Final Year Design Project Showcase
Batch-2022
Year 2026

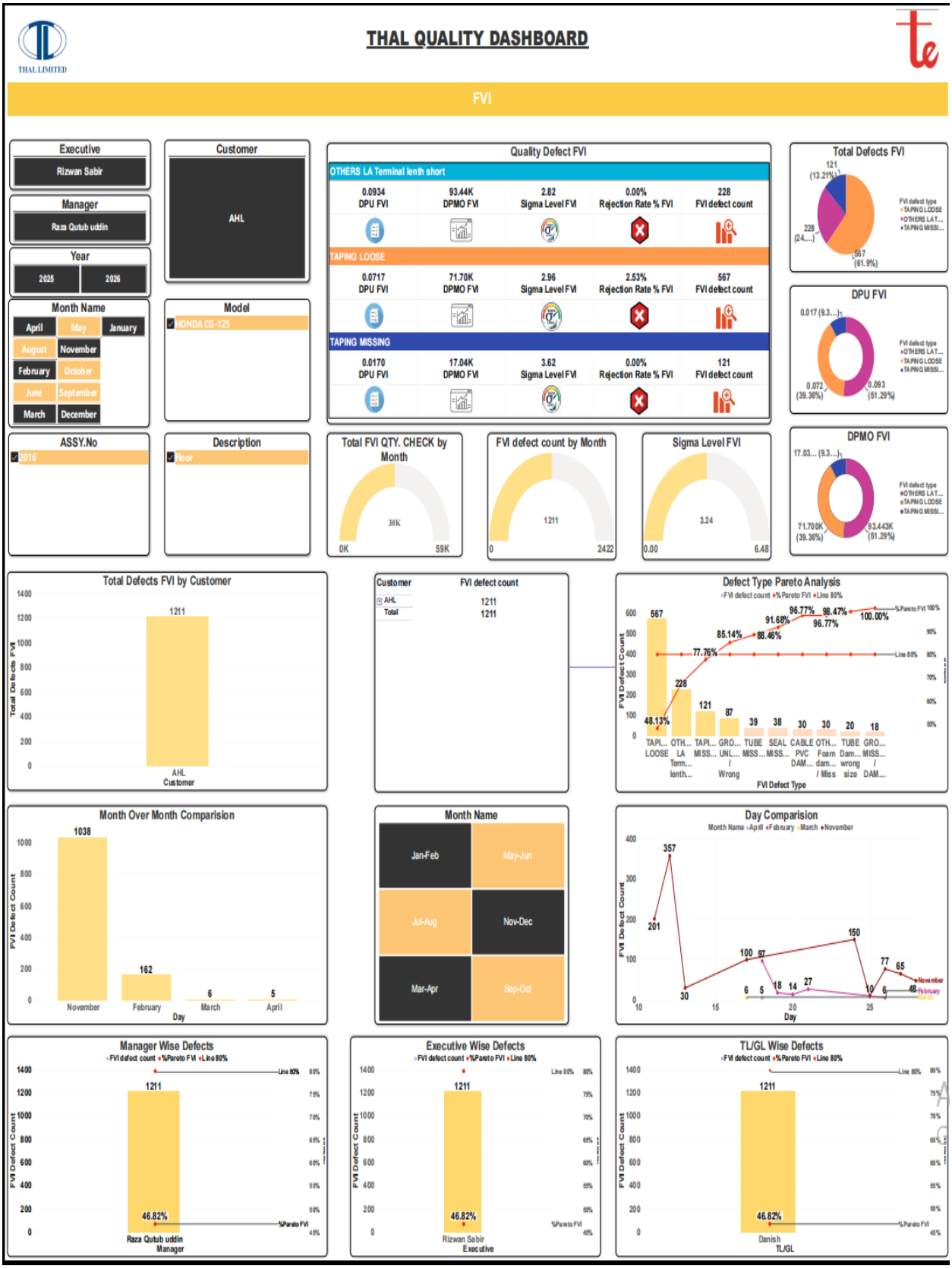
Department: Industrial & Manufacturing Engineering Programme: Quality Control	
1	**Project Title** Atlas Honda Limited Defects Prevention Strategy and its Implementation for CD70 and CG125 Models
2	**Project Idea** Thal Engineering – Electric Systems, a wire harness manufacturer and supplier to Atlas Honda Limited (AHL),faced persistently high defect flow in its AHL department across Honda CD-70 and CG-125 models. Defects escaping to the customer caused rework, warranty claims, and reputational risk. The project aimed to reduce defect overflow by a minimum of 20% through a structured, data-driven quality improvement approach.
3	**Process** Six Sigma DMAIC methodology was applied: **Define:** Scoped project to Electrical Continuity Testing (ECT) and and Final Visual Inspection (FVI) quality checkpoints; identified Critical-to-Quality (CTQ) factors. **Measure:** Performed binomial process capability analysis using Minitab to quantify defect rates and DPMO for six-month production data (Nov 2025 – Mar 2026) for both models. **Analyze:** **1. Minitab Analysis:** Applied Pareto analysis (VOC and VOP data) to isolate vital-few defects: taping loose/missing, grommet missing/damaged, terminal damage, and fuse miss. Root causes identified via Ishikawa diagrams and 5-Why analysis: absent Poka-Yoke mechanisms, unsequenced manual inspection, and uncontrolled WIP transportation. **2. Dashboard Development (Power BI Analysis):** To address the need for real-time visibility that static Cause-and-Effect and 5-Why analyses lack, a dynamic Power BI dashboard was developed. This system continuously monitors and visualizes defects in real time across two critical quality gates: ECT for functional defects and FVI for cosmetic and assembly issues. **Improve:** Two solutions implemented: **1. AI-Based FVI Poka-Yoke Device:** YOLOv8 deep learning + Python + Arduino Uno. Detects connector types, enforces sequential zone inspection via AI voice guidance, triggers LED feedback, and auto-logs SAP ID, cycle time, and timestamp. Cost: Rs 8,850. **2. Redesigned WIP Trolley:** Shelf-type with fixed dividers to prevent harness stacking. Deployed on shop floor. Total cost: Rs 72,000. **Control:** Shop floor layout standardized; pathway cleared; trolley zones designated. Post-implementation capability analysis conducted (April–May 2026).

