



What ever happened to US Gulf Coast construction cost as 25% of total installed cost* and sustained pipe installation rates of 24,000 feet per week?

*Excluding owner's cost

Recent data from current US Gulf Coast petrochemical projects has consistently demonstrated that historical expectations for construction cost and craft production are not being met. What can be done to move performance closer to the levels that were achieved 20 to 40 years ago? Our view is that much of the solution has to do with a renewed focus on achieving the required rates of production and nurturing craft leadership.

Focus on achieving construction productivity and the required rates of production

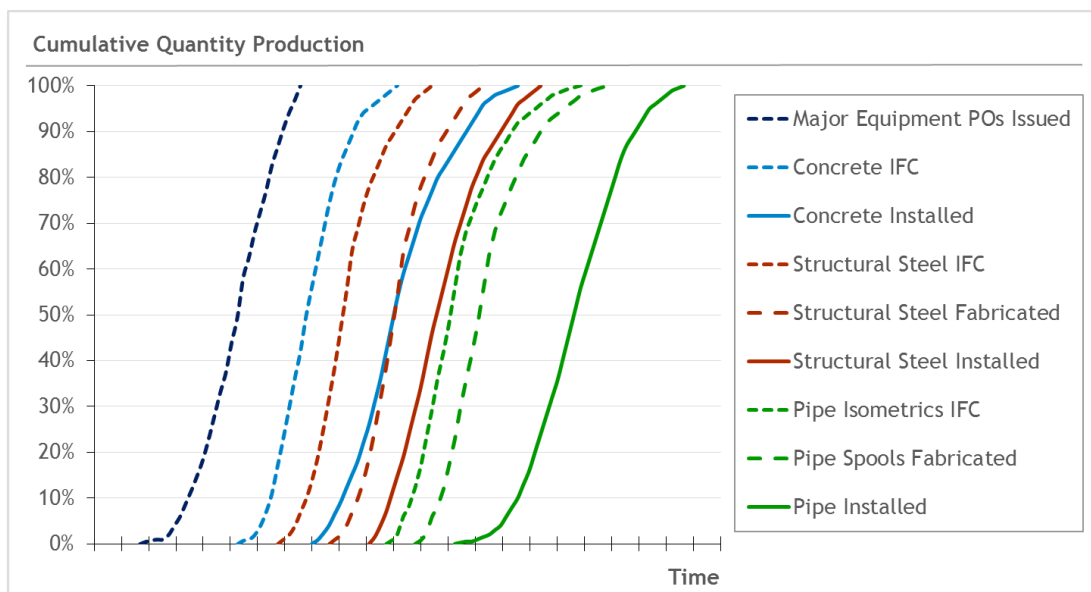
Currently, construction packages are often planned prior to the availability of final data and without input from craft leadership, resulting in incomplete information in the field and late changes. During execution, craft leadership is often preoccupied with trying to understand the actual work content, as opposed to focusing on the more important goal of achieving production based on efficient allocation of resources to available work fronts.

Accountability for providing the right information and organizing for production has become blurred as craft leadership attempts to adhere to the work package plan, and the productivity ratio of work-hours (resultant from the number of people working on site) divided by quantities installed is not in clear focus.

The five historical projects noted above used a different approach:

- The planning and execution was driven by a focus on achieving the rates of production for the total project, with daily corrective action taken by craft supervision to achieve productivity.
- Scheduling was performed by area (geographic and/or process unit), but daily decisions on resource allocation and work priority were made with a drive to achieve the production rate, while maintaining the productivity goals for each craft/trade.
- Simple but very effective production metrics were implemented to track construction quantities from IFC drawings through field installation, providing continual feedback on engineering, fabrication, and construction performance against schedule on a minimum weekly basis.
- The schedule was used as a tool to align engineering and procurement activities to ensure that the required production was supported by information, materials, and fabrication. When progress issues arose, the schedule was adjusted to assure production; this is contrasted with revising the production curves when schedule targets aren't met, which is common on today's projects.

The chart below gives an illustration of construction quantity tracking from engineering (IFC) to field installation.



Organize to provide clear direction and accountability for achieving the required rates of production across the entire project

We see current US Gulf Coast projects managed with the crafts directed by area supervision, working to the priority of packages developed by schedulers in the home office. In contrast, for the five referenced projects, workforce management was craft-centric, and the final decisions on workforce planning and daily work priority was made by craft leadership. The accountability for production and quality clearly resided with craft leadership, with area management only serving to enable the crafts to do their work (e.g., assuring design, material, and equipment availability). Under this concept, the workers were moved to available workfaces across areas in order to achieve the required production rates every day.

