DELAWARE VALLEY REGIONAL PLANNING COMMISSION'S INNOVATIVE TRAFFIC DATA SHARING PRACTICES

CASE STUDY

FHWA-SA-17-033

Federal Highway Administration Office of Safety
Roadway Safety Data Program
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Improved Data Collection and Analysis → More Informed Decision Making → Better Targeted Investments → Fewer Fatalities & Serious Injuries
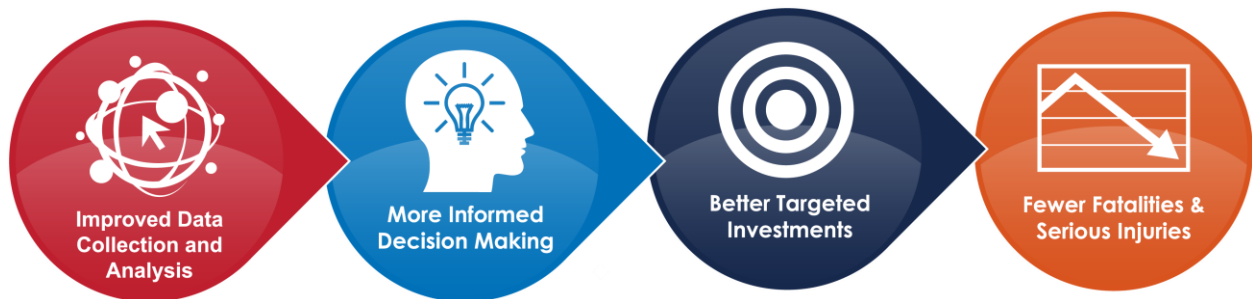
February 10, 2017

U.S. Department of Transportation
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16. Abstract

This case study highlights how the Delaware Valley Regional Planning Commission (DVRPC) promotes traffic data sharing with other agencies and makes traffic and geographic information system data available to the public. DVRPC has developed an interactive mapping application, called Traffic Count Viewer, that provides open access to different types of short-duration traffic counts that DVRPC and other external entities take. Traffic Count Viewer communicates with a regional database that DVRPC maintains, allowing users to view, filter, and download traffic data. Further, users can directly connect to DVRPC's ArcGIS server map service and extract data for traffic and safety analysis. After implementing this tool, DVRPC minimized duplicate data collection efforts, increased the efficiency of its data collection program, and improved its relationships with external entities by offering no-cost access to a comprehensive data source. The Viewer also resulted in time and cost savings for DVRPC's data partners and provided quick and easy access to data that otherwise would be difficult to obtain. DVRPC will continue to improve Traffic Count Viewer, considering its increased popularity with and positive feedback from users.

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ACRONYMS

Table 1. Acronyms.

Acronym	Description
AADT	Annual Average Daily Traffic
API	Application Program Interface
DOT	Department of Transportation
DVRPC	Delaware Valley Regional Planning Commission
GIS	Geographic Information System
LRS	Linear Referencing System
MPO	Metropolitan Planning Organization
QA/QC	Quality Assurance/Quality Control
REST	Representational State Transfer
TIP	Transportation Improvement Program

EXECUTIVE SUMMARY

This case study presents how a metropolitan planning organization, the Delaware Valley Regional Planning Commission (DVRPC), promotes traffic data sharing with other agencies and makes traffic and geographic information system (GIS) data available to the public. DVRPC has developed an open-source-code web platform, called Traffic Count Viewer, which provides public access to different types of short-duration traffic counts that DVRPC and other external entities take. Traffic Count Viewer communicates with a regional database that DVRPC maintains, allowing users to view, filter, and download traffic data. Further, users can directly connect to DVRPC's ArcGIS server and extract GIS layers and data in a tabular format for traffic, safety, and other types of analyses. After implementing this tool, DVRPC minimized data collection duplication, increased data collection program efficiency, and improved relationships with external entities by offering no-cost access to a comprehensive data source. Additional benefits of the Viewer were time and cost savings for DVRPC's data partners, as well as quick and easy access to data that otherwise would be difficult to obtain. DVRPC will continue to improve Traffic Count Viewer, considering its increased popularity and positive feedback from users.

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INTRODUCTION

The purpose of this case study is to highlight how a metropolitan planning organization (MPO), the Delaware Valley Regional Planning Commission (DVRPC), promotes traffic data sharing with the public and other state, county, and local governments. DVRPC has developed several interactive mapping applications (Figure 1) to support planning and improve decision-making in the Greater Philadelphia Region. Within each application, users can view geographic features, query selective data sets, create custom maps, and access detailed reports about certain features. These web mapping applications allow DVRPC to present geospatial information to the public without requiring special geographic information system (GIS) software.

Figure 1. DVRPC's Interactive Mapping Applications.

