

Steering Wheel Repair Data Analysis Report

1. Column Analysis

Dataset Overview:

- **Total Records:** 100 repair cases
- **Total Columns:** 52 fields (51 after cleaning)
- **Data Completeness:** 100% (after cleaning)

Column Categories:

Category	Count	Examples
Categorical	33	VIN, Platform, Body Style, Causal Part, Dealer Info
Numerical	18	Total Cost, Repair Age, Kilometers, Labor Cost
Date Fields	1	Repair Date

Top 5 Critical Columns for Analysis:

1. **PLATFORM** (11 unique platforms)
 - Shows which vehicle models have issues
 - Full-Size Trucks dominate with 52% of all repairs
2. **CAUSAL_PART_NM** (19 unique parts)
 - Identifies the specific broken component
 - Critical for supplier quality and root cause analysis
3. **GLOBAL_LABOR_CODE_DESCRIPTION** (4 repair types)
 - **Steering Wheel Replacement:** 78 cases (78%)
 - **Steering Wheel Spoke Cover Replacement:** 11 cases (11%)
 - **Heated Steering Wheel Module Replacement:** 6 cases (6%)

- **Horn Switch Wiring Harness Replacement:** 5 cases (5%)
- 4. **TOTALCOST** (Range: varies widely)
 - **Average:** \$563.32 per repair
 - **Highest:** \$3,205.45
 - **Total Impact:** \$56,332.14 for just 100 cases
- 5. **REPAIR_AGE** (35 unique ages, 0-48 months)
 - Shows when vehicles fail
 - Most failures occur early in vehicle life

Other Notable Findings:

- **Body Style Distribution:** 50% Crew Cab trucks, 37% SUVs (4-door utility)
- **Build Country:** 73% built in US, 23% Mexico, 4% Canada
- **Dealer Region:** 97% from Region 1 (North America)
- **Media Flag:** 38% of cases had media/customer escalation involvement

2. Data Cleaning Summary

Issues Identified & Fixed:

Problem	Count	Solution
Completely empty column	1 (CAMPAIGN_NBR)	Dropped entirely
Missing categorical values	11 columns (1-12% missing)	Filled with "Unknown"
Missing numerical values	2 columns	Filled with median value

Text inconsistencies	All 33 text columns	Standardized to Title Case, trimmed spaces
Date format issues	1 column	Converted to proper datetime

Cleaning Results:

- **Before:** 52 columns, 5-12% missing data in some fields
- **After:** 51 columns, 0% missing data
- **Total Cleaning Operations:** 48 steps performed

Key Discrepancies Addressed:

1. **No unique repair ID** - Each repair lacks a single identifier (VIN appears 98 times for only 100 records, suggesting repeat vehicles)
2. **Missing causal parts** - 5% of records didn't specify which part failed (now marked "Unknown")
3. **Geographic gaps** - 2% missing state/postal codes (filled with "Unknown")
4. **Engine/transmission data** - 12% missing supplier plant codes (filled with median)

3. Visualizations & Key Insights

Chart 1: Vehicle Platforms with Steering Issues

- **Full-Size Trucks:** 52 repairs (52% of all cases)
- **Mid-Size SUVs:** Second highest concentration
- **Sedans/Coupes:** Minimal issues
- **INSIGHT:** Truck platform has a systemic steering wheel problem requiring immediate attention

Chart 2: Top Faulty Steering Components

- Distribution of which parts are actually failing
- Shows concentration in specific components
- **INSIGHT:** Helps prioritize which supplier relationships need review

Chart 3: Distribution of Repair Costs

- Most repairs cost \$200-\$800
- Significant outliers above \$2,000 (likely Super Cruise or advanced systems)
- Average of \$563.32 means substantial warranty expense
- **INSIGHT:** At scale, if 10,000 vehicles need repair, that's \$5.6M in warranty costs

Chart 4: Types of Steering Repairs

- **78% Full Replacement** - Not repairable, must swap entire wheel
- **11% Spoke Cover** - Cosmetic failures
- **6% Heating Module** - Electrical/comfort feature
- **5% Horn/Wiring** - Electrical/safety feature
- **INSIGHT:** High replacement rate suggests design flaw, not wear-and-tear

Chart 5: Average Cost by Platform

- Some platforms cost more to repair than others
- Helps budget warranty reserves by vehicle line
- **INSIGHT:** Luxury/tech-heavy platforms have 2-3x higher repair costs

