

California Road Safety Investigation

Student Data Analysis Worksheet

Name: _____

Class / Period: _____ Date: _____

Investigation Question

Where should California investigate transportation-safety conditions more closely, and what evidence supports that decision?

Evidence rule: Use the interactive viewer to collect evidence. Do not choose a location from one number alone. Record the traffic exposure, the type of metric, and the roadway context whenever you compare places.

Part 1 · Before You Open the Data

1. In your own words, what is the difference between a crash count and a crash rate?

2. Prediction: Will the place with the most crashes always have the highest crash rate? Explain your reasoning before looking at the data.

Part 2 · Count vs. Rate

Open **Explore California**. Keep Geography = County, Area = Countywide, and Road type = All state highways.

Select three counties. For each county, record a count, its traffic exposure, and the corresponding rate.

County	Total crashes	Travel (MVM)	Total crash rate	What do you notice?

3. Did the ranking by crash count match the ranking by crash rate? Use at least two values from your table.

4. Why is travel (MVM) important when comparing crash rates between counties?

Part 3 · Road Type and Rural/Urban Context

Choose one county to investigate more closely. Change one filter at a time so you can identify which comparison produced each result.

County: _____

Area	Road type	Travel (MVM)	Crash rate	Fatal + injury rate

5. Which comparison changed the values the most: rural vs. urban, freeway vs. non-freeway, or another road type? Support your answer with numbers.

6. What additional information would you want before claiming that a roadway category causes a higher or lower crash rate?

Part 4 · Compare Places

Open **Compare Places**. Select three counties or three Caltrans districts. Keep your filters consistent while you compare them. Use the same places in both tables.

Place	Road miles	Travel (MVM)	Total crashes

Place	Crash rate	Fatal + injury rate	Fatality rate

7. Which place appears most important to investigate further? Explain why using at least **three different kinds of evidence**.

8. Identify one reason your choice could change if a different performance measure were used.

Part 5 · Vulnerable Road Users

Open **Vulnerable Road Users**. Choose two counties. Examine both pedestrian and bicycle data. Remember that the viewer reports counts for these road users.

County	Road user	Highway type	Total victims	Injured	Killed

9. What pattern do you observe across highway types or counties? Describe the evidence without converting these counts into a risk rate.

10. What denominator would be useful if you wanted to estimate pedestrian or bicycle risk rather than simply count victims?

Part 6 · Statewide Freeway Trend

Open **Statewide Trends**. Select one metric and one area category. Record the five-year series.

Selected metric: _____

Area category: _____

Year	Value
2020	
2021	
2022	
2023	
2024	

Percent change: $((\text{new value} - \text{old value}) \div \text{old value}) \times 100$

11. Calculate the percent change from 2020 to 2024 for your selected metric. Show your work.

12. Describe the five-year pattern. Does it move steadily in one direction, fluctuate, or show another pattern?

Part 7 · Road Risk Lab

Open **Road Risk Lab**. Choose Highway, Intersection, or Ramp. Compare two reference groups. When possible, choose configurations that differ in only one characteristic so the comparison is easier to describe.

Characteristic or measure	Configuration A	Configuration B
Rate group		
Facility type		
Area		
Other characteristic(s)		
Base rate		
% fatal		
% fatal + injury		

13. What is the numerical difference in base rate between Configuration A and Configuration B?

Part 7 · Interpreting the Results

14. What changed between the two reference groups? What did not change?

15. Write a cautious interpretation. Do not claim that one design feature caused the difference unless the data actually establish causation.

Part 8 · Evidence Check

Before your final claim, make sure your evidence includes more than one measure.

- ☐ A crash count or victim count
- ☐ A traffic-exposure value (MVM)
- ☐ At least one exposure-adjusted crash or fatality rate
- ☐ A roadway or rural/urban context
- ☐ A comparison with another place or reference group
- ☐ A limitation or missing piece of information

Part 9 · Final Claim

Where Should California Investigate Next?

CLAIM: Identify one county or Caltrans district that deserves further transportation-safety investigation. State your claim in one clear sentence.

EVIDENCE: Record at least **three pieces of evidence** from different parts of the viewer.

Evidence 1

Evidence and value(s)	Why this evidence matters to your claim

Evidence 2

Evidence and value(s)	Why this evidence matters to your claim

Evidence 3

Evidence and value(s)	Why this evidence matters to your claim

Part 9 · Reasoning and Limitation

REASONING: Explain how your evidence supports your claim. Address the difference between crash burden (counts) and exposure-adjusted rates.

LIMITATION: Identify one limitation of the data or one additional dataset you would want before recommending a specific engineering intervention.

Optional · Engineering Extension

If you were part of a transportation-safety team, what should be investigated next at your selected location? Describe one question, one type of additional data, and one constraint the team should consider.

Reference · NGSS Connections

The strongest NGSS alignment in this investigation is to the Science and Engineering Practices: analyzing and interpreting data, using mathematics and computational thinking, and arguing from evidence.

The activity also supports connections to HS-ETS1-1, HS-ETS1-2, and HS-ETS1-3 when used within a broader engineering-design sequence. The viewer and worksheet do not by themselves constitute a complete assessment of those performance expectations.

Science & Engineering Practices

Strongest connection: analyze and interpret data; use mathematics and computational thinking; engage in argument from evidence.

HS-ETS1-1

Supports problem framing by using evidence to identify transportation-safety priorities and relevant criteria or constraints for further investigation.

HS-ETS1-2

Supports breaking a complex real-world problem into manageable comparisons involving exposure, roadway type, severity, geography, and road-user context.

HS-ETS1-3

Supporting connection: students compare priorities, evidence, and tradeoffs. A full HS-ETS1-3 assessment would also require evaluating specific engineered solutions against criteria and constraints.

Crosscutting Concepts

Systems and system models; stability and change; cause and effect, with attention to the limits of causal claims from observational data.

Reference · Data Sources and Vocabulary

Primary displayed data: California Department of Transportation (Caltrans), Crash Data on California State Highways, 2024 publication tables. Official source: Caltrans Annual Collision Data.

Caltrans basic average crash-rate reference tables for highways, intersections, and ramps; these provide the Road Risk Lab reference values.

Federal Highway Administration (FHWA), roadway safety network-screening guidance for crash frequency, exposure, and performance measures (methodology reference, not the source of the displayed California crash counts).

California Department of Public Health / UCSF Healthy Communities Data and Indicators Project, historical transportation-to-work files based on Census/ACS and National Household Travel Survey data (background only; not merged with 2024 crash outcomes).

Vocabulary

Exposure: The amount of travel represented in a comparison. In the main crash dataset, travel is reported in million vehicle miles (MVM).

Crash count: The observed number of crashes in the selected category.

Crash rate: A crash count divided by a measure of exposure.

Fatality rate: People killed per 100 million vehicle miles in this Caltrans dataset.

Vulnerable road user: A road user such as a pedestrian or bicyclist who is not protected by a vehicle body.

Reference rate: A published comparison value for a roadway, intersection, or ramp group; it is not proof that a single feature caused the observed difference.