Methodology and Variable Definitions for 2020 Vermont Traffic Stop Data Analysis

Pat Autilio
Data Analyst
P.O. Box 728
Quechee, VT 05059
diversifiedpat@gmail.com

Nancy Brooks
Visiting Associate Professor
Dept. of City and Regional Planning
Cornell University
Ithaca, NY USA 14853
nb275@cornell.edu

Stephanie Seguino
Professor
Department of Economics
University of Vermont
Burlington, VT 05401
stephanie.seguino@uvm.edu

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Methodology and Variable Definitions for 2020 Vermont Traffic Stop Data Analysis

The traffic stop data used in the Seguino, Brooks, and Autilio (2020) studies of Vermont traffic policing spans multiple years.[1] Each row of data received from Vermont law enforcement agencies corresponds to a single outcome (warning, ticket, or arrest) resulting from a traffic stop. There may be multiple outcomes of a stop. The date and time of a stop is not required by legislation, although some agencies have chosen to provide date and time.

Here we outline the methodology adopted in "cleaning" the data used in these studies.

A. Missing or Unknown Data Values by Field

Many agency reports have missing data. In each of our agency studies, the appendix outlines the frequency of missing data/unknown data by field.

The definitions for missing or unknown values by field are:
- Stop ID (also called Profile Number or Incident Number) – Blank or Unusable to tie together outcomes from a single stop*[2]
- Stop Date and Time - Blank*
- Age – Blank or 0
- Race – Blank, "Business", "Unknown - U" or "Other – U"
- Gender – Blank, Business, NA or "Transgendered - T"[3]
- Stop Reason – Blank or "O = Other violation"
- Search Reason – Blank or "Unknown"
- Search Outcome – Blank or "Unknown"
- Stop Result – Blank or "Unknown"

Fields with non-standard, unrecognized values are also treated as missing values.

Additional to traffic stop data, DMV Accident reports are used to estimate the percentage of drivers in the area by race. We also track and report on the number of accident reports that are missing race information.

The number of fields with problem values varies dramatically depending on the reporting agency and year of the data.

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[1] Individual agency studies will be posted periodically as they are completed at:
https://www.uvm.edu/cas/economics/profiles/stephanie-seguino.
[2] This field is not required by law.
[3] The value "Transgendered – T" is identified in this study for 2019 data only.

B. Missing Months of Data

Since dates are frequently absent from the data, it is difficult to determine if stops are omitted for any significant time spans. Missing data can lead to misleading year-on-year (annual) comparison of traffic stops. This is one of the many benefits of having the dates and times provided.

C. Duplicate Blocks of Data

Occasionally, when date and time information is present, some agency data can have large segments of duplicate entries. This can be seen when each row in this time span appears twice with all field values matching exactly. When this situation is detected, the duplicate rows are removed prior to further analysis.

D. Stops with Multiple Outcomes

Most Vermont traffic stop data files contain only one stop outcome per row (where an outcome can be one arrest, one ticket, one warning, etc.).[4] However, a single traffic stop can have multiple outcomes. For example, it is possible for a single stop to result in multiple tickets being issued, or other combinations such as a ticket and a warning, and so forth. It is important to be able to collect multiple outcomes into stops to avoid overcounting as well as to recognize stops where more than one ticket is issued.

Identifying multiple outcomes for a stop can be a challenge. Some datasets provide stop IDs that enable this association. When stop IDs are present, each one of a stop's outcomes will have the same stop ID and so can be associated and analyzed together.

When stop IDs are absent, a heuristic approach is used to attempt to group together outcomes. This technique associates outcomes using a combination of fields with matching values. Typically, the following set of fields is used to identify incidents: agency, date/time, age, gender, and race.

If any of the above fields is missing from the data, the heuristic approach cannot work. In this case, each row must be assumed to be a separate stop, i.e., each stop has only one outcome. The absence of Stop IDs, date, and time makes this approach necessary for a large swath of the currently available Vermont data.

E. Resolving Single-Row Data Inconsistencies

In the traffic stop data, there are cases of apparent inconsistencies between values within stops. For example, a stop's search reason may be "reasonable suspicion" but its search outcome is "no search." This is an example of a conflict within a single outcome row. (There

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[4] One notable exception to this approach is Burlington data, which combines information from all outcomes into a single incident per row. https://www.burlingtonvt.gov/Police/Data .

can also be inconsistencies that appear across multiple outcome rows for a single stop. Those are covered in a later section.)

1. Conflicts Between Race and Ethnicity Fields

Some agency data files include both Race and Ethnicity fields. These must be merged into a single Race/Ethnicity field to be consistent with the standard designations used in Vermont policing, ("White", "Black", "Asian", "Hispanic", "Native American" and "Unknown"). It is most common for data files to lack an Ethnicity field. When one is present it is often blank or matches the value in the Race field. When they are in conflict, the following rules are used to merge Race and Ethnicity.
- If Ethnicity contains "Hispanic", set Race/Ethnicity to Hispanic,
- Otherwise, set Race/Ethnicity to the value in the Race field.