4	**Outcome** Post-implementation capability analysis (April–May 2026) confirmed: **CD-70 ECT:** Defect rate reduced from 2.94% to 0.91%, Z-score: 1.88 → 2.36, 69% reduction **CD-70 FVI:** Defect rate reduced from 11.09% to 0.80%, Z-score: 1.22 → 2.41, 96% reduction **CG-125 ECT:** Defect rate reduced from 2.18% to 0.43%, Z-score: 2.02 → 2.62, 80% reduction **CG-125 FVI:** Defect rate reduced from 7.74% to 0.13%, Z-score: 1.42 → 3.00, 98% reduction All four processes now operate within company standard limits, surpassing the 20% defect reduction target across all monitored quality checkpoints.
5	**Evidence (Theoretical Basis)** **Six Sigma DMAIC:** Supported by 7 QC Tools (Pareto charts, Ishikawa diagrams, control charts, histograms, check sheets, flowcharts) and process capability analysis (binomial capability, DPMO, Z-score, DPU, DPO) using Minitab. **YOLOv8 Deep Learning:** Real-time connector detection and zone tracking at FVI station, enabling automated sequential inspection enforcement.
6	**Competitive Advantage or Unique Selling Proposition**
a	**Attainment of any SDG** **SDG 9 — Industry, Innovation and Infrastructure:** AI-based Poka-Yoke device and redesigned trolley introduce Industry 4.0 practices into automotive wire harness manufacturing, improving process efficiency. **SDG 12 — Responsible Consumption and Production:** Reduction in defects and rework reduces material waste (tape, seals, connectors) and energy consumption, making production more sustainable.
b	**Any Environmental Aspect** Fewer rework cycles reduce consumption of tape, dummy seals, and connectors. Lower operator hours per unit produced contributes to energy efficiency. No hazardous materials or waste streams introduced — purely process-improvement based.
c	**Cost Reduction of Existing Product** Redesigned WIP trolley (Rs 72,000 total) projects annual rework savings of Rs 157,932 with payback under one year. AI FVI prototype (Rs 8,850) eliminates missed-checkpoint rework and supervisory overhead. Combined, solutions reduce the annual cost of transport-induced and inspection-related defects across both CD-70 and CG-125 production lines.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process**

