Project Documentation: Statistical Analysis of Traffic Fines Imposed vs. Road Maintenance and GDP

1️⃣ Introduction

Project Title:

Statistical Analysis of Traffic Fines Imposed vs. Road Maintenance and GDP

Objective/Purpose:

This project aims to analyze the relationship between traffic fines (including helmet fines) and road development budget allocations. Additionally, it explores the correlation between GDP and road budget release to understand if economic growth influences infrastructure investment.

Scope:

- Examining traffic fines collected from different states in India.
- Analyzing road budget release and budget accrual.
- Correlation analysis between fines collected and road budget.
- Evaluating the relationship between GDP and road budget allocation.
- Using statistical techniques to derive insights.

2️⃣ Data Collection & Sources

Data Sources:

The data is collected from the official government website: https://www.data.gov.in/.

Data Cleaning & Processing:

1. Manually filtered **Traffic Violation on NH (National Highways) State-wise** for the years 2020,2021 & 2022.
2. Used **Google Sheets Filter formula** to extract relevant data from:
    - GSDP at constant price.
    - Year-wise accrual & release for road development budget.
3. Removed null, zero, and NA values to ensure data integrity.

4. Matched **road budget data** with **fine collection data** to ensure consistency in analysis.
5. Used SUM and Mathematical formulas for calculating growth,difference & percentages.

3️⃣ Methodology

Tools & Technologies Used:

- **Google Sheets** for data processing and analysis.
- **Statistical Methods** including correlation analysis, regression analysis, and moving averages.
- **Charts & Graphs** for visualization.

Statistical Methods & Analysis:

- **Budget Utilization Formula:** `(Budget Release / Budget Accrual) * 100`
- **Moving Average of Budget Utilization:** `=AVERAGE(A1:A4)`
- **Correlation Analysis:**
  - **Traffic Fines vs. Road Development Budget Release**
  - **GDP vs. Road Budget Release**
- **Regression Analysis:** To explore predictive relationships.
- **Outlier Detection:** Identified unusual values in both fines and budget datasets.

Assumptions & Limitations:

- The analysis assumes that the government budget allocation and fine collection follow a standard distribution without external influences.
- Due to a lack of open government data, a limited **regression analysis** could only be performed. I.e. Used road budget release for 2022 (Till 31.10.2022) - Release

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4️⃣ Data Analysis & Key Findings

Exploratory Data Analysis (EDA):

- **Traffic fines collected surged by 43.62%** 🚀, while the **road budget release increased by only 14.19%**.
- There is a significant gap between revenue from fines and investments in road infrastructure.
- The moving average of budget utilization **(60.42%)** indicates consistent underutilization of road development funds.

Key Calculations:

- **Correlation Between Traffic Fines & Road Budget Release:** `0.09` (Negligible correlation)
- **Correlation Between GDP & Road Budget Release:** `0.1897` (Weak positive correlation)
- **Regression Analysis (Traffic Fines ~ Road Budget Release)**:
  - **Slope:** `0.3906` → An increase in the road budget correlates with a small increase in traffic fines.
  - **R^2:** `0.9907` → High statistical fit, but not causation.

5️⃣ Visualizations & Interpretation

Charts & Graphs:

1. **Bar Graph:** Traffic fines collected by states.
2. **Bar Graph:** Year-wise accrual & Release for road development.
3. **Scatter Plot:** Correlation between Road Budget released & GSDP at constant price.

Interpretation of Results:

- **Higher traffic fines do not mean a higher road budget.**
- **Road budgets are influenced by policies, taxation, and economic conditions, not just fine revenue.**
- **GDP has a weak but positive correlation with road budget allocation.**

6️⃣ Discussion & Limitations

Challenges & Data Gaps:

- Lack of government data for **regression analysis** & also Traffic fines for many states collected.
- No direct allocation of fines to road maintenance budgets.

Alternative Explanations:

- Stricter traffic enforcement may lead to higher fines, independent of the road budget.
- Road budgets are allocated **annually** and do not fluctuate based on fine collections.
- Other funding sources (e.g., state grants, infrastructure bonds) play a larger role in road budget allocation.

7️⃣ Conclusion & Recommendations

Summary of Findings:

- **Traffic fines collection and road budget allocation show no strong correlation (0.09).**
- **GDP and road budget show weak correlation (0.1897).**
- **Budget utilization remains at ~60%, indicating unspent funds.**

Actionable Recommendations:

✅ **Improve Fund Utilization:** Reduce inefficiencies to increase road development spending. ✅ **Explore Alternative Revenue Sources:** Fines should not be relied upon as a primary source for infrastructure funding. ✅ **Enhance Data Transparency:** Government agencies should provide data on how fines are allocated. ✅ **Investigate Time-Lagged Relationships:** Future research should consider how past budget allocations affect current fine collection.

Future Scope:

- Conduct **lagged regression analysis** if more data becomes available.
- Investigate the role of **law enforcement measures** in fine collection.
- Explore the **impact of vehicle population growth** on traffic violations.
- Explore the actual road improvements and the budget released.

8️⃣ References & Appendix

References:

- Data sourced from https://www.data.gov.in/.
- Statistical methods referenced from Google Sheets documentation.
- Government reports on road infrastructure funding.

Appendix:

- Additional data files on **overloading of truck fines.**
- Snippets of dataset filtering methods and raw data tables.

📌 **Key Takeaways:**
✅ **Higher fines ≠ Higher road budget.** ✅ **Road budgets depend on policies, not fine revenue.** ✅ **GDP shows only a weak correlation with road budget allocations.** ✅ **Future research should focus on fund utilization and enforcement efficiency.**

🚀 **Next Steps:** Perform multi-variable regression with additional factors like enforcement policies and economic conditions.

Prepared By: [Hariharan K P] **Date:** [04/03/2025] **Tools Used:** Google Sheets **Data Source:** data.gov.in