Executive Summary: Inventory Optimization Strategy

1. Objective and Scope

This project was initiated to optimize inventory holding levels for key product SKUs by calculating scientifically derived Reorder Points (ROP) and Safety Stock (SS). The goal was to maintain a competitive **95% Service Level** (a 5% stock out risk) while minimizing unnecessary capital expenditure on excess inventory. The analysis utilized daily demand history and item master data, including lead times and unit costs, to establish a quantitative basis for inventory decisions.

2. Key Challenge and Solution: Demand Volatility & Data Integrity

The initial model faced a major challenge: historical demand was highly influenced by promotions (50% of operating days). My initial hypothesis was that promotions were the primary source of unpredictable demand risk.

Scenario	Average Daily Demand ($\bar{D}$)	Standard Deviation (σ_D)	Reorder Point (ROP)
ALL Demand (Initial)	102.01	39.17	999
NORMAL Demand (Filtered)	100.23	39.899	988

Crucial Insight: Data segmentation revealed a negligible difference in the Standard Deviation. This indicates that the **promotions do not significantly increase the underlying, unpredictable daily volatility** of demand. Instead, the high Safety Stock requirement is driven by an **extreme level of baseline, inherent demand volatility** present even on non-promotional days (SD approx. 40).

3. Results and Recommendations (Normal Demand Scenario)

The segmentation solution was still crucial for establishing **data integrity** by correctly isolating planned demand from true risk. The model based on the stable 'NORMAL' demand

profile provides optimized Safety Stock and ROP for routine replenishment.

Metric	Summary of Impact
Safety Stock (SS)	The SS component of the ROP was only reduced by **11 units (1.1%)** for the sample SKU, confirming that the primary driver of the inventory buffer is the **high baseline volatility** of SD approx. 40(not promotions). This 11-unit reduction represents savings from unnecessary risk coverage.
Reorder Point (ROP)	The ROP is now set to trigger an order when stock levels can cover **expected consumption over the entire lead time**, plus the calculated Safety Stock. (ROP = Lead Time Demand + SS)
Inventory Investment	The calculated Cost of Safety Stock reveals the direct financial trade-off for the 95% service level. This metric highlights **High-Cost/High-Risk SKUs** (those with high SD and high unit cost), allowing management to prioritize strategic risk mitigation or explore lower service levels for those specific items.

Recommendation:

1. **Adopt New ROPs:** Immediately implement the ROP and Safety Stock figures generated by the 'NORMAL' Demand Scenario for routine weekly ordering to ensure data integrity and separate planned vs. unpredictable demand.
2. **Investigate Baseline Volatility:** Initiate a **Phase II analysis** focused on the 'NORMAL' demand data to identify the cause of the extremely high Standard Deviation (SD approx 40). This investigation should explore factors such as seasonality, competitor pricing, or distribution channel instability.

Future Enhancement: Integrate a separate forecasting module for planned promotional events to accurately calculate the required *temporary* stock increment, thereby formalizing the two-tiered inventory strategy.