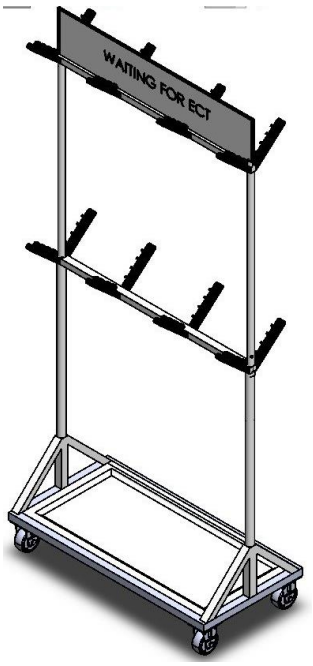
	Issue: AHL department relied on entirely manual inspection with no Poka-Yoke enforcement. Harnesses transported on unstructured trolleys, causing stacking-induced damage. **Improvement:** **1. AI FVI Poka-Yoke:** Enforces sequential connector inspection via YOLOv8; eliminates checkpoint omission; provides full automatic traceability. **2. Shelf-type WIP trolley:** Physically separates harness batches between stations; prevents transport-induced defects. **Result:** Defect rates reduced by 69–98% across all four monitored processes. **Monitoring:** A Power BI-based "Thal Quality Dashboard" was built to track FVI and ECT defects in real time, reporting DPU, DPMO, Sigma level, rejection rate, and Pareto-ranked defect types by month and by Manager/Executive/TL-GL.	
e	**Expanding of Market share** Not applicable — this is a process improvement project within an existing OEM supply relationship (Thal Engineering supplying Atlas Honda Limited).	
f	**Capture New Market** The AI-based FVI Poka-Yoke device (open-source: YOLOv8 + Python + Arduino) is scalable to other wire harness models and OEM departments within Thal Engineering, and adaptable to any automotive supplier facing manual inspection limitations.	
g	**Any Other Aspect** The project demonstrates a practical, low-cost application of AI and Industry 4.0 tools (computer vision, embedded systems, automatic data logging) in local automotive manufacturing, providing a replicable model for SME-scale quality improvement in Pakistan's automotive supply chain.	
7	**Target Market** **Primary:** Thal Engineering – Electric Systems (AHL Department), producing wire harnesses for Atlas Honda Limited — Pakistan's leading motorcycle manufacturer. **Broader:** Any automotive wire harness manufacturer or OEM supplier facing manual inspection bottlenecks and WIP transport-induced defects. Solutions are low-cost and scalable to Tier-1 and Tier-2 automotive suppliers across Pakistan's automotive industry.	
8	**Team Members** (Names along with email address)	**1.** Faiza (IM-003) — faizahamid405@gmail.com **2.** Jawwad Ahmed Khan (IM-030) — jakldhi2612@gmail.com **3.** Muhammad Osama Sajid (IM-040)—sajidosama223@gmail.com **4.** Mahnoor Badar (IM-087) — mahnoorbadar175@gmail.com
10	**Supervisor Name** (along with email address)	**Project Advisor:** Ms. Naima Javed (Assistant Professor, Dept. of IM Engineering, NEDUET) - naima@cloud.neduet.edu.pk **Industrial Advisor:** Mr. Zulfiqar Arfeen (Quality Manager, Thal Engineering– Electric Systems) - Zulfiqar.arfeen@thalengg.com

