MSX Lifecycle Optimization

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Navigating the Fleet Lifecycle

Managing a fleet effectively requires reliable data and informed decisions at every stage. In a competitive environment, value is created through consistency – and that consistency depends on having the right information to guide your choices.

To make this approach actionable, we structure the fleet lifecycle into three main stages:

Acquisition

Consolidate and govern data from multiple sources to align vehicle specifications with operational requirements. Evaluate not only purchase price, but total cost of ownership – including expected maintenance spend, reliability, performance under your specific operating conditions, and the implications of different service strategies.

Operations and Maintenance

Ensure fleet availability and predictable cost performance through condition-based insight, maintenance planning, and continuous monitoring of utilization, downtime, and service effectiveness. The goal is to increase uptime, reduce unplanned events, and standardize decision-making across sites and teams.

Disposal

Define clear end-of-life criteria and timing to protect residual value and avoid late-life cost escalation. Determine when assets should be redeployed, replaced, or disposed of based on performance, risk, and economics – not assumptions.

This three-stage model provides a clear foundation for optimizing cost, uptime, and asset value across the full lifecycle.

Contour Lifecyle Optimization Solution

Today, every phase of the fleet lifecycle presents distinct challenges. Many of these can be addressed through better use of data. But insight alone is not enough. Real impact comes from operational execution – the ability to turn recommendations into consistent actions across locations, workshops, and stakeholders. MSX is uniquely positioned here, combining advanced data capabilities with hands-on operational support.

This paper focuses on Operations and Maintenance. It explains how to maintain fleets more efficiently through an optimal, proactive maintenance approach, supported by the operational resources needed to implement the plan in the field. Our approach reflects years of investment in automotive-focused data science and proven on-the-ground execution.

The premise is straightforward: fleets generate value when vehicles are available to perform commercial activity. That requires maintenance that is planned, timely, and aligned with real-world usage. We design maintenance plans using component-level reliability analysis and deep vehicle expertise, with the objective of minimizing downtime and moving maintenance from unplanned events to scheduled interventions wherever possible.

Cost transparency is equally important. Maintenance and repair expenses can become unpredictable – particularly after warranty expiry – creating financial risk and reducing confidence in budgeting decisions. MSX has developed and refined a maintenance cost modelling methodology that has been validated with fleet operators managing more than 100,000 vehicles.

Our cost models incorporate fleet condition, historical maintenance activity, and repair patterns. This delivers higher accuracy than simplified regression-based approaches and gives fleet leaders a more reliable basis for forecasting and decision-making.