2. Conflicts Between Search Reason and Search Outcome Fields

The primary source of discrepancies within a single data row occurs between search reason and search outcome. Table 1 details how these conflicts are resolved in our data analysis. If, for example, the search reason is listed as "no search conducted" but the search outcome is "contraband," the search outcome is instead treated as "no search." Law enforcement agencies have indicated to us that this scenario emerges when contraband is visible to the officer without a search.

Table 1. Resolving Conflicts Between Search Reason and Outcome

Search Reason	Search Outcome	Modified Search Outcome	Include in Number of Searches	Include in Number of Contraband Hits
No Search Conducted	Contraband	No Search	No	No
No Search Conducted	No Contraband	No Search	No	No
No Search Conducted	No Search	No Search	No	No
No Search Conducted	Unknown	No Search	No	No
Probable Cause	Contraband	Contraband	Yes	Yes
Probable Cause	No Contraband	No Contraband	Yes	No
Probable Cause	No Search	No Contraband	Yes	No
Probable Cause	Unknown	Unknown	Yes	No
Reasonable Suspicion	Contraband	Contraband	Yes	Yes
Reasonable Suspicion	No Contraband	No Contraband	Yes	No
Reasonable Suspicion	No Search	No Contraband	Yes	No
Reasonable Suspicion	Unknown	Unknown	Yes	No
Warrant	Contraband	Contraband	Yes	Yes
Warrant	No Contraband	No Contraband	Yes	No
Warrant	No Search	No Contraband	Yes	No
Warrant	Unknown	Unknown	Yes	No

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Unknown	Contraband	Unknown	No	No
Unknown	No Contraband	Unknown	No	No
Unknown	No Search	Unknown	No	No
Unknown	Unknown	Unknown	No	No

As an example, the Colchester Police Department data has eighteen stops that require modification based on single-row inconsistencies.[5] In the example in Table 2, which represents multiple rows for the same stop, the Search Outcomes are modified to "Contraband."

Table 2. Specific Colchester Cases of Modification of Search Outcomes

Stop ID	Stop Reason	Search Reason	Search Outcome	Stop Outcome
18CC011715	Investigatory Stop	Probable Cause	No Search	Ticket
18CC011715	Investigatory Stop	Probable Cause	Contraband	Ticket
18CC011715	Investigatory Stop	Probable Cause	Contraband	Ticket

F. Resolving Multi-Row Data Inconsistencies

When stops include multiple outcomes, there are many opportunities for data inconsistencies across the rows. The primary types of conflict and their resolutions are described below.

1. Stop Reasons

Each stop (and thus outcomes of that stop) should be assigned one and only one stop reason (of which the choices are externally generated stop, moving violation, suspicion of DWI, investigatory stop, vehicle equipment). However, sometimes multiple stop reasons appear across a stop's outcome rows.

Table 3 shows the rules used to resolve conflicting stop reasons. Note that when "vehicle equipment," "moving violation, and "suspicion of DWI" are found in combination, the stop reason is designated "multiple stop reasons."

Table 3. Resolving Stop Reason Conflicts within Multi-Row Stops

Condition (in decreasing priority)	Action
1. "Externally Generated Stop" in combination with another reason	Use EGS as stop reason
2. "Investigatory Stop" in combination with another	Use "Investigatory Stop"

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[5] Colchester is used as an example for no particular reason. We could easily have used any other agency's data to illustrate the issues identified here.

reason (except EGS)		
3. Combinations of two or more of (vehicle equipment, moving violation, suspicion of DWI)	Use "Multiple Stop Reasons"	
4. "Suspicion of DWI" in combination with "unknown"	Use "Suspicion of DWI"	
5. "Moving Violation" in combination with "unknown"	Use "Moving Violation"	
6. "Vehicle Equipment" in combination with "unknown"	Use "Vehicle Equipment"	
7. "Unknown" as only stop reason	Use "Unknown"	

Using Colchester as an example once again, the stop reasons in Table 4 are inconsistent and will be modified to "moving violation."

Table 4. Example of Colchester Stop Reason Conflicts and Resolution

Stop Agency	Stop ID	Stop Reason	Search Reason	Search Outcome	Stop Outcome
Colchester	18CC004170	Unknown	Probable Cause	Contraband	Arrest for Violation
Colchester	18CC004170	Moving Violation	Probable Cause	Contraband	Ticket
Colchester	18CC004170	Unknown	Probable Cause	Contraband	Arrest for Warrant

2. Stop Search Reasons

A stop should be assigned one and only one search reason (probable cause, reasonable suspicion, warrant, or no search conducted). However, sometimes multiple search reasons appear across a stop's outcome rows.

The Table 5 shows the rules used to resolve conflicting search reasons within single incidents.

Table 5. Resolving Search Reason Conflicts within Multi-Row Stops

Condition (in decreasing priority)	Action
"Probable cause" (PC) in combination with another search reason	Use "probable cause" as stop reason
"Reasonable suspicion" (RS) in combination with any other search reason (except PC)	Use "reasonable suspicion"
"Warrant" in combination with "no search" or "unknown"	Use "warrant"
"No search" in combination with "unknown"	Use "no search"
"Unknown" only	Use "unknown"

The search reasons in the Colchester example in Table 6 are inconsistent and will be resolved to "probable cause."

