www.autoih.co.za

Case Study

Intra Logistics Simultaneous Engineering

AIH GROUP

CEER

Project Name: **Intra Logistics Simultaneous Engineering**

Client: CEER Automotive Company, Riyadh, Kingdom of Saudi Arabia

Project Overview

CEER Logistics is in the design phase of a greenfield project to build the CEER National Automotive Company's Manufacturing Plant in the King Abdullah Economic Centre (KEAC) in Jeddah, Saudi Arabia. The company aims to become a mass producer of vehicles in Saudi Arabia and the surrounding region by building a high-technology automotive manufacturing industry that seeks to attract tier one global brands, partners, and suppliers. Their vision and mission are aligned to Saudi Arabia's vision 2030 and the Saudi Green Initiative to grow and diversify the economy and promote sustainability.

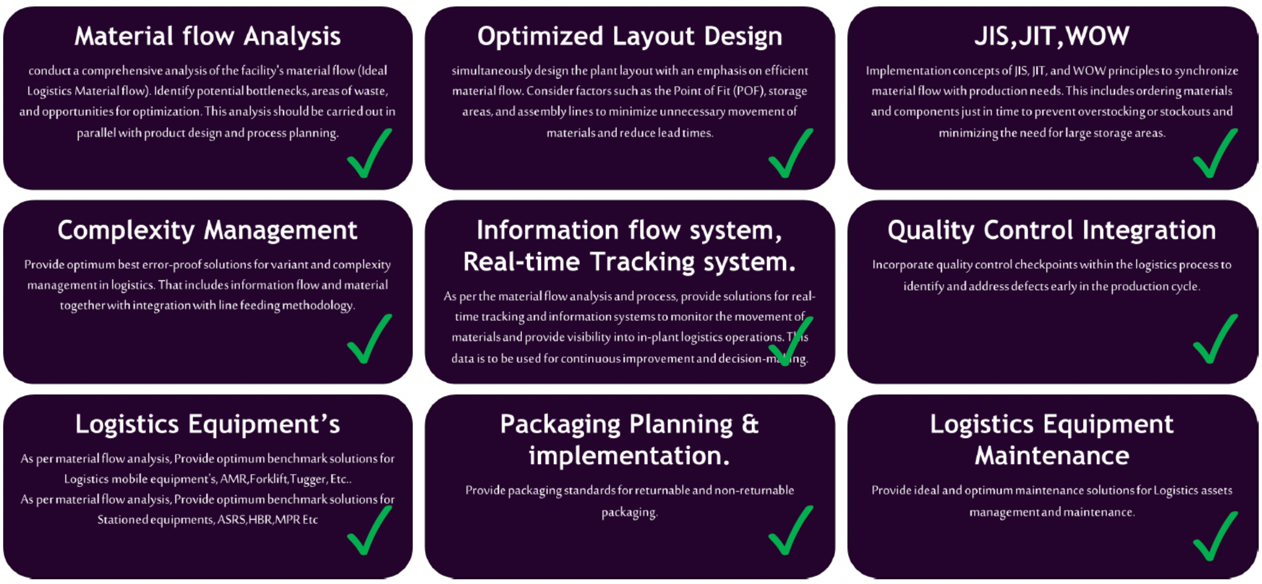
CEER Logistics sought the services of a qualified partner to provide Intra Logistics Simultaneous Engineering Services that will assist CEER's Logistics Engineering Team to achieve CEER Automotive's objectives. The PAC Group assisted CEER to develop high-level strategies for each defined project objective that will result in the design and build of a state-of-the-art automotive manufacturing facility.

Project Objectives

The project objectives were based on the following 9 agreed project pillars:

- ***Material Flow Analysis***

  To conduct a comprehensive analysis of the facility's material flow to identify potential bottlenecks, areas of waste, and opportunities for optimization. The outcome of this analysis should provide an end-to-end intra-logistics flow map for each supply value stream.



- ***Optimized Layout Design***

  Produce block CAD layouts to minimize unnecessary movement of materials and reduce lead times at the Points of Fit (POF), storage areas, and assembly lines.

- ***Just in Sequence (JIS), Just in Time (JIT), Warehouse on Wheels (WOW)***
  Implement concepts for JIS, JIT, and WOW to synchronize material flow with production needs, whilst giving due consideration for the ordering of materials and components to prevent overstocking, stockouts and the need for large storage areas. An expected outcome would be the provision of a commodity-wise strategy for every material type.

- ***Variant Management and Complexity Management.***
  (Kitting, Sequencing, Re-packaging/Downsizing/Minomi)
  To provide optimum best error-proof solutions for variant and complexity management, considering information and material flow for integration with line feeding methodologies. Solutions should include the implementation of optimal re-packaging, downsizing, or Minomi concepts for the end-to-end supply chain and logistics.