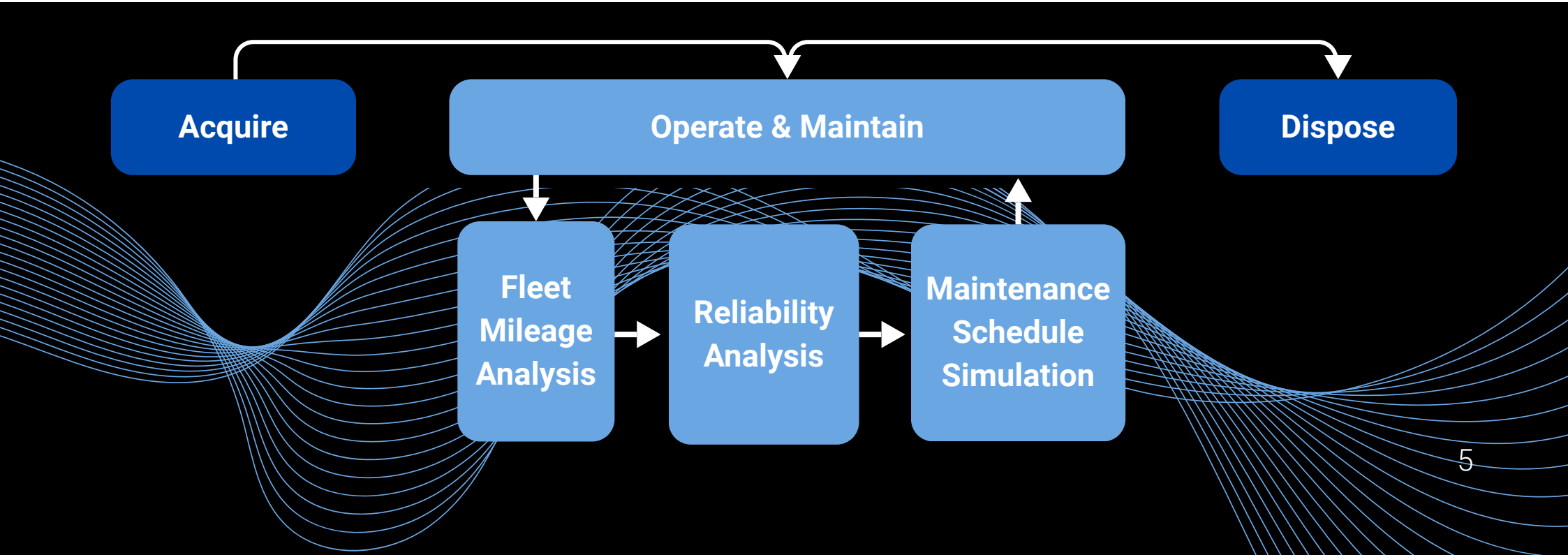
Key Activities and Benefits

In practical terms, the objective is to understand how your fleet will be used in the future, identify what is most likely to fail and when, and use simulation to design a maintenance schedule that fits your operational constraints and financial targets.

More specifically, we:

- Predict the mileage distribution of your fleet over the subsequent operational years.
- Analyze failure rates of key vehicle components to quantify risk, expected repair volumes, and cost exposure.
- Simulate tailored maintenance schedules to identify the option that best supports your operational and financial goals.

The resulting maintenance schedule is designed to reduce unplanned downtime and, in many cases, lower total maintenance cost by shifting work from disruptive unplanned repairs to faster, lower-cost planned interventions.



