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Optimizing Warehouse Rack Utilization and Inventory Flow Through Plan for Every Part (PFEP) Data Mapping : An Automotive In-Plant Study

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Abstract **- Inadequate material visibility usually leads to late line-side replenishment or overcrowded storage bays. This study aims at the assessment of inventory control and use of the rack of the store in Material Planning & Logistics (MP&L) of Automotive Company, Chakan. I conducted an audit of 30 storage racks, documented part number, quantity, bin, location and rack, and observed the inbound Goods Receipt Note (GRN) procedure from 22 June to 31 August 2026. I then ran spreadsheet models and ABC split on inventory master of 8,572 parts to compare with Plan for Every Part (PFEP) planned parts. FIFO stock worth ₹1,620.4 million was compared to a PFEP of ₹148.9 million for 3,861 components, that is a gap of ₹1,471.5 million. The gap is highly concentrated: 404 imported parts make up 77.7% of stock value; 96.1% of Class A items; and 2,021 line items are more than their Maximum Days on Hand (MDOH). The gap to the end is filled by three programs (V167, V214 and X254) which comprise ₹1,038.9 million, which is represented by 79 large seat-kit items in the bays below the floor. The issue isn't stock bloat throughout the industry, but rather large, high-value batch arrivals and fixed slotting. I recommend a slotted ABC class, pick velocity, bulky imported kits should be stored in high-bay racks, check high-MDOH parts weekly, and add the location of the rack to QAD ERP with barcodes.**

Index Terms**—inventory gap analysis, material location visibility, Plan for Every Part (PFEP), rack optimization, warehouse storage utilization**

I. INTRODUCTION

The number of parts in an automotive plant continues to increase and the system record can become out of sync with what's on the shelf. Typical outputs are insufficient storage, too much stock and late line feed. Plan for Every Part (PFEP) is intended for avoiding this by maintaining one plan per Part: storage location, packaging, consumption rate, lead time. That record only does as much good as is used when someone looks it up on the floor. Without regular physical mapping, racks will be less dense, operators will lose handling time and parts will become difficult to trace. It is a study on storage and inventory control in the store of MP&L at Automotive Company, Chakan. It brings together two works. The first one is a physical inventory for 30 racks which includes part number, bin, rack position and quantity on hand. The second is an analysis of a collection of 8,572 item numbers, their demands, ABC class, their lead time, their inventory value and the differences between the numbers of items counted in a warehouse and the numbers in the PFEP system. The objectives are to make materials visible, mark materials that could be surplus and improve vertical and horizontal rack space utilization.

The method is designed to be transferable and repeatable to other automotive plants seeking to create PFEP data in a bottom-up approach to help align inventory policy with the actual store layout and avoid the drift between the two.

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II. THEORETICAL BACKGROUND AND LITERATURE REVIEW

Theoretical background and literature review. The study takes the chain in Fig. 1 from the PFEP data to visibility, then to storage location management, rack optimization and finally excess identification. Fig. 1. This study was conceptual chain. The main data record is PFEP. It contains the part specifications, consumption rates, supplier information and storage areas, and internal logistics can follow a uniform standard, reducing unnecessary handling, searching and excess motion. Gu et al. [1] consider storage as one of the key factors in the throughput of a warehouse: the place where a part is stored dictates the handling effort, access and replenishment speed along the lines. Rojas Reyes et al. [2] cite the Storage Location Assignment Problem (SLAP) and prove that optimal rack allocation allocates parts to the demand velocity and physical size of the bin, rather than randomly. DeHoratius and Raman [3] discovered that faulty inventory information also affected replenishment, which meant that physical audits like a rack survey supported replenishment. Prospective reduction in inventory without supporting data can adversely affect operations, as seen in the payoff of leaner inventories as found by Eroglu and Hofer [4]. A combination of ABC value classes and a gap analysis yields: $\Delta = \text{Icur} - \text{IPFEP}$ (1) *whererew is the current inventory and IPFEP is the PFEP planned inventory. A positive difference is not viewed as a waste flag, but rather as a signal to perform root cause analysis. The sources conclude that combined, the mapping of the physical rack and central PFEP control can increase storage density without jeopardizing production continuity.



Fig. 1. Conceptual chain followed in this study.

