NVH Analysis Dashboard Report

Overview of approach:

The objective of this NVH (Noise Vibration Harshness) analysis was to analyse and study the performance of vehicles in terms of noise, vibration and the comfort of the customers. The approach consists of various steps like Data preparation, Analysis, Dashboard Creation, Insights and Recommendations.

- Data Sources: The dataset used here was a synthetic data generated in python to simulate real-world measurements and provide a basis for creating an interactive PowerBi dashboard. The data contains Manufacturing date, timestamp for measurement, various road surfaces and operating conditions. It also contains the noise level, vibration level and sources of both. It also concentrates on Harshness score and the important is customer feedback and comments. There are 5 different vehicle models like Coupe, Hatchback, Sedan, SUV and Truck. The data consists of 1000 entry points.
- Assumptions and Data Preparation: The synthetic data accurately represents real-world NVH conditions. Missing values of character type were replaced and handled by idle conditions stating it can fill by previous measurements. On the other hand, the numeric data type were handled by replacing the values with 0 as taking mean or removing the data did not make sense. Data types were also corrected in Power Query Editor.
- Dashboard Creation: The dashboard provides actionable insights and recommendations for improving NVH performance, based on the analysis. The dashboard consists of 2 pages:
    1. Overview: Summary of key NVH metrics, trends, and distribution of vehicle models. Correlation of NVH metrics with customer satisfaction.
    2. Noise and Vibration Analysis: Detailed analysis of noise sources and recommendations for noise reduction. Analysis of vibration levels, particularly focusing on components like steering wheel and driver seat. Analysis of both factors on different road surfaces and operating conditions.

Key Insights:

Trucks (Model D) have significantly higher noise levels, particularly under rough road conditions or during highway driving. Engine and exhaust noise are the primary contributors to total noise levels.

Trucks and SUVs show higher vibration levels, especially under rough road conditions. Steering wheel and driver seat vibrations are among the highest recorded, suggesting areas for improvement.

A Sedan is more comfortable if we consider noise and harshness. On the other hand, customer finds Coupe is ergonomically balanced if they have little noise tolerance as vibrations and harshness is less.

Clearly the road conditions have effect on the NVH metrics. Different type of surfaces and operating conditions give different result. There's a clear correlation between NVH levels and customer feedback, with higher NVH leading to lower satisfaction. The experience of customer is not good at higher noise levels and vibration.

Recommendations:

Implement active noise cancellation technologies in cabins, particularly for trucks. Use advanced sound insulation materials in engine compartments and exhaust systems. Enhance suspension systems for trucks and SUVs to reduce road-induced vibrations. Use vibration isolators in steering columns and seats.

Continuously analyze NVH data to refine vehicle designs. Implement real-time NVH monitoring systems for ongoing data collection. Use customer feedback to prioritize NVH improvements that directly impact satisfaction.

Limitations:

The dataset includes simulated data, which might not fully reflect real world vehicle performance. Some data points are missing which may hamper the analysis result. The dashboard does not account for external factors like weather conditions or driver behavior that might influence NVH performance. Different customers have different requirements like some have high noise tolerance and want more things than comfort. Even if luxury cars are shown as most comforting vehicle with less number of negative feedbacks, not everyone can afford them. The recommendations are broad and would require further validation through real-world testing and customer feedback.