More detail regarding the construction practices used on the five historical projects is provided below:

- The projects were executed by a single contractor on a direct-hire basis; four of the projects were contracted as EP&C with no CM, and one as EPC.
- Constructability logic networks were developed and maintained by the site schedulers to facilitate the required rates of production. The constructability logic was integrated with engineering and procurement production at the physical object level – i.e., identifiable, commonly understood project elements such as foundations, structures, and lines of pipe. These objects were the common denominator of communication between engineering and construction.
- Area coordinators were organizationally responsible for assuring materials, equipment, and design deliverables were consistent with the constructability logic schedule to the object level in their area. The area coordinators were held accountable for making sure the craft leadership was informed of what work was available, and assisting the craft leadership to find other workfaces when the scheduled workforce was not available.
- The craft superintendent was totally and directly responsible (in addition to clearly accountable) for production, productivity, and quality.
- The workforce planning took place in the craft site office, with the decision on workforce priority made by the craft leadership, who were focused on achieving production rates.
- Materials under the physical control of materials management were released to the craft by object, consistent with the constructability logic networks.

Promote, nurture, and reward craft leadership

Perhaps the most critical root cause behind the current poor construction performance is the loss of key craft leadership within contractors. For the most part, contractors are not organized to develop and sustain people in these roles. The availability of experienced craft leadership has been further reduced due to the cyclical nature of the US Gulf Coast workload, pressure from Wall Street to reduce overhead, and owners buying construction on a “commodity” basis (i.e., assuming each contractor has equal capabilities).

To address this trend, owners should encourage and reward contractors that maintain craft leadership resources and develop the skills of craft management. The cost to owners may be a bit more initially, but we believe that this investment will be returned several times from the improved construction productivity that will result.

Note that a 10% improvement in construction productivity on a cracker project is worth over \$100 million. To illustrate the point, many of the current projects on the US Gulf Coast could have paid the contractor’s pipe superintendent from the five referenced historical projects an NFL quarterback’s salary for the project duration and come out ahead. These superintendents were the “quarterbacks” who had teams populated with enough trusted resources to install over 22,000 feet of pipe per week, at 2.5 work hours per linear foot, for nearly a year.

It is very unlikely we will see significant improvement in productivity until contractors can return to supplying a core of tenured leaders and resources that represents at least 20% of the total requirements for critical crafts like pipe.

Alternative contracting strategies should be considered

Given the recent performance, it is unlikely that any construction contractor on the US Gulf Coast today can qualify under the above criteria (i.e., 20% tenured resources) for a large project such as an ethane cracker. Greater modularization is currently assumed to be the solution, but it is an expensive alternative on the US Gulf Coast. When the costs affiliated with the additional engineering, oversight, transportation, site sanitization, and module installation are considered, modularization can easily be 20% more expensive than stick-built construction.

Even with modularization, the best outcome for US Gulf Coast construction is likely to come from implementing a construction management approach that engages multiple well-vetted contractors with tenured resources consistent with their scope. However, with this approach, the required construction management will add about 10 to 15% to overall construction cost, due to duplication of management resources with the constructor (and in some cases, the owner) and additional interface issues. It will also limit “cross crafting” and site craft integration.

So how can owners build projects in today’s environment with improved productivity, while incentivizing contractors to re-invest in craft leadership? We believe that the following contracting approach would improve results both in the short- and the long-term:

- Seriously vet contractors on the skill and tenure of their craft leadership.
- Subdivide large projects into sub-projects that match available contractors’ ability to staff them with tenured resources.
- Use modularization selectively to make up contractors’ resource shortfalls.
- Only pay full overhead recovery and profit on:
 - Craft superintendents with at least 5 years’ company tenure and proof of production
 - General foremen with 4,000 hours for the company in the last 3 years
 - Foremen with 3,000 hours for the company in the last 3 years

Path forward

Both owners and contractors need to take steps to improve the overall construction cost problem.

Construction contractors need to carefully examine how they are organized to perform the work, nurture craft leadership, and assure the crafts have information with which they can execute effectively.

Owners need to perform due diligence on the contractor’s installation resources. They may also need to add construction management resources to plan and oversee the work when employing multiple contractors. And finally, owners need to take a different contracting approach to incentivize contractors to assure they invest in construction craft supervision.

While we may never return to historic US Gulf Coast performance levels, we are convinced that construction performance can be significantly improved with a renewed commitment to driving production and nurturing quality craft leadership.

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