Traffic Volume & API Research – Road Report AI

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1. Historic Traffic Volume Data (AI Training Support)

To properly train the AI model on both crash and non-crash scenarios, historic traffic volume data is required to measure vehicle exposure (how many vehicles travel on a road segment). This allows the model to normalize crash frequency relative to traffic density.

Primary Source: Texas Department of Transportation (TxDOT)

TxDOT Traffic Count Maps (AADT Data)
Annual Average Daily Traffic (AADT) provides an estimate of average vehicles per day on monitored road segments.

- Includes historical yearly counts
- Provides GIS-compatible traffic station data
- Covers highways and major roads near Plano, TX

Link:
https://www.txdot.gov/data-maps/traffic-count-maps.html

STARS II – Statewide Traffic Analysis and Reporting System

Provides detailed station-level traffic count tables, including historical traffic volume statistics.

- Road segment vehicle counts
- Historical annual volume data
- Traffic monitoring station data

Link:
https://www.txdot.gov/data-maps/traffic-count-maps/stars.html

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Regional & Local Supplemental Sources

North Central Texas Council of Governments (NCTCOG)
Regional transportation and mobility data for the Dallas–Fort Worth area, which includes Plano.

Link:
https://www.nctcog.org/trans

Data Management

Why Traffic Volume Matters for the AI Model

Traffic volume allows the model to calculate crash exposure metrics, such as:

- Crash rate per 100,000 vehicles
- Crash density relative to vehicle flow
- Comparison between high-volume and low-volume roads

This improves predictive fairness and prevents high-traffic roads from being labeled dangerous purely due to volume.

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2. Google Maps API Research

The Google Maps Platform will support:

- Interactive map display
- Geocoding road names to coordinates
- Snapping coordinates to road segments
- Overlaying AI-generated risk predictions

Google Maps Platform Overview:
https://developers.google.com/maps

Pricing Overview:
https://developers.google.com/maps/billing-and-pricing/overview

Google Maps Platform core services pricing list | Pricing and Billing | Google for Developers

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Relevant Google APIs

Maps JavaScript API

- Renders interactive web maps
- Allows overlays, markers, and polylines

Geocoding API

- Converts road names or addresses to coordinates

Roads API

- Snaps latitude/longitude points to actual road geometry

Traffic Layer

- Displays real-time traffic conditions visually

Google Maps Pricing (Pay-As-You-Go Model)

Google Maps uses usage-based billing.

Approximate pricing (subject to change):

- Dynamic Maps: ~$7 per 1,000 map loads
- Geocoding API: ~$5 per 1,000 requests
- Roads API: billed per 1,000 requests

Google provides free monthly usage credits depending on account type. For a university-scale project with limited traffic, usage is expected to remain low and manageable.

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3. Google Maps Cost Optimization Strategy

To minimize API costs:

1. Cache Geocoding Results

Store road name → coordinate mappings in the database after first lookup to prevent repeated geocoding calls.

2. Cache AI Risk Scores

Precompute risk predictions for common road segments and store them in the database. Only recompute when needed.

3. Limit Map Reloads

Update overlays dynamically instead of reloading the entire map instance.

4. Backend API Mediation

Route Google API calls through the backend to prevent duplicate frontend requests.

5. Use Static Demo Data

For presentations, use stored road geometries to reduce live API calls.

These strategies ensure minimal cost exposure while maintaining full functionality.

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4. Map Display & Risk Overlay Implementation

The Google Maps JavaScript API supports visual overlays that allow risk predictions to be displayed directly on the map.

Potentiel overlay methods:

A. Color-Coded Road Segments

Roads will be highlighted using polylines:

- Green → Low Risk
- Yellow → Moderate Risk
- Orange → High Risk
- Red → Severe Risk

This allows intuitive visualization of AI classifications.

B. Clickable Risk Popups

When a user selects a road segment:

Displayed Information:

- Risk Level
- AI Confidence Percentage
- Summary explanation

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5. Alternative Map & Traffic APIs (Researched)

While Google Maps is the primary platform, additional APIs were researched:

Mapbox

Interactive map rendering and optional traffic data.

Pricing Page:
https://www.mapbox.com/pricing

- Includes free tier (limited map loads and geocoding)
- Usage-based billing beyond free limits
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Historical traffic volume data from US Department of Transportation
Special Tabulations / U.S Traffic Volume Data - Policy | Federal Highway Administration

Texas Department of Transportation has several links from a traffic count map to a traffic analysis and reporting system
Traffic count maps