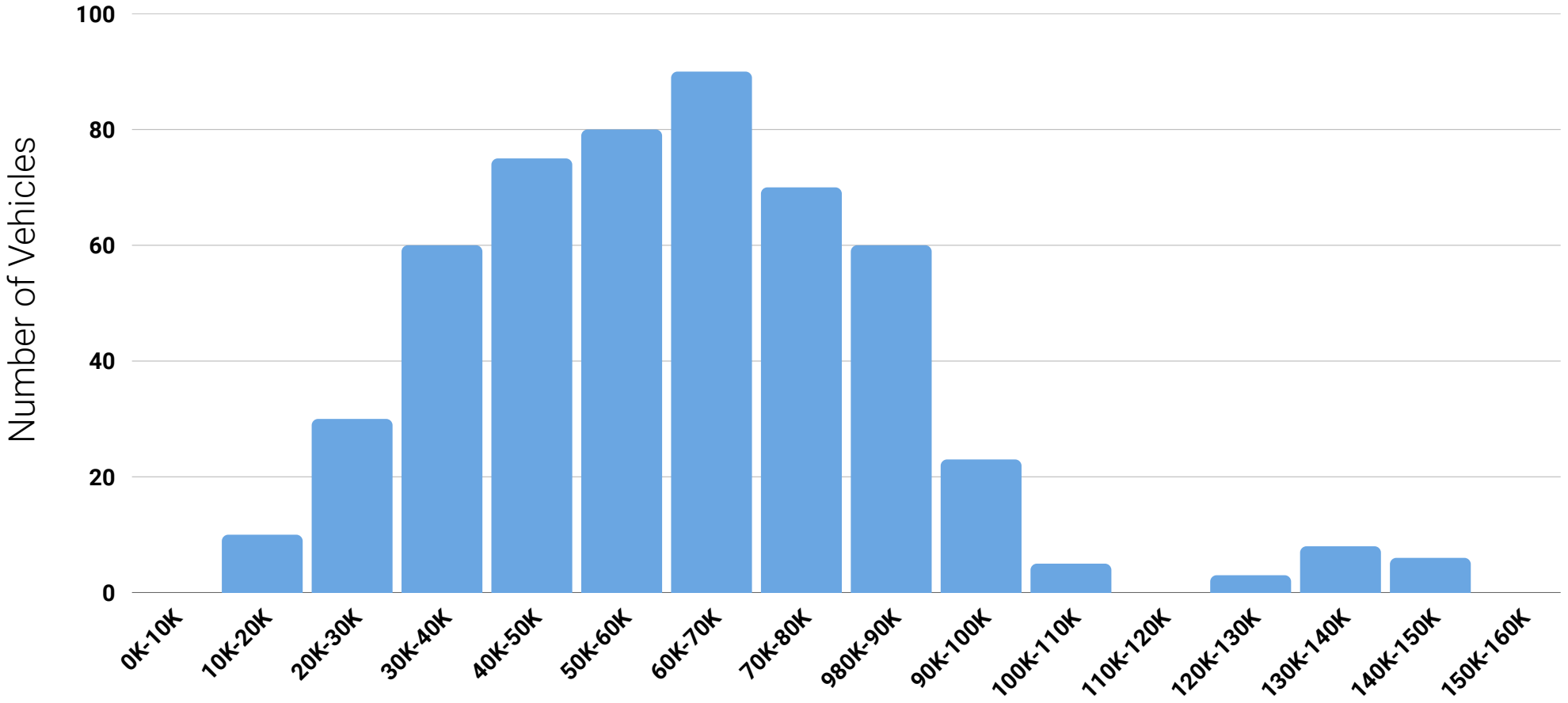
Fleet’s Mileage Distribution

Maintenance optimization and accurate cost visibility depend on understanding how fleet mileage will evolve over time. Mileage is the primary driver of wear, service demand, and failure risk. Without a forward-looking view, maintenance plans and cost forecasts are based on assumptions rather than evidence.

Specifically, the mileage distribution of a fleet in a particular operational year shows that vehicles can be grouped into distinct mileage bands. Each band may be treated differently, as certain groups pose a higher risk due to the varying reliability of vehicle components; therefore, we always analyse the fleet from this detailed perspective.