III. RESEARCH METHODOLOGY

A. Research Objectives

The study checks how parts are physically stored in the store and tests the inventory parameters in the system against them. The objectives were:

1) To collect part number, quantity, bin number, location and rack number from the Chakan store by physical audit.
2) To organize that data for PFEP preparation and better material-location visibility.
3) To find inventory and material-flow gaps using stock levels, demand, lead times, physical locations and inventory policy parameters.
4) To find practical ways to improve rack use and storage management across the warehouse.

B. Research Design, Timeline and Data Collection

The design is descriptive, observational and quantitative, and the work ran for ten weeks, from 22 June 2026 to 31 August 2026. I audited 30 storage racks at the Chakan plant on site, picking racks by convenience. For each position I recorded part number, count, bin identifier, store location and rack coordinate. I also traced the inbound GRN workflow: gate entry, invoice verification, discrepancy tracking through Material Discrepancy Notes (MDN), and entry into QAD ERP.

C. Quantitative Analysis and PFEP Synthesis

Results and Reporting It is descriptive, observational and quantitative, the work period was for 10 weeks, from 22nd June 2026 to 31st August 2026. In the Chakan plant, I inspected 30 racks, taking random samples known as pick racks. Part number, count, bin identifier, store location, rack coordinate were recorded for each position. I also followed the inbound GRN workflow from gate entry to verification of the invoice, discrepancy tracking in the Material Discrepancy Notes (MDN) and finally into the QAD ERP. Analysis of the numerical data and synthesis of PFEP. I analyzed an internal dataset of 8,572 automotive components next to the floor audit. ABC class part splitting and consumption rates, safety stock and lead times were examined in spreadsheet models. Gap analysis was done on physical stock, planned physical stock (physical stock – planned PFEP stock), and inventory value. When the rack coordinates were compared to the PFEP baseline of 8,572 parts, the position of each part was indicated, any surplus stock was marked and areas for optimization of rack density were identified.

IV. DATA ANALYSIS, RESULTS AND DISCUSSION

Analysis of the results and discussion of the data B. Assessment of the importance of the data to be collected (Objective 2) The fields recorded by the audit are listed in Table I. The audit included 5 columns (part no, on-hand quantity, bin identifier, store location, rack coordinate) for 30 racks at the Chakan store. Prior to this, in-bound material was received in the warehouse via GRN workflows or QAD ERP into the warehouse, but the bin it was received in was not always associated with a physical rack. The audit provides the store verified bin level records from the floor. Should reduce search time and reduce handling errors, but not timed, and give the physical groundwork to integrate with the inventory system. TABLE I Physical Store Audit Parameters Survey scope Field metric Count / details Recording method Racks audited Total racks surveyed 30 storage racks Visual on-site audit directly done on site. Store coordinates Space and rack number Grid-mapped alphanumeric IDs Shop floor audit sheets (manually completed) Receptacle traceability Bin

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identifier Unique bin / container barcode ID's Physical container logging Component identification Part number records Cross checked with physical labels. This is a master record that is synchronized with the QAD ERP. Stock verification The numbers in the boxes are the actual amounts on hand. Unit count per bin (by item) Cross checked with GRN / MDN slips B. Organize the Storage Data and Make it Visible with PFEP (Objective 2)

TABLE I
PHYSICAL STORE AUDIT PARAMETERS

Survey scope	Field metric	Count / details	Recording method
Racks audited	Total racks surveyed	30 storage racks	Direct on-site visual audit
Store coordinates	Location and rack number	Grid-mapped alphanumeric IDs	Manual shop-floor audit sheets
Receptacle traceability	Bin identifier	Unique bin / container barcode IDs	Physical container logging
Component identification	Part number records	Verified against physical labels	Reconciled with QAD ERP master
Stock verification	Quantity counted on hand	Itemized unit count per bin	Cross-checked against GRN / MDN slips

Table II breaks the repository down by sourcing type. There were 8,572 items in the repository of which 4,214 items were in stock. The FIFO value of their was ₹1,620.40 million and the plan was set at ₹148.90 million for PFEP. Most of it comes from imports: 404 imported components account for ₹1,260.00 million (77.76% of the value of stock) and 8,168 local components are valued at ₹360.81 million. This division calls for a different replenishment approach, particularly where long-lead imports are concerned, as opposed to local Just-in-Time (JIT) deliveries. When the records are added to one PFEP database, both sets can be more easily viewed.