Table 6. Resolving Colchester Search Reason Conflicts within Multi-Row Stops

Stop Agency	Stop ID	Stop Reason	Search Reason	Search Outcome	Stop Outcome
Colchester	17CC004339	Moving Violation	Probable Cause	Contraband	Ticket
Colchester	17CC004339	Moving Violation	No Search Conducted	No Search	Ticket

3. Search Outcomes

A stop should be assigned one and only one search outcome ("no search," "no contraband," or "contraband"). However, sometimes multiple search outcomes appear across a stop's outcome rows. Table 7 shows rules for resolving conflicting search outcomes.

Table 7. Conflicting Search Outcomes within Multi-Row Stops

Search Reason	Search Outcome	Conflicting Search Outcome	Use Search Outcome
No Search with Arrest (report separately)	Contraband	No Search	No Search
No Search with no arrest (report separately)	Contraband	No Search	No Search
No search conducted	Contraband	Unknown	No Search
No search conducted	Contraband	Unknown	No Search
No search conducted	No Contraband	No Search	No Search
No search conducted	No Contraband	Unknown	No Search
No search conducted	No Search	Unknown	No Search
Probable cause	Contraband	No Contraband	Contraband
Probable cause	Contraband	No Search	Contraband
Probable cause	Contraband	Unknown	Contraband
Probable cause	No Contraband	No Search	No Contraband
Probable cause	No Contraband	Unknown	No Contraband
Probable cause	No Search	Unknown	No Search
Reasonable suspicion	Contraband	No Contraband	Contraband
Reasonable suspicion	Contraband	No Search	Contraband
Reasonable suspicion	Contraband	Unknown	Contraband
Reasonable suspicion	No Contraband	No Search	No Contraband
Reasonable suspicion	No Contraband	Unknown	No Contraband
Reasonable suspicion	No Search	Unknown	No Search
Warrant	Contraband	No Contraband	Contraband
Warrant	Contraband	No Search	Contraband
Warrant	Contraband	Unknown	Contraband

Warrant	No Contraband	No Search	No Contraband
Warrant	No Contraband	Unknown	No Contraband
Warrant	No Search	Unknown	No Search
Unknown	Contraband	No Contraband	Unknown
Unknown	Contraband	No Search	Unknown
Unknown	No Contraband	No Search	Unknown

By way of example, Table 8 shows that search outcomes for a specific Colchester stop are inconsistent and are modified to "contraband."

Table 8. Resolving Colchester Search Outcome Conflicts within Multi-Row Incidents

Stop Agency	Stop ID	Stop Reason	Search Reason	Search Outcome	Stop Outcome
Colchester	18CC011715	Investigatory Stop	Probable Cause	Contraband	Ticket
Colchester	18CC011715	Investigatory Stop	Probable Cause	Contraband	Ticket
Colchester	18CC011715	Investigatory Stop	Probable Cause	No Search	Ticket

G. Variable Definitions

Table 9 defines the variables used in the 2020 Vermont law enforcement studies by Seguino, Brooks, and Autilio which can be found at this website: https://www.uvm.edu/cas/economics/profiles/stephanie-seguino.

Table 9. Variable Definitions

Variable	Formula
Total Traffic Stops	
Including externally generated stops	Count of all stops
Excluding externally generated stops	Count of all stops except where stop reason is "externally generated stop"
Reasons For Stops	
Safety Stops	Count of all stops where stop reason is "moving violation" or "suspicion of DWI"
Moving Violation	Count of all stops where stop reason is "moving violation"
Suspicion of DWI	Count of all stops where stop reason is "suspicion of DWI"
Investigatory/Pretextual Stops	Count of all stops where stop reason is "investigatory stop" or "vehicle equipment"
Investigatory Stop	Count of all stops where stop reason is "investigatory stop"
Vehicle Equipment	Count of all stops where stop reason is "vehicle equipment"
Externally Generated Stop	Count of all stops where stop reason is "externally generated stop"
Multiple Reasons - Moving Violation & Suspicion of DWI	Count of all stops where stop reasons include both "moving violation" and "suspicion of DWI"
Multiple Reasons - Moving Violation & Vehicle	Count of all stops where stop reasons include both