Pictures

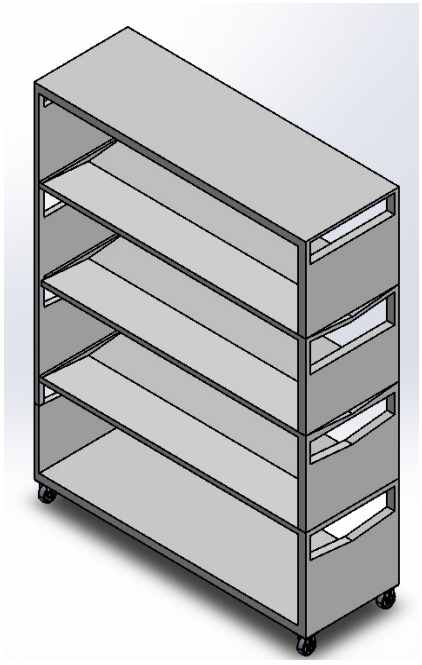
THAL QUALITY DASHBOARD
THAL LIMITED
ECT
Executive
Rizwan Sabir
Manager
Raza Qutub uddin
Year
2024
2025
2026
Month Name
April
June
August
March
December
May
February
November
January
October
July
September
Customer
AHL
Model
HONDA CD-70
ASSY.NO
059
Description
Wire_harn_CD-70
Quality Defect ECT
(OTHERS)Fuse miss
0.0670 DPU ECT
67.01K DPMO ECT
3.00 Sigma Level ECT 1
0.93% Rejection Rate % ECT
722 ECT defect count
CIRCUIT SHORT
0.0184 DPU ECT
18.39K DPMO ECT
3.59 Sigma Level ECT 1
0.00% Rejection Rate % ECT
379 ECT defect count
TERMINAL REVERSED (NP LOCK)
0.0151 DPU ECT
15.10K DPMO ECT
3.67 Sigma Level ECT 1
0.00% Rejection Rate % ECT
146 ECT defect count
Total Defects ECT
DPU ECT
DPMO ECT
Total ECT QTY. CHECK by Month
ECT defect count by Month
Sigma level ECT
Total Defects ECT by Customer
Customer
ECT defect count
AHL
Total
1465
1465
Defect Type Pareto Analysis
ECT Defect Type
Month Over Month Comparision
November
January
December
February
March
April
Day
Month Name
Jan-Feb
May-Jun
Jul-Aug
Nov-Dec
Mar-Apr
Sep-Oct
Day Comparision
Day
Manager Wise Defects
Raza Qutub uddin
Manager
Executive Wise Defects
Rizwan Sabir
Executive
TL/GL Wise Defects
Faisal
TL/GL


THAL QUALITY DASHBOARD
THAL LIMITED
FVI
Executive
Rizwan Sabir
Manager
Raza Qutub uddin
Year
2025
2026
Month Name
April
May
January
August
November
February
October
June
September
March
December
Customer
AHL
Model
HONDA CG-125
ASSY.No
2016
Description
Floor
Quality Defect FVI
OTHERS LA Terminal lenth short
0.0934 DPU FVI
93.44K DPMO FVI
2.82 Sigma Level FVI
0.00% Rejection Rate % FVI
228 FVI defect count
TAPING LOOSE
0.0717 DPU FVI
71.70K DPMO FVI
2.96 Sigma Level FVI
2.53% Rejection Rate % FVI
567 FVI defect count
TAPING MISSING
0.0170 DPU FVI
17.04K DPMO FVI
3.62 Sigma Level FVI
0.00% Rejection Rate % FVI
121 FVI defect count
Total Defects FVI
DPU FVI
DPMO FVI
Total FVI QTY. CHECK by Month
FVI defect count by Month
Sigma Level FVI
Total Defects FVI by Customer
Customer
FVI defect count
AHL
Total
1211
1211
Defect Type Pareto Analysis
FVI Defect Type
Month Over Month Comparision
Month Name
Jan-Feb
May-Jun
Jul-Aug
Nov-Dec
Mar-Apr
Sep-Oct
Day Comparision
Manager Wise Defects
Executive Wise Defects
TL/GL Wise Defects
Raza Qutub uddin
Manager
Rizwan Sabir
Executive
Danish
TL/GL

AI FVI Poka-Yoke



Redesigned Trolley (1)



Redesigned Trolley (2)

Implemented Shelf Type Trolley (2)