Source: http://www.dvrpc.org/Mapping/Webmaps/
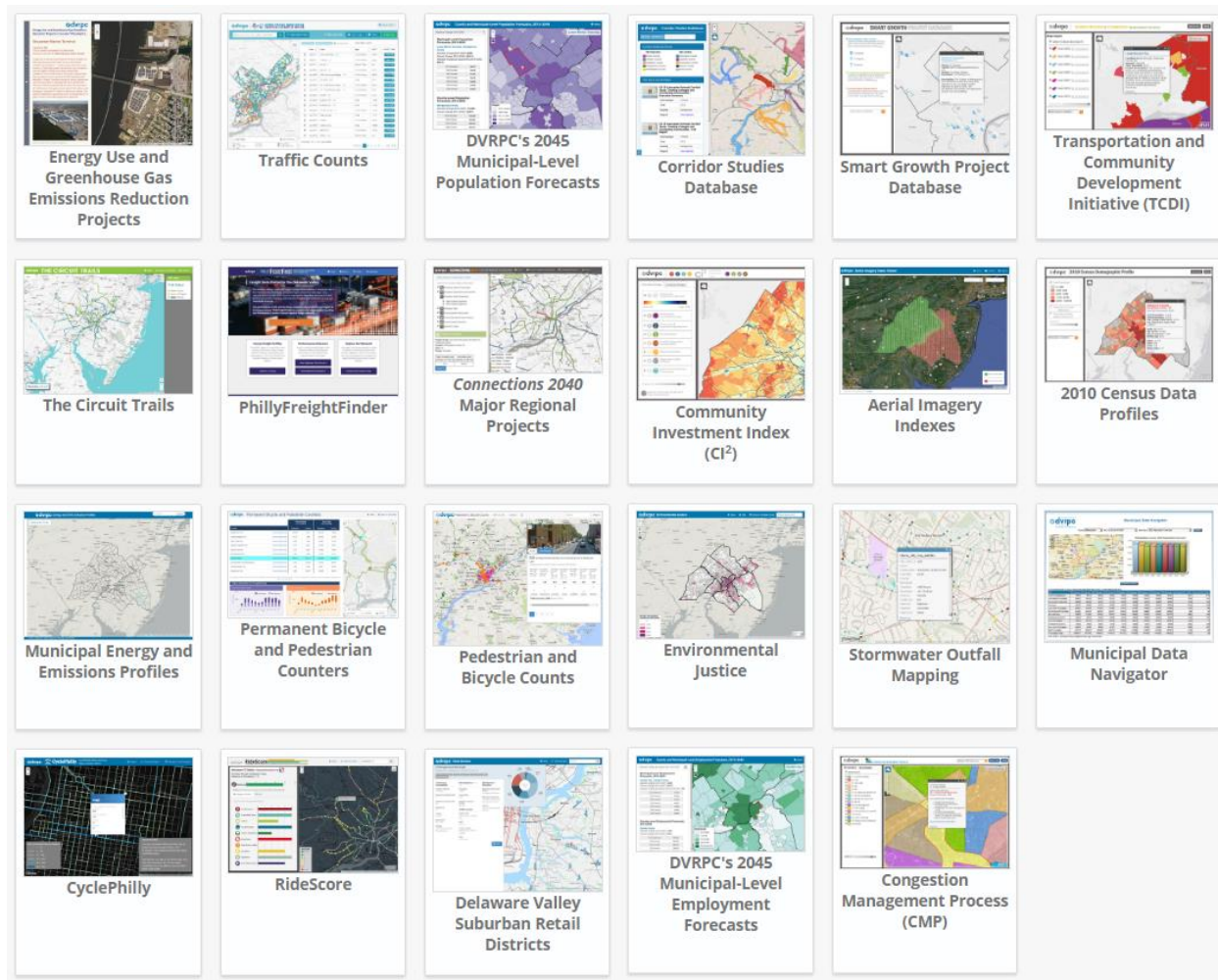
This case study focuses on one of these applications, called Traffic Count Viewer, which provides open access to different types of short-duration traffic counts. DVRPC gathers traffic data, collected both in-house and by external entities. After cleaning and processing the data, it stores them in a regional database. Traffic Count Viewer communicates with the database, allowing users to view, filter, and download the count data. Further, users can directly connect to DVRPC's ArcGIS server and extract GIS layers and data in a tabular format for traffic, safety, and other types of analyses. This practice has benefited DVRPC and stakeholders such as transportation engineers, planners, developers, market analysts, and the public. The main benefits involve:

- Increased efficiency of the data collection program by creating and maintaining a central data depository. Users do not have to extract and process data from multiple remote data sources,

- Elimination of duplicate data collection efforts, resulting in time and cost savings for data partners and users,

- Quick and easy access to data regardless of users' objectives, background, and knowledge level in database administration and data management,

- Improved relationships with external entities by offering no-cost access to a comprehensive data source, and

- Improved data transparency by allowing users open access to DVRPC's ArcGIS server to: download different types of traffic counts, GIS layers, and other metadata for analytical purposes.