Variable	Formula
Equipment	"moving violation" and "vehicle equipment"
Multiple Reasons - Suspicion of DWI & Vehicle Equipment	Count of all stops where stop reasons include both "suspicion of DWI" and "vehicle equipment"
Unknown Stop Reason	Count of all stops where stop reason is "unknown"
Outcomes (excl. EGS)	
Ticket	Count of all stops where at least one ticket was issued.
Warning	Count of all stops where at least one warning was issued.
No action taken	Count of all stops where no action was taken was issued.
Arrest for violation	Count of all stops where there was an arrest for violation.
Arrest for warrant	Count of all stops where there was an arrest for warrant.
Searches	
Total stops with no search	Count of all stops where search reason was "no search"
No Search & Contraband & Arrest for violation	Count of all stops where search reason was "no search" and stop search outcome was "contraband" and there was an arrest for violation
No Search & Contraband & No Arrest	Count of all stops where search reason was "no search" and stop search outcome was "contraband" and there was not an arrest for violation
No Search (all others)	Count of all stops where search reason was "no search" and stop search outcome was not "contraband"
Total Stops with Unknown Search	Count of all stops where search reason was "unknown"
Total Stops with Search	Count of all stops where search reason was one of "probable cause," "reasonable suspicion," or "warrant"
Search with Probable Cause (PC)	Count of all stops where search reason was "probable cause"
Stops with PC Searches, No contraband	Count of all stops where search reason was "probable cause" and search outcome was "no contraband" or "no search"
Stops with PC Searches, Unknown contraband	Count of all stops where search reason was "probable cause" and search outcome was "unknown"
Stops with PC Searches, Contraband	Count of all stops where search reason was "probable cause" and search outcome was "contraband"
*Outcomes of PC Search**	
Stops with PC Searches, Contraband & Warning, No Action or Unknown*	Count of all stops where search reason was "probable cause" and search outcome was "contraband" and one or more of the following outcomes were recorded: "warning," "no action," or "unknown" but no tickets or arrests
Stops with PC Searches, Contraband and Ticket*	Count of all stops where search reason was "probable cause" and search outcome was "contraband" and one or more tickets were issued but no arrest
Stops with PC Searches, Contraband and Arrest*	Count of all stops where search reason was "probable cause" and search outcome was "contraband" and one or more arrests were made (for Violation or Warrant)
Search with Reasonable Suspicion (RS)	Count of all stops where search reason was "reasonable suspicion"
Stops with RS Searches, No contraband	Count of all stops where search reason was "reasonable suspicion" and search outcome was "no contraband" or "no search"
Stops with RS Searches, Unknown contraband	Count of all stops where search reason was "reasonable suspicion" and search outcome was "unknown"
Stops with RS Searches, Contraband	Count of all stops where search reason was "reasonable

Variable	Formula
	suspicion" and search outcome was "contraband"
Outcomes of RS Search*	
Stops with RS Searches, Contraband & Warning, No Action or Unknown*	Count of all stops where search reason was "reasonable suspicion" and search outcome was "contraband" and one or more of the following outcomes were recorded: "warning," "no action," or "unknown" but no tickets or arrests
Stops with RS Searches, Contraband & Ticket*	Count of all stops where search reason was "reasonable suspicion" and search outcome was "contraband" and one or more tickets were issued but no arrest
Stops with RS Searches, Contraband & Arrest*	Count of all stops where search reason was "reasonable suspicion" and search outcome was "contraband" and one or more arrests were made (for Violation or Warrant)
Search with Warrant	Count of all stops where search reason was "warrant".
Stops with Warrant Searches, No contraband	Count of all stops where search reason was "warrant" and search outcome was "no contraband" or "no search"
Stops with Warrant Searches, Unknown contraband	Count of all stops where search reason was "warrant" and search outcome was "unknown"
Stops with Warrant Searches, Contraband	Count of all stops where search reason was "warrant" and search outcome was "contraband"
Outcomes of Warrant Search*	
Stops with Warrant Searches, Contraband & Warning, No Action or Unknown*	Count of all stops where search reason was "warrant" and search outcome was "contraband" and one or more of the following outcomes were recorded: "warning," "no action," or "unknown" but no tickets or arrests
Stops with Warrant Searches, Contraband & Ticket*	Count of all stops where search reason was "warrant" and search outcome was "contraband" and one or more tickets were issued but no arrest
Stops with Warrant Searches, Contraband & Arrest*	Count of all stops where search reason was "warrant" and search outcome was "contraband" and one or more arrests were made
Racial Shares of Stops	
Including externally generated stops	Number of stops for a race divided by number of stops for all races
Excluding externally generated stops	Number of non-EGS stops for a race divided by number of non-EGS stops for all races (excluding "Unknown")
Racial share of stops (ACS)	Percentage of area residents of a particular race as determined by the American Community Survey (ACS) five-year estimates for 2013-2017 (See https://www.census.gov/programs-surveys/acs)
Racial share of stops (DMV accident data)	Percentage of drivers of a particular race with accident reports logged by the agency as determined by Vermont DMV Accident data for 2013-19.
Disparity Index (using ACS)	For a particular race, the Disparity Index (ACS) is the % of non-EGS stops for that race divided by the % of area residents for that race based on the ACS 5-year estimates from 2013-2017.
Disparity Index (using DMV Accident data)	For a particular race, the Disparity Index (DMV) is the % of non-EGS stops for that race by the % of drivers for that race with accident reports based on Vermont DMV accident data for 2013-2019.
Stop Reason as % of All Stops	
Safety Stops	% of all stops (including EGS) where stop reason is

