such as document control and design reviews, will also be established during the KOM.

Engineering and equipment procurement

Commencement of engineering and equipment procurement activities, which incorporates any adjustments, should begin immediately following the KOM. Typically, weekly project meetings will be arranged to discuss progress, and identify and resolve issues as they may develop. Focus on two primary areas during this stage of the project is important. Firstly, completion of critical engineering required for submission of permit applications (building, storm water pollution prevention plant, grading, signage, etc) to construct the facility due to the often-protracted process of obtaining permits from the various governing agencies. Secondly, completion of the engineering for procurement of long lead-time equipment items to ensure timely delivery for installation.

Groundbreaking and construction

With the various required permits in place based on issued for construction (IFC) design documents, the design-build entity should now be ready to break ground. The point-of-the-spear during the construction phase will be the seasoned site manager (SM) as the project now focusses on field activities. The SM should be supported by a home-office team consisting of a safety, project, and purchasing manager plus a project

type of foundation design that is used to accommodate the extreme loads for the product storage. Close collaboration with the geotechnical consultant to select the optimum foundation design in terms of cost and schedule for the specific subsurface conditions is critically important. By evaluating multiple options the owner can select the most cost-effective facility. The ultimate measure of a successful project is owner satisfaction and owner satisfaction can only be achieved by meeting owner expectations. The feasibility study methodology is the best approach to defining and establishing owner expectations.

Once the terminal site is selected and the product storage and material handling equipment have been determined, a formal price and design-build project delivery offer can be developed. In the design-build approach, a total engineering, equipment supply,

construction and facility commissioning package is offered where the design-build entity has single-point responsibility for the project. Final adjustments to price and schedule can be made based on owner input.

Project launch

With a letter of intent (LOI) or a fully-executed agreement in place, the design-build entity will assign an experienced project manager (PM) who will be the point-of-contact for the owner's project representative. A multi-disciplined team of engineers and construction staff will support the PM. The PM needs to be in constant communication with the owner's representative throughout the total duration of the project.

The primary goal of the kick-off meeting (KOM) will be to freeze the mechanical flow sheet, site plan and general arrangements based on the results

administrator. Prior to mobilisation to the site, detailed construction preplanning by the team should have already taken place to help ensure a smooth and safe commencement of field activities.

Commitment to the safe execution of construction comes from the 'top down'. Under the leadership of the SM, no work activity is performed unless it can be performed safely. The SM must also have the full support of the home office safety manager and the safety manager should make periodic safety inspections and audits of the project site. The owner's safety director should be actively engaged during the construction phase. Daily inspections and toolbox meetings should be conducted by the SM and all contractors working at the site to ensure a safe work site.

Along with safety, construction quality is paramount. Employment of totally independent, professionally licensed third-party services to perform geotechnical observations and material testing such as soil and concrete testing is the best approach. Periodic inspections at fabrication shops and manufacturing facilities are necessary to ensure quality and schedule performance is maintained. Additionally, during the course of major mechanical and electrical equipment installation, utilisation of vendor technical advisors to conduct pre-installation meetings and on-site inspection at critical points to insure proper installation can reduce system start-up issues and ensure compliance with equipment warranty requirements.

Construction execution

The SM is the 'field marshal' responsible for ensuring construction is executed safely, efficiently, with high-quality workmanship and with the goals of completing the project ahead of schedule and within budget.

Working closely with local building officials, utility companies, property lease holders, railroads etc, the SM coordinates the various construction tasks and trade-disciplines including:

- civil and underground utilities
- deep and shallow foundations
- super-structures
- mechanical equipment installation and piping
- electrical construction.

The SM regularly conducts project progress meetings with subcontractors and vendors for planning and coordination purposes. The SM directly interfaces with the engineering project manager to resolve any design related issues. Depending on project size and complexity, the SM may have support staff on-site to assist during construction. The SM holds special meetings with the various project parties if required to address any urgent matters impacting cost, schedule or safety. The SM should prepare and submit a formal written monthly report to the owner documenting the project progress.

Start-up and commissioning

The commissioning team for facility start-up is often under the leadership of the SM, and typically consists of the electrical engineering lead, system programmer,

main vendor field technicians and the owner's operating staff. The start-up and commissioning period is designed to provide the necessary training to the owner's staff to safely and efficiently operate the new facility. Supporting the commissioning team are both mechanical and electrical tradesmen to assist with equipment troubleshooting and diagnostic activities. Additionally, the field technicians provide instruction on the proper maintenance procedures required for their particular equipment.

Following successful facility performance testing to confirm achievement of guarantees, the design-build entity hands-over the keys of the facility to the client. All O&M manuals, equipment installation records, certificates, and record ('as-built') drawings are turned over to the owner for their use in operating and maintaining the new facility.

Straight to the point

PENTA has many years of design-build approach to fast-track project delivery and has managed to streamline the engineering, procurement and construction phases. PENTA's use of modular designs and prefabricated fully-shop assembled systems to the greatest extent possible has reduced field installation cost and time. PENTA understands and has demonstrated the importance of getting the manufacturer's product from the point of production to the owner's point-of-need rapidly, efficiently and at a low cost.

Prefabricated items and modular designs reduce field installation times, but safety and quality construction are paramount for any design-build project