TABLE II
INVENTORY CONSOLIDATION AND PFEP VALUE GAP BY SOURCING TYPE

Category	Item records	Items with stock	FIFO value	PFEP value	Net gap	Share of value
Imported	404	293	1,260.00	27.97	+1,232.03	77.76%
Local	8,168	3,921	360.81	120.91	+239.90	22.24%
Total	**8,572**	**4,214**	**1,620.40**	**148.90**	**+1,471.50**	**100.00%**

Values in ₹ million.

TABLE II This report consolidates inventory data and presents the value gap analysis across the different sourcing types. Category Item records Items with stock FIFO value PFEP value Net gap Share of value Imported 404 293 1,260.00 27.97 +1,232.03 77.76% Local 8,168 3,921 360.81 120.91 +239.90 22.24% Total 8,572 4,214 1,620.40 148.90 +1,471.50 100.00% Values in ₹ million. D. Waste and Risk Analysis (Objective 4) This is broken down by ABC class in Table III. The biggest disparities are in high dollar components. Class A materials have a value of ₹1,557.00 million which is equivalent to 96.10% of the value of inventory and are operating at ₹1,412.30 million above their PFEP. There are 1,936 items in Class A that exceeded the maximum stock-day thresholds and require review (46.94% of Class A). Excess from classes B & C combined is less than about ₹1.00 million. Class D is the class with the lowest number of items with a gap of ₹58.15 million, that's also worth checking out. The pattern suggests high value batch ordering, Minimum Order Quantity (MOQ) and fluctuations of customer demand. Weekly cycle counts and cushion buffers that are variable as needed are required, rather than a blanket reduction of stock. TABLE III ABC Classification and Exception Review. Class Items FIFO value PFEP value Difference Items for review Review share A 4,124 1,557.00 144.70 1,412.30 1,936 46.94% B 1,043 1.73 1.28 0.45 34 3.26% C 2,600 1.49 0.99 0.50 4 0.15% D 794 60.05 1.90 58.15 45 5.67% Total 8,572 1,620.27 148.87 1,471.40 2,019 23.55% Values in ₹ million. D. Rack Optimization and Storage Management Opportunities (Objective 4) The picture at the program level is given in Table IV. The layout of the racks should be based on the amount of space each program requires and on the speed of the components of each program. Value and floor space are focused in a few programmes. The gap is filled by only 79 line items, comprising V167, V214 and X254, which are mostly large imported seat kits, that block staging on the floor. A lot of pick faces will be on MVML Common (270 review items) and VW (346). The solution varies for each group. Sub-assemblies from outside the company that are heavy should be stored in vertical high bay racks.Heavy sub-assemblies from outside the company should be stored in vertical high bay racks. Domestic parts should be placed in pick faces zoned by velocity and set to a comfortable working height to avoid any bottlenecks in aisles and provide additional rack space.

TABLE III
ABC CLASSIFICATION AND EXCEPTION REVIEW

Class	Items	FIFO value	PFEP value	Difference	Items for review	Review share
A	4,124	1,557.00	144.70	1,412.30	1,936	46.94%
B	1,043	1.73	1.28	0.45	34	3.26%
C	2,600	1.49	0.99	0.50	4	0.15%
D	794	60.05	1.90	58.15	45	5.67%
Total	**8,572**	**1,620.27**	**148.87**	**1,471.40**	**2,019**	**23.55%**

TABLE IV Actions for program-level inventory concentration and rack optimization. Program Line items FIFO value PFEP

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value Diff. Items for review Storage optimization action A 33 572.82 10.91 561.91 2 Remove waste in bulk staging and maximize vertical pallet space efficiency. B 18 350.71 8.39 342.31 3 Slow moving kits: address them and re-slot near main aisles; C 28 136.75 2.05 134.70 0 Combine multiple bin footprints on high bay racks. D 470 130.96 26.85 104.11 270 Ensure high velocity bin picking locations are standardised E 868 71.04 21.21 49.83 346 Real-time velocity-based shelf reslotting based on pick velocity F 7,155 357.99 79.46 278.53 1,400 Wrap-up skinned bin positions on low runners Values in ₹ million.