Variable	Formula
	"moving violation" or "suspicion of DWI"
Moving Violation	% of all stops (including EGS) where stop reason is "moving violation"
Suspicion of DWI	% of all stops (including EGS) where stop reason is "suspicion of DWI"
Investigatory/Pretextual Stops	% of all stops (including EGS) where stop reason is "investigatory stop" or "vehicle equipment"
Investigatory Stops	% of all stops (including EGS) where stop reason is "investigatory stop"
Vehicle Equipment	% of all stops (including EGS) where stop reason is "vehicle equipment"
Externally Generated Stops	% of all stops (including EGS) where stop reason is "externally generated stop"
Multiple Reasons	% of all stops (including EGS) where there are multiple stop reasons in the following combinations: "moving violation" and "suspicion of DWI" or "moving violation" and "vehicle equipment" or "suspicion of DWI" and "vehicle equipment"
Unknown Reason	% of all stops (including EGS) where stop reason is "unknown"
Outcome Rates as a % of All Stops	
Warning Rate	% of non-EGS stops where at least one warning was issued
Ticket Rate	% of non-EGS stops where at least one ticket was issued
Arrest for Violation Rate	% of non-EGS stops where there was an arrest for violation
Arrest for Warrant Rate	% of non-EGS stops where there was an arrest for warrant
No Action Rate	% of non-EGS stops where there was no action taken
Search Rates	
Search rate (excl. searches on warrant)	% of non-EGS stops where the search reason was "probable cause" or "reasonable suspicion"
Search rate (incl. searches on warrant)	% of non-EGS stops where the search reason was "probable cause," "reasonable suspicion," or "warrant search"
Hit rates (as a % of PC, RS, & Warrant Searches)	
Hit rates (incl. all outcomes)	% of non-EGS stops where the search reason was "probable cause," "reasonable suspicion," or "warrant" and contraband was found
Hit rates (excl. warnings as outcomes)	% of non-EGS where the search reason was "probable cause," "reasonable suspicion," or "warrant" and contraband was found, and the stop resulted in at least one ticket or arrest
Hit rates (outcome = arrest)	% of non-EGS stops where the search reason was "probable cause," "reasonable suspicion." or "warrant" and contraband was found, and the stop resulted in an arrest for violation or warrant

*Does not appear in all reports

H. Vermont Law Enforcement Agencies

Table 10 shows the complete list of Vermont law enforcement agencies that required to provide traffic stop data. Agency groupings, such as "All Police," are also listed near end of the table.

Each agency is associated with a "Driver Entity." This signifies the geographical area that is within the agency's jurisdiction. A Driver Entity is used to map an agency to the correct entries in the American Community Survey data. (See also Table 11).

Table 10. Vermont Law Enforcement Agencies

Agency - Full Name	Agency - Short Name	Agency Type	Driver Entity / ACS Place
Barre City Police	Barre City	police	Barre City
Barre Town Police	Barre Town	police	Barre Town
Bellows Falls Police	Bellows Falls	police	Bellows Falls
Bennington Police	Bennington	police	Bennington
Berlin Police	Berlin	police	Berlin
Bethel Police	Bethel	police	Bethel
Bradford Police	Bradford	police	Bradford
Brandon Police	Brandon	police	Brandon
Brattleboro Police	Brattleboro	police	Brattleboro
Brighton Police	Brighton	police	Essex County
Bristol Police	Bristol	police	Bristol
Burlington Police	Burlington	police	Burlington
Canaan Police	Canaan	police	Canaan
Castleton Police	Castleton	police	Castleton
Chester Police	Chester	police	Chester
Colchester Police	Colchester	police	Colchester
Dover Police	Dover	police	Dover
Essex Police	Essex	police	Essex
Fair Haven Police	Fair Haven	police	Fair Haven
Fairlee Police	Fairlee	police	Fairlee
Hardwick Police	Hardwick	police	Hardwick
Hartford Police	Hartford	police	Hartford
Hinesburg Police	Hinesburg	police	Hinesburg
Killington Police	Killington	police	Killington
Ludlow Police	Ludlow	police	Ludlow
Lyndon Police	Lyndon	police	Lyndon
Manchester Police	Manchester	police	Manchester
Middlebury Police	Middlebury	police	Middlebury
Milton Police	Milton	police	Milton
Montpelier Police	Montpelier	police	Montpelier
Morristown Police	Morristown	police	Morristown
Newport Police	Newport	police	Newport
Northfield Police	Northfield	police	Northfield
Norwich Police	Norwich	police	Norwich
Pawlet Constabulary	Pawlet	police	Pawlet
Pittsford Police	Pittsford	police	Pittsford
Poultney Constabulary	Poultney	police	Poultney
Randolph Police	Randolph	police	Randolph
Richmond Police	Richmond	police	Richmond