Vehicle Distribution by Mileage

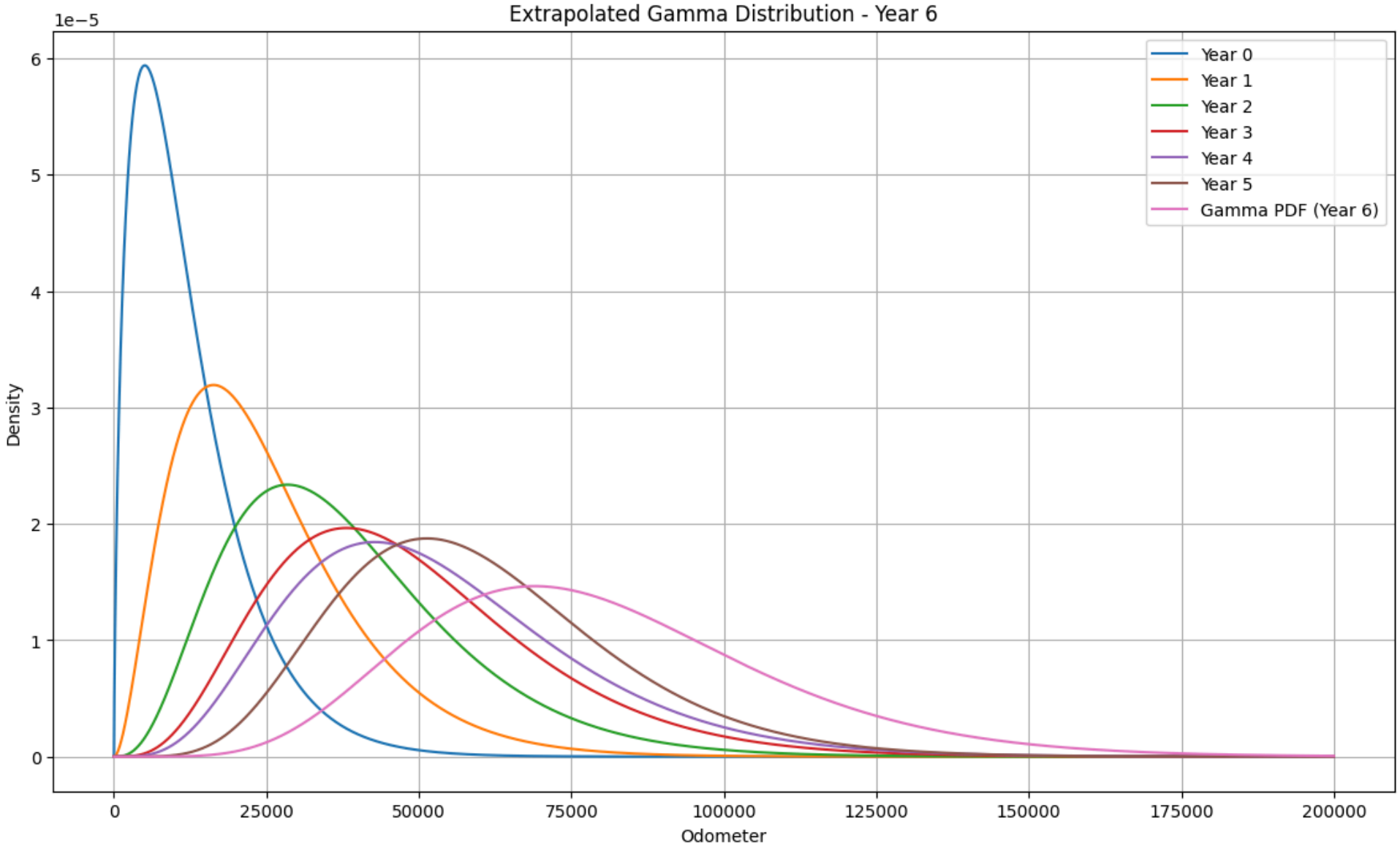
Avg: 60.4 K km | Total: 518 vehicles



Predictive Mileage Modelling

Our modelling predicts the mileage distribution for subsequent operational years with greater fidelity than approaches that simply extrapolate a fleet's annual average mileage. This forecast is a foundational input to both our cost models and our maintenance cost projections. It allows decisions to be based on expected usage patterns instead of broad averages.

A key differentiator from standard OEM support is that our analysis is tailored to your operating conditions. Commercial vehicles operate within duty cycles and environments that are often very different from those assumed in testing or baseline service guidance. By reflecting your real-world usage, we generate maintenance and cost recommendations that are more relevant, more practical, and more effective.


Extrapolated Gamma Distribution - Year 6
1e−5
Density
Odometer
Year 0
Year 1
Year 2
Year 3
Year 4
Year 5
Gamma PDF (Year 6)
0
1
2
3
4
5
6
0
25000
50000
75000
100000
125000
150000
175000
200000