TABLE IV
PROGRAM-LEVEL INVENTORY CONCENTRATION AND RACK OPTIMIZATION ACTIONS

Program	Line items	FIFO value	PFEP value	Diff.	Items for review	Storage optimization action
A	33	572.82	10.91	561.91	2	Clear bulk staging; optimize vertical pallet density
B	18	350.71	8.39	342.31	3	Address slow-moving kits; re-slot near main aisles
C	28	136.75	2.05	134.70	0	Consolidate multi-bin footprints into high-bay racks
D	470	130.96	26.85	104.11	270	Standardize high-velocity bin picking locations
E	868	71.04	21.21	49.83	346	Dynamic shelf re-slotting based on pick velocity
F	7,155	357.99	79.46	278.53	1,400	Reclaim fragmented bin positions across low-runners

Values in ₹ million.

V. KEY FINDINGS

Key Findings The physical survey of 30 racks revealed that bin allocation was not standardized and coordinates were not recorded in the system, resulting in additional searching and inefficient use of cubic space. Over the 8,572 items in the PFEP repository, current FIFO inventory was ₹1,620.4 million compared to the plan of ₹148.9 million, which is a positive variance of ₹1,471.5 million. The exposure is one sided. 404 parts, 77.7% of the stock value (₹1,260 million), imported goods. Class A parts are 96.1% (₹1,557 million) of inventory investment and make up 1,936 of the 2,021 line items over their MDOH limit. 79 bulky seat-kit items that are prone to crowding floor-level staging and lower rack bays have a gap of ₹1,038.9 million which is made up by three programs: V167, V214 and X254. It is not a lack of uniform overstock that causes inefficiency, but the concentrated, high value, imported batches and weak velocity based slotting. The data validates the concept of using rack coordinates as a mechanism to release vertical storage space and lower holding risk by using structured PFEP data.

VI. RECOMMENDATIONS AND STAKEHOLDER IMPLICATIONS

A. Practical Recommendations

A. Practical Recommendations Slot the ABC class and select the pick velocity. Place fast moving domestic parts in the golden zone (waist to shoulder level) to reduce picking time and move bulky imported seat kits vertically from high bay to free floor space – starting with V167 and V214. MP&L leadership must review all 2021 items from the maximum stock days every week in conjunction with procurement and Tier-1 suppliers to renegotiate minimum order quantities and delay imports over a longer period. For high dollar items (Class A), annual physical counts should be replaced with rolling cycle counts by Finance and Inventory Controllers. IT and store supervisors are required to barcode or QR scan at GRN receive and enter the verified location (rack and bin) into QAD ERP and PFEP database, which will be visible in real time. The implications are given for the following key stakeholders: SOP and Supervisors can benefit from precise bin and rack mapping as it eliminates wasted time in searching, walking, and material lost in searching, walking, and contributes to safer handling and 5S. The Material Planning & Logistics (MP&L) Team benefits by being able to automatically sync real-time inventory to the parameters in PFEP, reducing guesswork in scheduling and eliminating stock-outs and replenishment issues on the line. For Finance and Executive Management, the action of working down the variance of ₹1,471.5 million would free up working capital and reduce carrying cost and scrap risk of obsolete parts. Clear days-of-inventory data enables Procurement and Tier-1 Suppliers to de-clutter ordering swings, while planning call-offs and renegotiating lot sizes and sharing buffer management. More predictable on time kit delivery for Assembly Operations.

VII. FUTURE SCOPE OF RESEARCH

The research will continue in the following ways: The next step will be to take these 30 racks surveyed and map the remainder of the plant at Store, including raw material, sub-assembly and finished goods areas. The station for receiving the GRN might be replaced by RFID, 2D matrix barcode scanners or optical character recognition (OCR) systems. Two-way integration of PFEP with a Warehouse Management System (WMS) and QAD ERP could be tested in later studies. Machine learning models might also be developed to forecast safety stocks and modify slotting with evolving OEM demand forecasts, transit lead time, and seasonal production plans.

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VIII. CONCLUSION

A record of physical racks and a link to PFEP data provides the store with what it can believe and enable it to make better use of its space. The issue at Automotive Company, Chakan is not about the general issue of overstocking. It is focused on class A parts and long lead imported kits for seats. Part number, bin, location and rack were captured on the surveyed racks, bridging the rift between shop floor and the ERP record for parts. Comparing stock with PFEP values also reveals that blanket cuts would be the wrong cuts. Targeted exception reviews work better for the high exposure programs (V167, V214, X254) and 2,021 items across their maximum stock days. Having the data stored physically within the central PFEP database, the store can then go from fixed locations to slotting based on velocity. The same vertical rack space can be utilized at other Tier-1 auto sites to recover the vertical rack space, reduce the handling waste and maintain high levels of control of high value raw and in-process inventories.

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