Royalton Police	Royalton	police	Royalton
Rutland Police	Rutland	police	Rutland
Rutland Town Police	Rutland Town	police	Rutland Town
S. Burlington Police	S. Burlington	police	S. Burlington
Shelburne Police	Shelburne	police	Shelburne
Springfield Police	Springfield	police	Springfield
St. Albans Police	St. Albans	police	St. Albans
St. Johnsbury Police	St. Johnsbury	police	St. Johnsbury
Stowe Police	Stowe	police	Stowe
Swanton Police	Swanton	police	Swanton
Thetford Police	Thetford	police	Thetford
UVM Police	UVM	police	Burlington
Vergennes Police	Vergennes	police	Vergennes
VT DMV	VT DMV	police	All Vermont
VT Fish and Wildlife	VT Fish and Wildlife	police	All Vermont
Waterbury Police	Waterbury	police	Waterbury
Weathersfield Police	Weathersfield	police	Weathersfield
Wells Constabulary	Wells	police	Wells
Williston Police	Williston	police	Williston
Wilmington Police	Wilmington	police	Wilmington
Windsor Police	Windsor	police	Windsor
Winhall Police	Winhall	police	Winhall
Winooski Police	Winooski	police	Winooski
Woodstock Police	Woodstock	police	Woodstock
Addison County Sheriff	Addison County	sheriff	Addison County
Bennington County Sheriff	Bennington County	sheriff	Bennington County
Caledonia County Sheriff	Caledonia County	sheriff	Caledonia County
Chittenden County Sheriff	Chittenden County	sheriff	Chittenden County
Essex County Sheriff	Essex County	sheriff	Essex County
Franklin County Sheriff	Franklin County	sheriff	Franklin County
Grand Isle Sheriff	Grand Isle County	sheriff	Grand Isle County
Lamoille County Sheriff	Lamoille County	sheriff	Lamoille County
Orange County Sheriff	Orange County	sheriff	Orange County
Orleans County Sheriff	Orleans County	sheriff	Orleans County
Rutland County Sheriff	Rutland County	sheriff	Rutland County
Washington County Sheriff	Washington County	sheriff	Washington County
Windham County Sheriff	Windham County	sheriff	Windham County
Windsor County Sheriff	Windsor County	sheriff	Windsor County
VSP HQ - BCI/SIU/NIU	VSP HQ - BCI/SIU/NIU	state police	All Vermont

VSP Headquarters	VSP HQ - Field Force	state police	All Vermont
VSP_Bradford State Police	VSP_Bradford	state police	Orange County
VSP_Brattleboro State Police	VSP_Brattleboro	state police	Windham County
VSP_Derby State Police	VSP_Derby	state police	Orleans County
VSP_Middlesex State Police	VSP_Middlesex	state police	Washington County
VSP_New Haven State Police	VSP_New Haven	state police	Addison County
VSP_Rockingham State Police	VSP_Rockingham	state police	Windham County
VSP_Royalton State Police	VSP_Royalton	state police	Windsor County
VSP_Rutland State Police	VSP_Rutland	state police	Rutland County
VSP_Shaftsbury State Police	VSP_Shaftsbury	state police	Bennington County
VSP_St. Albans State Police	VSP_St. Albans	state police	Franklin County
VSP_St. Johnsbury State Police	VSP_St. Johnsbury	state police	Caledonia County
VSP_Westminster State Police	VSP_Westminster	state police	Windham County
VSP_Williston State Police	VSP_Williston	state police	Chittenden County
AGGREGATES			
All Police	All Police	multiple	All Vermont
All Sheriffs	All Sheriffs	Multiple	All Vermont
All Vermont Agencies	All Vermont	multiple	All Vermont
VSP - All	VSP – All	state police	All Vermont

I.   Vermont Places ("Entities")

Table 11 shows geographic places or "Entities" in Vermont. Each place has a GEOID code used to map it to the American Community Survey data. This mapping combined with the mapping shown in Table 10 allows each law enforcement agency to be tied to the correct ACS data.

Table 11. Vermont Places ("Entities")

Entity/Place	Entity Type	Geo_GEOID	Entity/Place	Entity Type	Geo_GEOID
			Bennington	township	16000US5004750
Addison County	county	05000US50001	**Bennington County**	county	05000US50003
Albany	township	16000US5000400	**Benson**	township	16000US5005125
Alburgh	township	16000US5000850	**Berlin**	township	06000US5002305650
Arlington	township	16000US5001375	**Bethel**	township	16000US5005725
Barnet	township	16000US5002800	**Bradford**	township	16000US5007225
Barre City	city	16000US5003175	**Brandon**	township	16000US5007675
Barre Town	township	06000US5002303250	**Brattleboro**	township	16000US5007975
Barton	township	16000US5003475	**Bristol**	township	16000US5008950
Bellows Falls	village	16000US5004225	**Burlington**	city	16000US5010675

