

Technical Feasibility Assessment of a Modular Fabrication Transport Module (FTM) for Heavy Project-Shop Manufacturing

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THE PROBLEM

LMEL builds bespoke, one-off assemblies in an Engineer-to-Order project-shop so variability is the business model, not a fault.

- Scope, standards & interfaces reset every project.
- No learning mechanism perpetual re-set.
- Survival crowds out improvement

3,496

Labour hours lost to weld repairs (2023-24)

Root cause: production instability & expediting pressure not welding quality.



Photo of Ledwood's Pipe production facility during Project B: LNG Storage Case Study.

AIMS & OBJECTIVES

Design and assess the feasibility of a Fabrication Transport Module (FTM).

1. Investigate project-shop inefficiencies.
2. Define engineering requirements.
3. Develop FTM Conceptually.
4. Validate Structurally.

THE FTM SOLUTION

The FTM is a standardised, trailer-sized flow unit. An engineered structural frame intended to replace project-shop variability with controlled, repeatable sequencing at the systems constraint point.

Fixed Constraint

Sized to the geometry that never changes, the size of flatbed trailer (dispatch size).

Modular Flow Unit

Contains variability inside a block, like shipbuilding.

Pull, Not Push

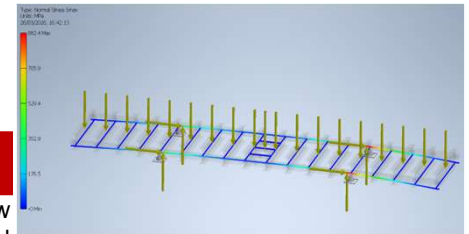
Dispatch is the pull signal disruption can't cascade downstream.

Lean, Theory of Constraints and Modularisation independently arrive at the same solution: a standardised handling unit at the constraint point. The FTM is how local excellence becomes global excellence.

CONCEPT TO REALITY

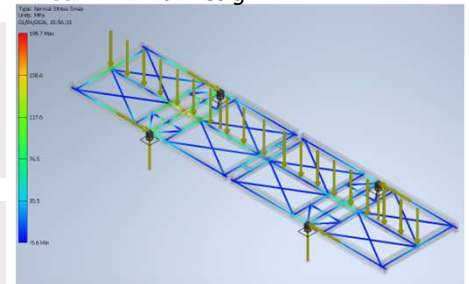
Idealised as a free-standing frame, pinned at lifting points, 75/25 eccentric load, 647 kN total. Then screen, refined and verified.

FAILED – Iteration 1



~882 MPA Peak – inadequate load path

PASSED – Final Design



~199 MPA Peak stresses.

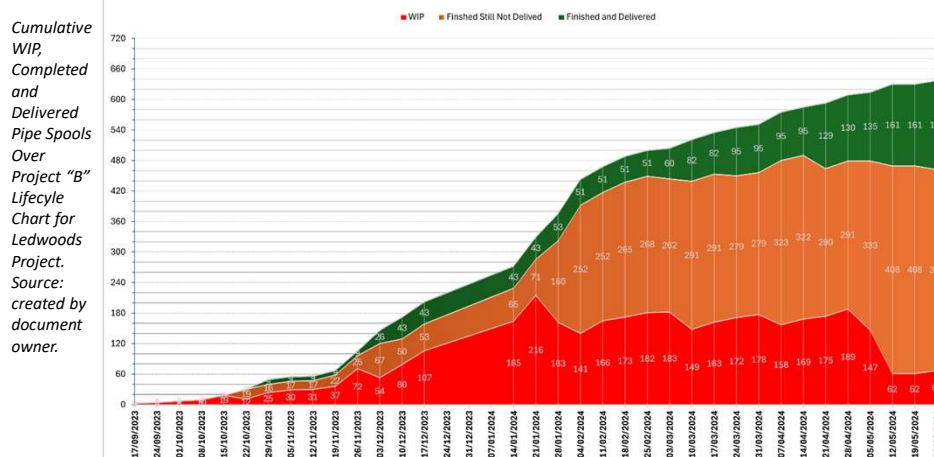
Design evolution – Stiffness vs. Mass

Design	Stiffness (N/mm)	Mass (kg)	Lift / self-wt
Initial Concept	6914.42	2156.030	20.4:1
Design iteration 2	471830.11	8335.38	5.27:1
Design iteration 3	89714.96	5453.402	8.07:1

Iteration 3 trades raw stiffness for mass efficiency.

The insight: the bottleneck isn't skill or quality it's the absence of a system level control point.

Work-in-Progress and Delivery Accumulation in a Project-Shop Environment (Project B: LNG Storage Case Study)



VERIFIED, NOT JUST SCREENED

Eurocode 3 – all primary members pass ULS at ~52% utilisation.

ASME BTH-1 – padeyes refined (lug height ~126 mm) to resolve shear-rupture governing case.

Service Class 1 – ~71,250 lifetime cycles
Manufacturability defined – S355, hybrid CJP/PJP welds, EXC3 inspection