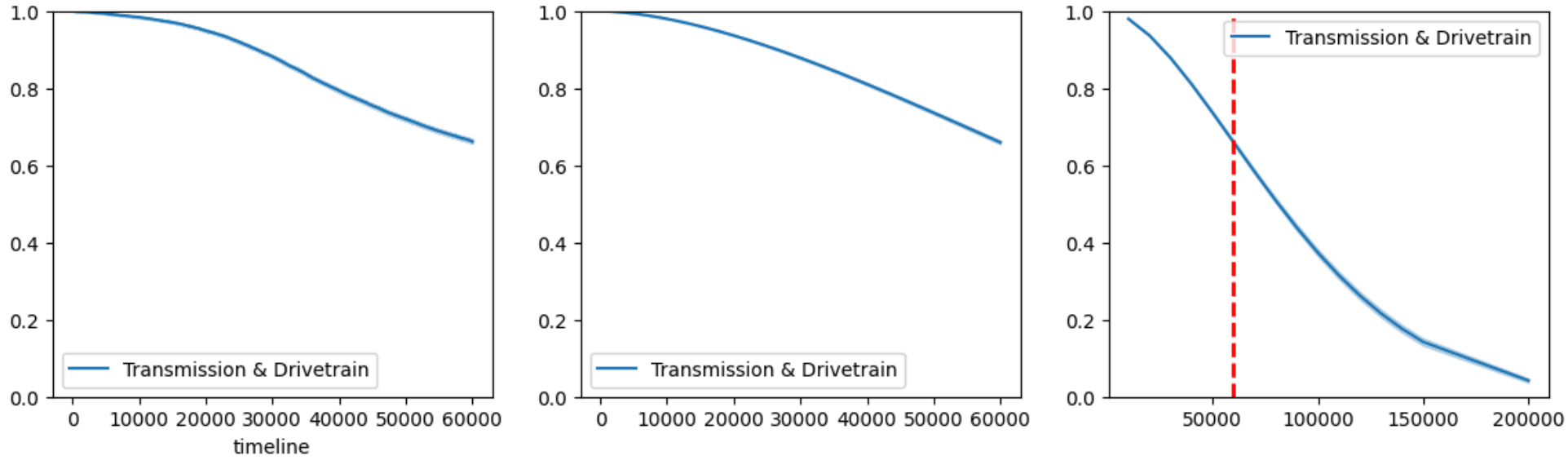
Reliability Analysis

Vehicles in different mileage bands carry different risk profiles, and appropriate maintenance actions vary accordingly. Our methodology is pragmatic and rigorous. We assess each major vehicle component and build component-level reliability models to quantify failure risk as mileage accumulates.

Reliability modelling delivers two important advantages. It supports forward-looking prediction and it remains transparent and easy to interpret for operational decision-making. Using human-curated warranty and repair data, we build models that answer practical questions about future reliability, such as:

- failure likelihood by mileage band
- anticipated repair volumes
- how risk evolves over time

This component-level view is central to our approach.
An anonymized example of a univariate reliability model illustrates this:



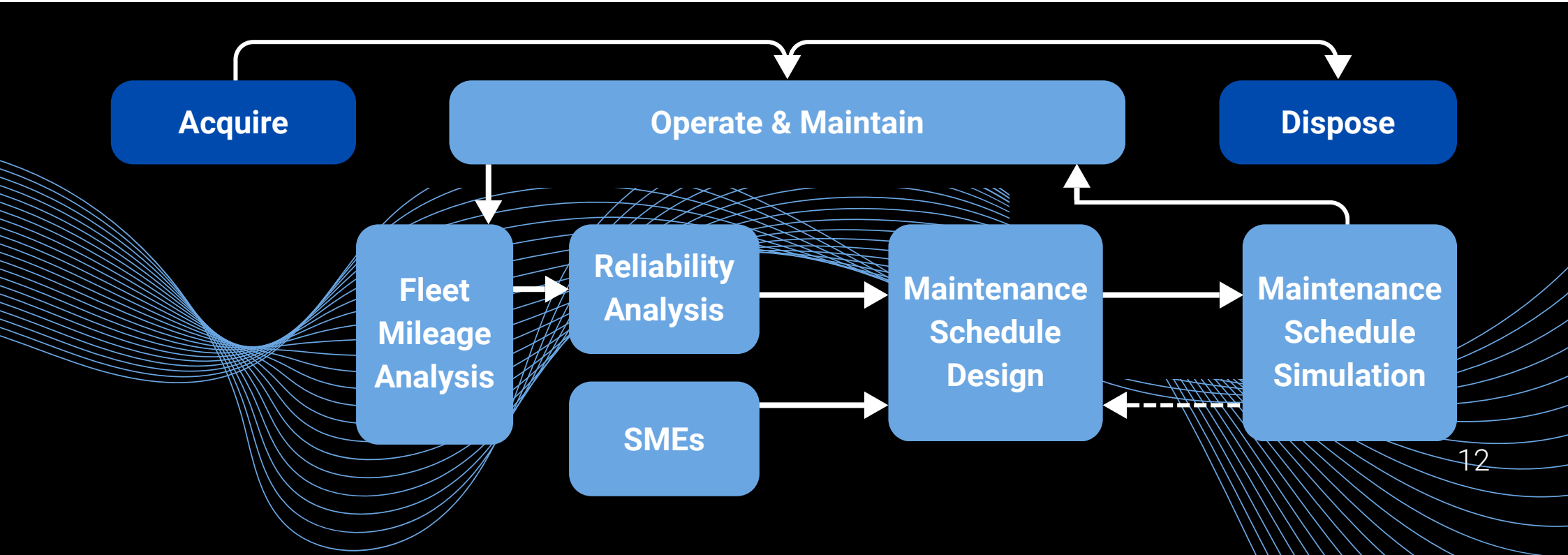
Left: the observed data within the current mileage range
Middle: the model fitted over the same mileage interval
Right: the full model, including extrapolation beyond 50,000 miles

