**Slide 1 – Title**

* *“Good [morning/afternoon], everyone. My name is Noorullah Khan. Today I’ll be walking you through an analysis of national road fatalities — what the data tells us, and how statistical and machine learning techniques can help us understand risks and improve outcomes.”*

**Transition →** *“Let’s begin with the high-level picture.”*

**Slide 2 – Executive Summary**

* *“In short, road fatalities have fallen dramatically since the 1980s — a remarkable achievement given there are more cars and roads today. But progress has plateaued since 2020. We see strong demographic and behavioural patterns: young adults, males, and high-speed environments are most at risk, particularly on weekends and late nights.  
  Machine learning confirms that hour of day, speed, and weekend driving are the strongest predictors. These insights point to targeted interventions as the best way forward.”*

**Transition →** *“To test these points, we began with some clear aims and hypotheses.”*

**Slide 3 – Aim & Hypotheses**

* \*“Our aim was to investigate what drives fatal crashes. We started with four working hypotheses:
  1. Crashes concentrate on weekends and late nights.
  2. Young male drivers are disproportionately involved.
  3. High-speed zones lead to more single-vehicle crashes, while commuting hours see more multi-vehicle crashes.
  4. And finally, that weekend late-night driving at high speeds is the most dangerous recipe for fatalities.”\*

**Transition →** *“So, what data do we have to test these ideas?”*

**Slide 4 – Dataset Overview**

* *“We worked with a dataset covering over three decades of fatal crashes, with details on time, location, demographics, and road environment. With this breadth of data, we can test both surface-level trends and deeper statistical patterns.”*

**Transition →** *“Let’s start with the big picture — how fatalities have changed over time.”*

**Slide 5 – Crash Trends Over Time**

* *“Here we see the long-term trend. Fatal crashes have declined steeply since the late 1980s. This is remarkable because car ownership, population, and road use all increased.  
  But notice the curve: since around 2020, improvements have slowed, even ticking upwards. The dip in 2025 is only because the year isn’t complete yet.”*

**Transition →** *“So fatalities have come down, but who is most at risk?”*

**Slides 6–7 – Fatal Crash Demographics**

* *“Looking at age, young adults — particularly 18 to 25 — are heavily overrepresented. But it’s not only young drivers; middle-aged groups also play a role. Elderly drivers show increasing involvement too, likely due to vulnerability in crashes.”*
* *“Gender tells an even clearer story: about 72% of fatal crashes involve males.  
  When we add crash environments, we see nearly half happen on high-speed roads — 100 km/h and above. Urban low-speed zones, despite slower speeds, still contribute about a third, due to higher traffic density.  
  Single-vehicle crashes slightly outnumber multi-vehicle crashes, reflecting the role of speed, control, and behaviour.”*

**Transition →** *“So demographics and environments are important. But when, exactly, are these crashes happening?”*

**Slide 8 – Temporal Patterns**

* *“Time of day and day of week tell us a lot. Fatal crashes spike on weekends — Friday through Sunday — and especially late at night or early morning.  
  On weekdays, the pattern is steadier, with multiple-vehicle crashes concentrated in commuting peaks. This shows how behaviour and context shift risk.”*

**Transition →** *“At this point, we might wonder: are these relationships strong in a statistical sense?”*

**Slide 9 – Linear Correlation**

* *“We checked for simple linear relationships between variables. Surprisingly, correlations are weak.  
  This highlights an important point: just looking at linear correlations isn’t enough — crashes are driven by complex, interacting factors.”*

**Transition →** *“So instead of stopping here, we went deeper — stacking dimensions like day and hour.”*

**Slide 10 – Stacked Temporal Patterns**

* *“By stacking day type with hour of day, a clearer pattern emerges. Weekend late nights show sharp rises in single-vehicle crashes, compared to flatter weekday averages.  
  This layered view reveals what simple linear analysis misses: timing and behaviour interact strongly.”*

**Transition →** *“But we wanted to be sure these weren’t random patterns — so we applied statistical tests.”*

**Slide 11 – Statistical Significance**

* *“Chi-square and ANOVA tests confirmed the associations are statistically significant. Crash type is strongly linked with speed, day of week, and gender. Age and hour also show significant differences.  
  So the story the charts suggest is backed by statistical evidence.”*

**Transition →** *“But statistics can only go so far. To capture nonlinear patterns, we turned to machine learning.”*

**Slides 12–14 – Machine Learning Insights**

* *“We trained models like XGBoost to predict crash type. The model’s feature importance highlights hour of day, speed band, and weekend driving as the strongest predictors.”*
* *“SHAP values tell us how these features work: high speeds and late hours push strongly toward single-vehicle crashes, while earlier hours and lower speeds push toward multi-vehicle outcomes.  
  In other words, the model confirms what we suspected — and quantifies the strength of these risks.”*
* *“Interactions matter too. When we look at high speeds combined with weekend late nights, the risk of single-vehicle crashes peaks. This supports our hypothesis that this is the most dangerous recipe.”*

**Transition →** *“So what does this all add up to?”*

**Slide 15 – Key Findings & Conclusion**

* *“To summarise:  
  – Fatalities have fallen long-term, but improvements are stalling.  
  – Young males and high-speed environments are consistently overrepresented.  
  – Weekends and nights are the riskiest times.  
  – Machine learning confirms timing, speed, and demographics are the top predictors.  
  The message is clear: future interventions should focus on behavioural risks — especially speeding and weekend late-night driving — if we want to continue reducing road fatalities.”*