- ***Information flow system, Real-time Tracking system.***
  As per the material flow analysis and process, provide solutions for real-time tracking and information systems to monitor the movement of materials and provide visibility into in-plant logistics operations. Suggest the best methodologies used by automotive OEMs for tracking of parts, inventory and equipment, continuous improvement and decision-making.

- ***Quality Control Integration***
  Incorporate quality control checkpoints within the logistics process to identify and address defects early in the production cycle. This should include solutions for the use of RFID, Poka-Yoke, Pick to light, etc. An expected outcome is to provide logistics quality control systems per area.

- ***Mobile Equipment and Stationed Logistics Equipment***
  As per the material flow analysis, provide optimum benchmark solutions for logistics mobile equipment that include the use of autonomous mobile robots (AMR), autonomous mobile forklifts and autonomous mobile tuggers. The material flow analysis should also consider optimum benchmark solutions for stationed equipment such as autonomous storage and retrieval system (ASRS), high bay racking, marketplace racking, manual storage and retrieval systems. Reasons were to be provided for equipment type and vehicle selection preferences.

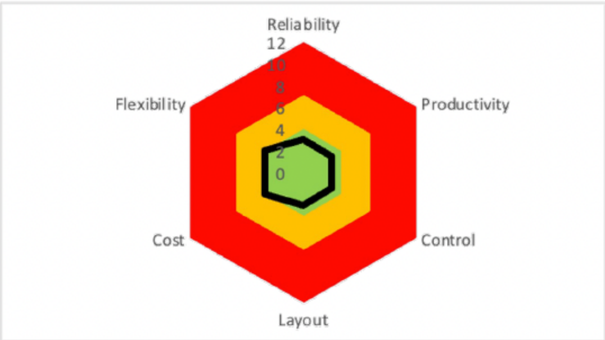
- ***Packaging Planning & implementation***
  Provide packaging standards for returnable and non-returnable packaging, including the provision of ideal and optimum packaging concepts and proposals.

- ***Packaging Pallets, Mobile Equipment and stationed Logistics Equipment Maintenance***
  Provide ideal and optimum maintenance solutions for logistics assets, including best practice equipment lifecycle management methodologies.

Methodology Adopted

A collaborative planning approach was followed to ensure that all project requirements were considered for design and production decisions. PAC adopted a hybrid working model where project team members worked on- and off-site throughout the project duration. Interfaces with the CEER team involved scheduled daily debrief session with the team leads, ad hoc working session and workshops with various stream leads, a weekly Steercom meeting for project updates

Evaluation Methodology Example



and decision making and a monthly Executive Management update. Each Steerco session was recorded for final project and decision records.

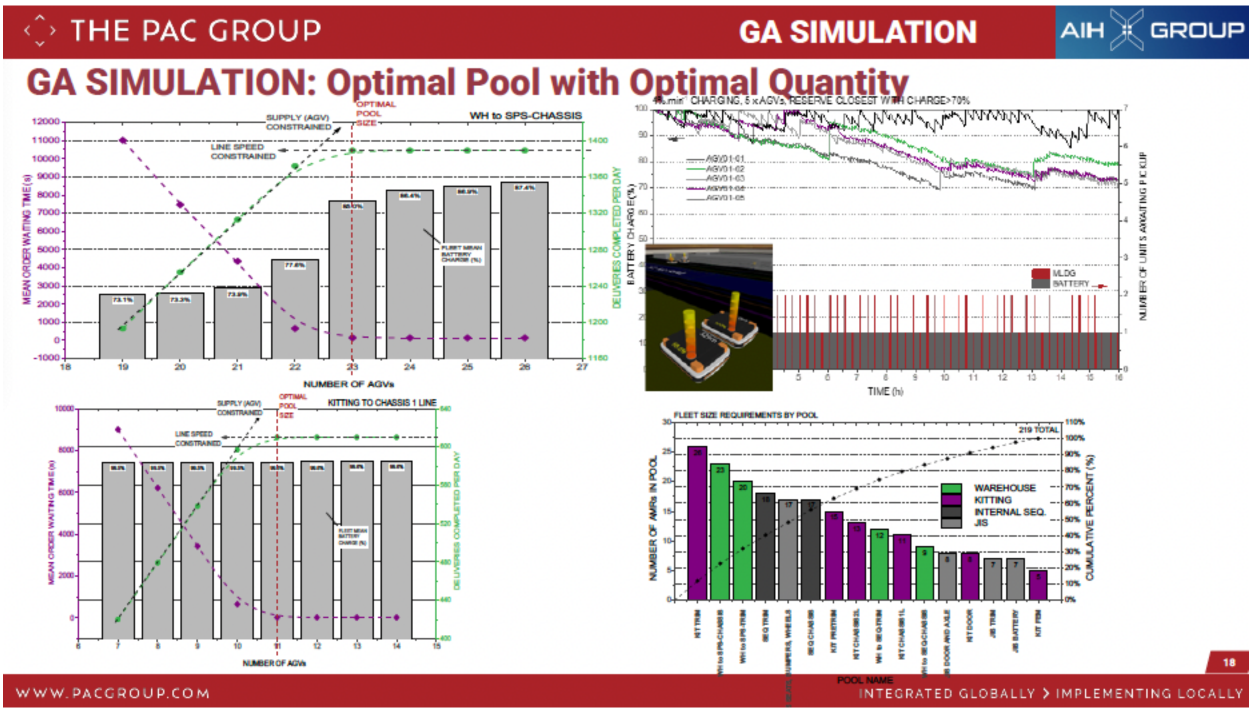
Workshops involved cross-functional teams from logistics engineering, logistics operations, manufacturing engineering, quality and procurement. Relevant stakeholders from the Stamping -, Body in White -, Paint -, and General Assembly plants were consulted from the early stages in the project. This was augmented by the review of existing process material, Bills of Material (BOM) and product data.