At a high level, a vehicle's future cost is driven mainly by two factors: its current mileage and the condition and reliability profile of its key components. By quantifying these drivers, our models provide the predictive capability needed to improve cost forecasting and to translate risk into operational priorities. This includes where to allocate maintenance capacity, which parts to position in advance, and how to schedule workshop resources to mitigate the most likely and most expensive events.

Maintenance Schedule Simulation and Selection

We then bring these inputs together to design alternative maintenance schedules and simulate their expected impact on reliability, downtime, and maintenance cost.

Our subject-matter experts conduct a structured review of the fleet's dominant issues by vehicle model, model year, and other relevant attributes. They translate these findings into targeted maintenance actions. The outcome is a set of schedule options that reduce unplanned events and pull high-cost repairs forward into earlier, planned interventions where appropriate.

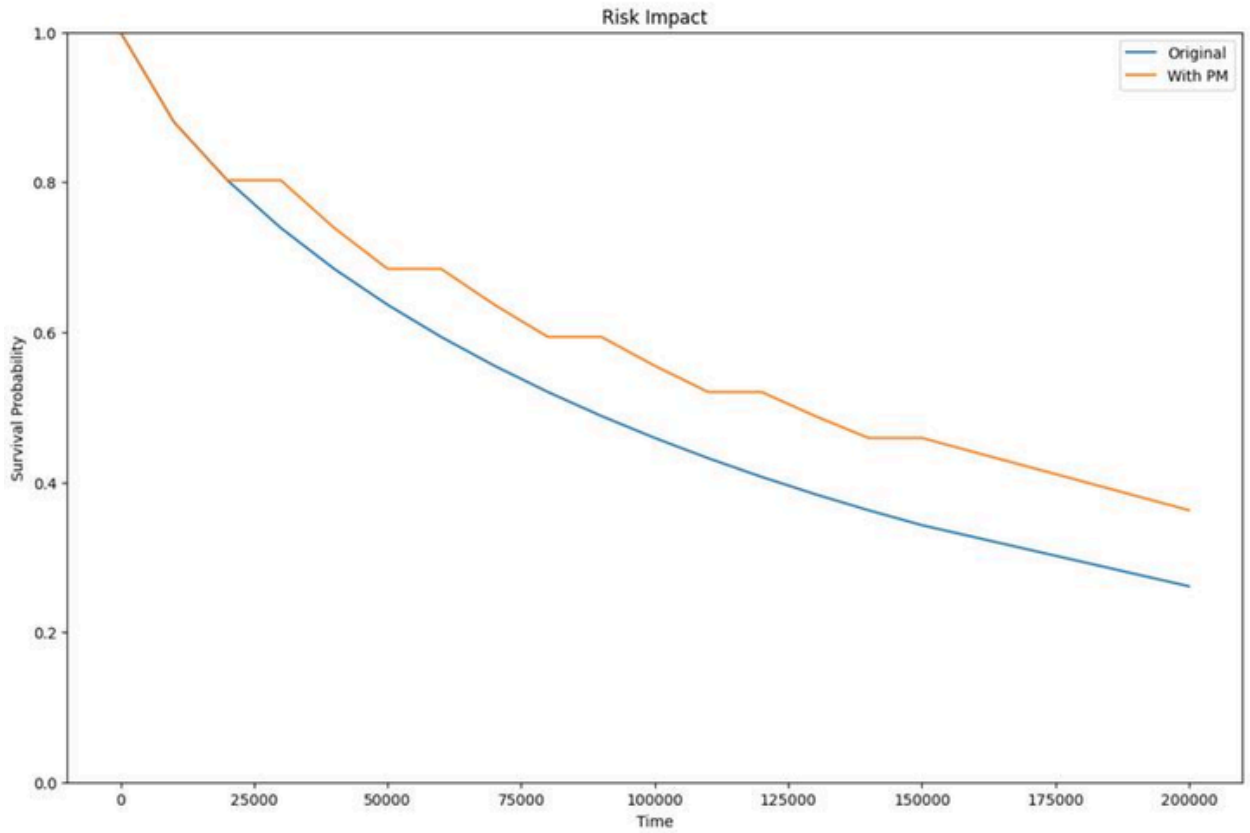


Using our models as a baseline, we can simulate “what-if” scenarios. For example:

- What is the expected impact on transmission failures if activity A is performed every 25,000 km/miles?

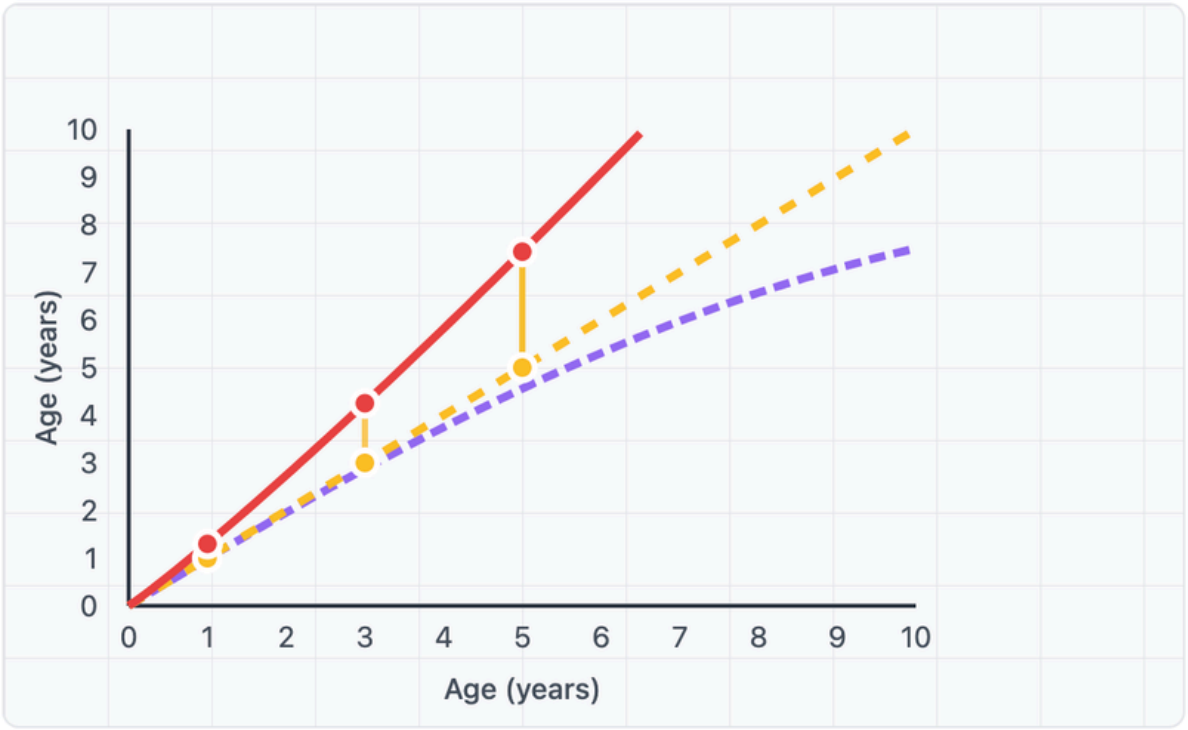
This allows us to quantify the trade-offs between intervention frequency, risk reduction, downtime, and cost.