Chart 6: Vehicle Age at Repair

- Peak failures happening early (under 12 months)
- Shows this is a manufacturing quality issue, not customer misuse
- **INSIGHT:** Early failures = warranty exposure; late failures = normal wear

4. Generated Tags & Key Takeaways

Automated Issue Classification from Repair Notes:

We analyzed technician notes and customer complaints to automatically categorize problems:

Issue Type	Cases	% of Total	What This Means
Material Failure	35	35%	Leather peeling, stitching coming apart, finish degrading
Heating Issue	32	32%	Heated steering wheel not working or intermittent
Electrical Issue	20	20%	Wiring, circuits, power problems

Safety System Issue	17	17%	Horn, airbag, driver assist integration problems
Mechanical Issue	16	16%	Physical rattles, loose components
Software Issue	13	13%	Programming, calibration needed
Cosmetic Issue	12	12%	Appearance defects not affecting function

Note: Many repairs involve multiple issue types (e.g., heating doesn't work AND leather is peeling)

Key Findings Summary

1. Quality Crisis in Full-Size Trucks

- 52 out of 100 repairs (52%) from truck platform
- Concentrated problem requiring root cause investigation
- Likely shared component or supplier across truck line

2. Material Failures Dominate

- 35% of cases involve leather, stitching, or finish problems
- This is a **quality control issue** in manufacturing or supplier materials
- Often appears alongside functional problems (dual failures)

3. Heating Systems Are Unreliable

- 32% involve heating module failures
- This comfort feature is failing at unacceptable rates
- Likely single supplier or design flaw

4. High Replacement Rate

- 78% of repairs require complete steering wheel replacement
- Very few are adjustments or simple fixes
- Suggests components aren't designed to be serviced

5. Expensive Warranty Impact

- \$563.32 average \times 100 cases = \$56,332
- If this represents a larger population of 10,000 vehicles: **\$5.6 Million**
- Maximum single repair: \$3,205 (likely advanced technology integration)

6. Early Failure Pattern

- Most repairs happen within first year of ownership
- This is a **manufacturing defect**, not wear-and-tear
- High CSI (customer satisfaction) risk

Actionable Recommendations

IMMEDIATE (This Week):

1. **Issue stop-ship notice** for Full-Size Truck steering wheels pending investigation
2. **Audit material supplier** for leather/finish quality (35% of issues)
3. **Contact heating module supplier** for failure analysis (32% of issues)

SHORT-TERM (Next 30 Days): 4. **Implement enhanced inspection** at assembly plants for steering wheel finish quality 5. **Review warranty policy** - with early failures, consider extended coverage to improve customer satisfaction 6. **Issue Technical Service Bulletin** to dealers on common heating module failures and diagnostic procedures

LONG-TERM (3-6 Months): 7. **Redesign heating module** with improved reliability and redundancy 8. **Develop new material specifications** for steering wheel leather/finishes 9. **Consider alternative suppliers** for high-failure components 10. **Add real-time quality monitoring** during steering wheel assembly process

Additional Observations

Geographic Patterns:

- 97% of repairs in Region 1 (North America)
- Missing geographic detail limits climate-related analysis (heating failures in cold regions?)

Media Involvement:

- 38% of cases flagged with media attention
- Suggests customer dissatisfaction leading to escalations
- High reputational risk beyond just warranty costs

Repeat Vehicles:

- 98 unique VINs for 100 repairs
- At least 2 vehicles had multiple steering wheel repairs
- Indicates persistent quality issues not resolved on first fix

Data Gaps:

- No link to specific manufacturing dates/batches
- No supplier part numbers for traceability
- Missing customer satisfaction scores post-repair

Conclusion

This analysis reveals a **serious quality issue** concentrated in Full-Size Truck steering wheels, with material failures (35%) and heating system problems (32%) being the primary culprits. With an average repair cost of \$563 and most failures occurring in the first year, this represents both significant warranty expense and customer satisfaction risk.

The 78% replacement rate indicates these are not minor issues but fundamental design or manufacturing problems requiring immediate corrective action. At projected scale, this could represent millions in warranty costs and lasting reputational damage.

Most Critical Action: Investigate Full-Size Truck steering wheel material supplier and heating module supplier immediately. Stop production if systemic defect is confirmed.