Cabot	township	16000US5011050		**Newbury**	township	16000US5048100
Caledonia County	county	05000US50005		**Newfane**	township	16000US5048325
Cambridge	township	16000US5011425		**Newport**	city	16000US5048850
Canaan	township	16000US5011725		**Northfield**	township	16000US5050200
Castleton	township	16000US5011875		**Norwich**	township	16000US5052825
Cavendish	township	16000US5012175		**Orange County**	county	05000US50017
Chelsea	township	16000US5013450		**Orleans County**	county	05000US50019
Chester	township	16000US5013600		**Pawlet**	township	06000US5002154250
Chittenden County	county	05000US50007		**Pittsford**	township	16000US5055525
Colchester	township	06000US5000714875		**Plainfield**	township	16000US5055750
Concord	township	16000US5015175		**Poultney**	township	16000US5056800
Coventry	township	16000US5016075		**Putney**	township	16000US5057625
Danville	township	16000US5017050		**Randolph**	township	16000US5058000
Dorset	township	16000US5017650		**Readsboro**	township	16000US5058525
Dover	township	06000US5002517875		**Richford**	township	16000US5059050
East Montpelier	township	16000US5021850		**Richmond**	township	16000US5059200
Essex	township	16000US5024400		**Rochester**	township	16000US5060025
Essex County	county	05000US50009		**Royalton**	township	06000US5002760850
Fair Haven	township	16000US5025450		**Rutland**	city	16000US5061225
Fairfax	township	16000US5024850		**Rutland County**	county	05000US50021
Fairlee	township	16000US5025600		**Rutland Town**	township	06000US5002161300
Franklin County	county	05000US50011		**S. Burlington**	city	16000US5066175
Glover	township	16000US5028000		**Shelburne**	township	16000US5064225
Grand Isle County	county	05000US50013		**Springfield**	township	16000US5069475
Greensboro	township	16000US5030100		**St. Albans**	city	16000US5061675
Groton	township	16000US5030475		**St. Johnsbury**	township	16000US5062125
Hardwick	township	16000US5031750		**Stowe**	township	16000US5070450
Hartford	township	06000US5002732275		**Swanton**	township	16000US5071650
Hartland	township	16000US5032350		**Thetford**	township	06000US5001772400
Hinesburg	township	16000US5033400		**Troy**	township	16000US5073450
Hyde Park	township	16000US5034975		**Vergennes**	city	16000US5074650
Irasburg	township	16000US5035500		**Waitsfield**	township	16000US5075250
Jericho	township	16000US5036625		**Wallingford**	township	16000US5075850
Johnson	township	16000US5037000		**Washington County**	county	05000US50023
Killington	township	06000US5002137685		**Waterbury**	township	16000US5076900
Lamoille County	county	05000US50015		**Weathersfield**	township	06000US5002777500
Lowell	township	16000US5040450		**Wells**	township	16000US5077875
Ludlow	township	16000US5041200		**West Rutland**	township	16000US5082375
Lyndon	township	16000US5041950		**Westminster**	township	16000US5081325
Manchester	township	16000US5042700		**Williamstown**	township	16000US5084100
Marshfield	township	16000US5043525		**Williston**	township	06000US5000784475
Middlebury	township	16000US5044275		**Wilmington**	township	16000US5084625
Milton	township	16000US5045175		**Windham County**	county	05000US50025
Montpelier	city	16000US5046000		**Windsor**	township	16000US5085000
Morristown	township	06000US5001546675		**Windsor County**	county	05000US50027

| Winhall | township | 06000US5000385075 | Woodstock | township | 16000US5085900 |
| Winooski | city | 16000US5085150 | Worcester | township | 16000US5086050 |

J. Methodology for using US Census American Community Survey (ACS)

For each place covered by the American Community Survey, the data is disaggregated by race, gender, and age group. For example, the data field "B01001C025" provides an estimated count of "People Who Are American Indian and Alaska Native Alone: Female: 30 to 34 Years." ("Alone" signifies these people do not identify as multi-racial). In spite of the large number of data categories, not all combinations are available. (See notes below.)

Table 12 shows the association between ACS racial categories and the race categories used in this study.

Table 12. ACS Racial Categories Used with Mappings

ACS Racial Category	ACS Racial Category IDs	Maps to Race used in this study	Maps to Gender used in this study
White Alone - Male	B01001A006 through B01001A016	White	Male
White Alone - Female	B01001A021 through B01001A031	White	Female
Black or African American Alone – Male	B01001B006 through B01001B016	Black	Male
Black or African American Alone - Female	B01001B021 through B01001B031	Black	Female
Population of Two Races: White; Black or African American	C02003013	Black	Unknown
Population of Two Races: Black or African American; American Indian and Alaska Native	C02003016	Black	Unknown
Asian Alone – Male	B01001D006 through B01001D016, B01001D021 through B01001D031	Asian	Male
Asian Alone – Female	B01001D006 through B01001D016, B01001D021	Asian	Female

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	through B01001D031		
Native Hawaiian and Other Pacific Islander Alone – Male	B01001E006 through B01001E016	Asian	Male
Native Hawaiian and Other Pacific Islander Alone – Female	B01001E021 through B01001E031	Asian	Female
Population of Two Races: White; Asian	C02003015	Asian	Unknown
American Indian and Alaska Native Alone – Male	B01001C006 through B01001C016	Native American	Male
American Indian and Alaska Native Alone – Female	B01001C021 through B01001C031	Native American	Female
Population of Two Races: White; American Indian and Alaska Native	C02003014	Native American	Unknown
Total Population: Population of One Race: Some Other Race	C02003008	Unknown	Unknown
Total Population: Population of Two or More Races: Population of Two Races: All Other Two Race Combinations	C02003017	Unknown	Unknown
Total Population: Population of Two or More Races: Population of Three Races	C02003018	Unknown	Unknown
Total Population: Population of Two or More Races: Population of Four or More Races	C02003019	Unknown	Unknown

Notes on ACS Data Mappings:

- The U.S. Census Bureau considers "Hispanic" an ethnicity, so no Hispanic population counts were available in this race-focused ACS data set. For the study, only DMV accident data is used to estimate Hispanic driver counts.
- To identify all potential drivers in a population, we would want to have counts of all people of legal driving age, 16 and older. However, breakpoints in ACS occur at ages 15 and 18. To avoid under-estimating, we use ages 15 and up for the driving-age population.