As illustrated in the example below, the proposed maintenance schedule for a specific component improves its expected survivability. This reduces unplanned maintenance events, which are typically the primary driver of extended downtime. In many cases, reducing unplanned work also lowers overall maintenance cost by avoiding secondary damage, emergency labor rates, and prolonged vehicle-off-road time. The cost outcome is scenario-dependent and is always assessed against the available operational levers, including workshop capacity, parts availability, and service network constraints.



Our solver quantifies the reliability impact of each intervention and optimizes maintenance intervals to avoid unnecessary work and disruption. By running simulations across multiple parameter sets, strategies, and operational constraints, we identify a maintenance schedule that is optimized and tailored to your fleet.

This approach also supports a more accurate way to manage assets: effective age versus chronological age. Vehicles operating under heavy duty cycles often accumulate "effective age" faster than calendar time would suggest. If they are maintained solely on generic intervals, failure risk increases. An optimally designed maintenance program narrows this gap by aligning interventions with actual usage, condition, and risk. This helps extend productive life while maintaining availability.



Our overall objective is to provide practical support and decision-grade insight that help you manage the fleet lifecycle as effectively as possible. While this paper focuses on Operations and Maintenance, the same capabilities and expertise apply across the full lifecycle. This includes more informed acquisition decisions and more value-driven disposal strategies.

Driving Better Outcomes Together

The MSX Contour Lifecycle Optimization solution applies proven, modern analytics to deliver actionable guidance across the end-to-end fleet lifecycle. Within Operations and Maintenance, we focus on three fundamentals:

- forecasting how mileage will accumulate across the fleet
- assessing the real-world reliability of major components by vehicle model
- translating these insights into practical expectations and measurable outcomes

Our methodology is designed to manage uncertainty explicitly and to convert complex data into clear operational strategies.

By combining data science with vehicle engineering expertise, we help reduce unplanned maintenance – typically the most expensive and disruptive category of work. We also identify cost-effective preventive actions that can avoid higher-cost failures, improving both uptime and operating expense.

Finally, by modelling how maintenance cost and risk evolve as vehicles age under your specific duty cycle, we support evidence-based decisions on when to dispose of or replace assets. This increases the likelihood of stronger disposal outcomes by selling vehicles in better condition, supported by a documented vehicle health score.

MSX Can Help

At MSX, we operate at the intersection of transformation and execution. From fleet lifecycle optimization to digital aftersales, technical training, and operational excellence, we help mobility providers and fleet operators turn insight into action.

The MSX Contour Lifecycle Optimization solution reflects what the data reveals: the need for practical, evidence-based decision-making, deep vehicle expertise, and operational support that delivers real results in the field.

Whether you're looking to reduce unplanned maintenance, improve cost visibility, or extend asset value, we combine advanced analytics with hands-on execution to help you achieve measurable outcomes across every stage of the fleet lifecycle.

To learn more, visit msxi.com or connect with us on LinkedIn.