Source documentation for each workstream identified consisted of Plan of Reference, CAD drawings and high-level process maps. All of these formed the basis for PAC's analysis and solution development. All relevant material were shared in a central repository which remained accessible to team members from both parties.

Challenges

A major challenge experienced at the onset of the project was the low level of maturity of the proposed Bills of Material for General Assembly and Body in White. Multiple sources of information, all still in development stages, were made available by Logistics Engineering, Manufacturing and Procurement. Supplementary information was supplied by the packaging and manufacturing teams. These files contained little to no corresponding product numbers or cross-referencing.

Combining the different sets of information resulted in a Bill of Material which contained 70% product data for one model variant. This was further exacerbated by the fact that the variant is also the lowest volume derivative in the complete product line. It was agreed with CEER that this data will be extrapolated across the other 6 model variants for the purposes of solution development and calculations.



Outcomes

PAC produced dynamic simulation solutions to highlight the material and process flows in the proposed layout areas across the facility. Through these exercises the following were achieved:

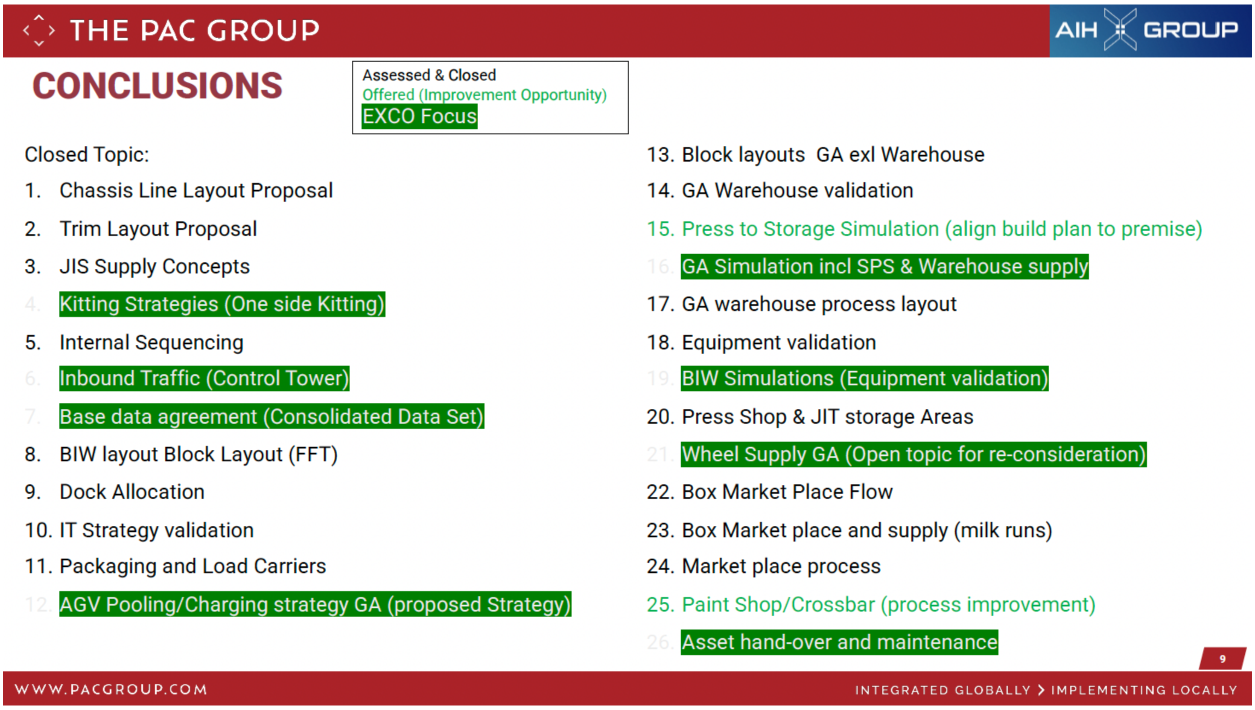
- The validation of the proposed layout and logistics capabilities within the various plants,
- The characterisation of AGV and AMR flows within the facility, including different equipment pooling strategies for in line with production rates,