- Counts for biracial and multi-racial groups are not disaggregated by age. For multi-racial counts, it is assumed the entire count is of driving age. The effect of this is to slightly overestimate the non-white racial shares of the driving population.
- Counts for biracial and multi-racial groups are not disaggregated by gender. Therefore, these counts are not used for any analysis requiring gender identification and are classified as Gender Unknown.

When calculating counts ("PopCount") by place and race, values are first grouped and summed by gender using the mappings show above:

PopCount(Place, Race) = MalePopCount(Place, Race) + FemalePopCount(Place, Race) + UnknownGenderPopCount(Place, Race)

Then race percentages can be calculated as follows:
PopPercentage(Place, Race) = PopCount(Place, Race) / PopCount(Place, All Races)

K. Data Quality Field Values Explained
Each individual law enforcement agency study contains *Appendix Tables A.3a-3c.*, which summarize our analysis of the quality of the data reported. Table 13 (below) defines how each category in that table is defined.

Table 13. Field Values Explained for Appendix Table A.3a

(Table rotated for ease of viewing)				
Stop Years		…		…
Stops		Count of all stops excluding Externally Generated Stops (EGS)		Count of all stops excluding Externally Generated Stops (EGS)
Stop ID		Count of all non-EGS stops where Stop ID is missing or cannot be used to tie together multiple outcomes		% of all non-EGS stops where Stop ID is missing or cannot be used to tie together multiple outcomes
Stop Date/Time		Count of all non-EGS stops where Stop Date & Time is unknown		% of all non-EGS stops where Stop Date & Time is unknown.
Age		Count of all non-EGS stops where Age of driver is unknown		% of all non-EGS stops where Age of driver is unknown
Race		Count of all non-EGS stops where Race of driver is unknown		% of all non-EGS stops where Race of driver is unknown
Gender	**Count of Blank or Unknown Stops**	Count of all non-EGS stops where Gender of driver is unknown	**Percentage of Blank or Unknown Stops**	% of all non-EGS stops where Gender of driver is unknown
Stop Reason		Count of all stops (incl. EGS) where stop reason is unknown.		% of all stops (incl. EGS) where stop reason is "unknown"
Search Reason		Count of all non-EGS stops where search reason is unknown		% of all non-EGS stops where search reason is "unknown"
Contraband		Count of all non-EGS outcomes where search reason was one of "probable cause," "reasonable suspicion," or "warrant" and it is unknown if contraband was found.		% of all probable cause, reasonable suspicion, or warrant searches where it is unknown if contraband was found (excl. EGS stops)
Stop Outcome		Count of all non-EGS stop outcome rows (may be more than one outcome per stop) where Stop Outcome is unknown		% of all stop outcomes where Outcome is "unknown" (excl. EGS)
Reported Accidents		Count of all reported accidents		Count of all reported accidents

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Race in Reported Accidents		Count of reported accidents where Race is unknown		% of reported accidents where Race is unknown

Table 14. Field Values Explained for Appendix Table A.3b

Stop Years	**Total Stops**	**Rows Missing Value(s)**	**% of Rows Missing Value(s)**
…	Count of all stops excluding Externally Generated Stops (EGS)	Count of all non-EGS stops where at least one required field values is unknown	% of all non-EGS stops where at least one required field values is unknown

Table 15. Field Values Explained for Appendix Table A.3c

Count of Blank or Unknown Rows	
Total Stop Rows (excl. EGS)	Count of all stops excluding Externally Generated Stops (EGS)
Unknown Stop Reason	Count of all stops where stop reason is unknown
Unknown Stop Outcome	Count of all non-EGS stop outcome rows (may be more than one outcome per stop) where Stop Outcome is unknown
Unknown if Search occurred	Count of all non-EGS stops where search reason is unknown
Unknown if Contraband found subsequent to a search	Count of all non-EGS stops where search reason was one of "probable cause," "reasonable suspicion," or "warrant" and it is unknown if contraband was found
Unknown Outcome if contraband found	Count of all non-EGS stops where search reason was one of "probable cause," "reasonable suspicion," or "warrant" and contraband was found but stop outcome is unknown
Percentage of Blank or Unknown Rows	
Unknown Stop Reason as % of all stops	% of all stops (incl. EGS) where stop reason is "unknown"
Unknown Stop Outcome as % of all stops	% of all stop outcomes where Outcome is "unknown" (excl. EGS)
Unknown if Search occurred as % of all stops	% of all non-EGS stops where search reason is "unknown"
Unknown if Contraband found as % of all searches	% of all probable cause, reasonable suspicion, or warrant searches where it is unknown if contraband was found (excl. EGS stops)
Unknown Outcome if contraband found as % of all searches	% of all probable cause, reasonable suspicion, or warrant searches where contraband was found but stop outcome is unknown (excl. EGS stops)