- The establishment of fleet requirements for different material supply lines,
- The assessment of different fleet management philosophies, in terms of inter alia vehicle pool allocation, battery charging strategies and packing strategies,
- Validation of space and equipment requirements as per the initial Plans of Reference,
- The calculation of optimal quantities for purpose-built equipment types and their applicability for operational execution, and
- The proposal for suitable equipment lifecycle management and maintenance strategies.

Space capacity calculations proofed that the planned facility sizes, layout and positioning would be sufficient to handle, store and process all inbound and internal movements of materials. PAC produced suitable SANKEY flows that validated container and supplier park JIS and JIT material flows. A proposal was made to adopt the use of container marshalling services and facilities for optimal inbound container management.

For internal facility flows it was suggested that to accommodate the two production lines, there must be multiple supply strategies and frequencies, in particular for Kitting and Sequence as well as JIT and JIS conveyance methods. Dock allocations for specific operations were validated based on lineside fitment and positioning of JIT, JIS and WOW materials.

To synchronize the material flow with the production processes a review was conducted on the implementation of the concepts for JIS, JIT, and WOW. This included the processes for the just in time ordering of components to prevent overstocking, stockouts or the need for large storage requirements. Specific commodities were identified to test against the suitability for JIS, JIT or WoW applicability and proposals were made accordingly.



Layout designs validation and proposals included optimal solutions for the Kitting, Sequencing, Doorline, BIW and Press Shop areas. Static simulations conducted highlighted several improvement opportunities. Proposals included designs for side-by-side kitting trolley placement, adoption of phased kitting strategies, repositioning of doorline kitting for optimal space utilisation, reviewing of the Press Shop production schedule to synchronise storage and consumption rates, and the suggestion to keep the BIW layout as per the Plan of Reference in contrast to the suggested layout changes from other CEER contractors.

The interrogation of the variant and complexity management processes allowed for the provision of optimal best error-proof solutions in the intra-logistics activities for material flows. Line feeding methodologies were reviewed to provide optimal best concepts and implementation strategies for the end-to-end supply chain and logistics activities. PAC identified and proposed unused free space for further extension of the kitting/sequencing area.

Mobile and storage equipment reviews resulted in a number of proposals which included the calculation of the required quantities of high-bay racks, automated storage and retrieval systems and floor space storage. Best in class equipment types such as very narrow aisle units, electric stackers, AMR forklifts, AMR tuggers, etc., were suggested with the required quantities per equipment types. The storage equipment proposal included conveyance packaging such as stillages, trolleys, KLTs and GLT. Packaging included best practice proposal for the conveyance of key components such as wheel and tyres, seats, instrument panels, centre consoles and bumpers.

Reviews were done to test the suitability of planned quality and information technology systems and processes. Whilst this was found to be sufficient as per the current Plans of Reference, suggestion made included the incorporation of a Transport Management System (TMS) in the planned information technology Control Tower.

Considering the planned level of technology and sophisticated automation in the CEER facility it was proposed that adopts an equipment maintenance that will assign accountability to the correct equipment owners as users. The recommendation was that CEER adopts the Reliability Centred Maintenance best practice model that is fully aligned with Total Production Maintenance philosophies. An equipment ownership and maintenance matrix were shared to highlight the migration of responsibility and accountability from the Logistics Engineering team to the relevant operations and maintenance teams within CEER.

Lessons Learnt

Some of the key takeaways for the teams were that:

- Data maturity is key for effective design and solution development. The incomplete data sets resulted in protracted consultation, validation and consensus seeking, which caused undue extensions on the timelines allocated for design and solution development.

- The collaborative approach adopted throughout the project allowed for the seamless exchange of ideas and problem-solving, ensuring that the project objectives remained top of mind. These interactions were not just limited to troubleshooting but also involved brainstorming sessions that led to innovative approaches and the validation of concepts.

- There was consensus from both teams that a simultaneous engineering exercise should take place much earlier in the overall planning cycle for projects of this nature. This would help with the early detection of potential design and manufacturing issues. PAC proposed a number of design changes that would have resulted in better material flows at the chassis and final lines. This would have resulted in construction changes that could only have been accommodated at earlier stages of the project construction timeline.

- A central document repository provided for the easy sharing of material and real time availability of information. This proofed particularly helpful where teams worked across different time zones.

The project lead was Mike Sutherland. Contact him at Mike@autoih.co.za or via info@autoih.co.za and please visit our web at www.autoih.co.za