Because of the positive experience and feedback related to this initiative, DVRPC will continue to improve Traffic Count Viewer and collaborate with more stakeholders.

BACKGROUND

DVRPC is the federally designated MPO for the Greater Philadelphia Region and serves nine counties in two states: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC cooperates with other state, county, and local agencies to support various transportation planning and programming functions. Two of the most important objectives of DVRPC include the development of a long-range plan and the Transportation Improvement Program (TIP). Toward these objectives, DVRPC collects different types of travel data through surveys, counts, and innovative web applications and uses them as input in various analytical tools.

DVRPC conducts short-duration traffic counts every year at over 5,000 locations using pneumatic road tubes. Rural minor collectors and local roads account for approximately 20 percent of these counts. DVRPC also obtains traffic and non-traffic data collected by other entities and stores internal and external traffic data in a database that it developed and maintains. DVRPC publishes the data online and allows users to explore them using modern GIS mapping applications, data reporting, and other visualization tools. It provides open access to the data as a public map service, allowing users to connect to its ArcGIS server using a URL link. From there, users can download GIS layers, metadata, and various traffic data in a tabular format that is suitable for analytical purposes. DVRPC also provides disaggregated data, stored in its database, by request.

The next section presents the most important development and implementation activities, as well as basic components and features of Traffic Count Viewer.

TRAFFIC COUNT DATA SHARING TOOL

DEVELOPMENT AND IMPLEMENTATION

In 2009, DVRPC developed the first version of Traffic Count Viewer to display various traffic count data. The main objective of this initiative was to gather, use, and publish data collected from various internal and external sources. The goal was to reduce data collection costs, promote data sharing, and enhance collaboration with other entities. DVRPC developed the first version of the Viewer using a third-party software. DVRPC staff maintained the website for approximately seven years.

In 2016, DVRPC developed (in-house) a second, updated version of Traffic Count Viewer to expand its functionality and make it more efficient and user friendly. When developing the new application, DVRPC used open-source code technologies and data libraries for several reasons, including the following:

- They allow the creation of modern mapping features and tools that are necessary for a web application like Traffic Count Viewer.

- They work efficiently across most major desktop and mobile platforms.

- Adding online plugins can extend their functionality.

- They have well-documented application program interface (API) and free tutorials online.

- They allow individuals to expand the functionality by modifying the open source code.

- They offer several open-source code blogs and forums that address users' questions and issues, and provide relevant information and technical support.

- They may be transferrable to other agencies.

DVRPC shares the open-source code, by request, to help agencies develop and implement similar products.

PARTICIPATING AGENCIES

The Traffic Count Viewer displays traffic data collected by DVRPC and other entities. External entities such as HERE (formerly traffic.com) collected approximately 30 percent of the data that are available on DVRPC's website. Consultants conduct a high percent of short-term counts that they use in special studies, and they occasionally send the traffic data to DVRPC. They

must also directly submit the traffic data they collect to DVRPC. This requirement accelerates the data sharing process and enhances data collaboration among agencies. DVRPC downloads counts from the New Jersey Department of Transportation's (DOT's) website and uploads them to its database. The counts that DVRPC takes for the Pennsylvania DOT are also available on the Traffic Count Viewer.

Collecting and storing traffic data in a central depository and making the regional database accessible online benefits DVRPC and other stakeholders, who traditionally use traffic data to address certain needs and make decisions. For clarity, DVRPC publishes one PDF file for each traffic count available on Traffic Count Viewer indicating the count taker and the data source (internal or external). Users also have the option to connect to DVRPC's ArcGIS server and download in an electronic tabular format various data for traffic and safety analyses. DVRPC also provides, by request, disaggregated data that are stored in its database but not available in the Viewer.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

DVRPC conducts QA/QC checks to ensure quality of the data before publishing them online. For the counts conducted internally, DVRPC staff compares the traffic patterns of a new count against those of historical counts from the same location or from adjacent counted segments if historical data at the location of interest are not available. DVRPC staff determines counts that deviate from historical traffic patterns by 20 percent or more and identifies possible causes of the variations. DVRPC documents these causes by commenting in the PDF files. Depending on the validity of a potential cause, DVRPC repeats counts that do not pass the quality checks.

DVRPC follows the same QA/QC process for the counts received from other agencies. If the counts do not pass the quality control checks and there is no evident cause of the potential discrepancies in the data, DVRPC does not upload the counts to its database. Instead, it contacts the data provider and asks for additional information (for example, construction, inclement weather conditions) that may explain the data variations. Occasionally, some data suppliers retake counts to address the issues.

FUNCTIONALITY

Traffic Count Viewer provides users with multiple options, such as:

- Search counts by area.

- View locations of counts on a map.

- Filter counts for specific years.

- Download traffic data.

Figure 2 shows the Viewer webpage that allows users to search for traffic counts within a particular zip code or location, which can be a municipality, city, or neighborhood.

Figure 2. Search Options in Traffic Count Viewer.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/
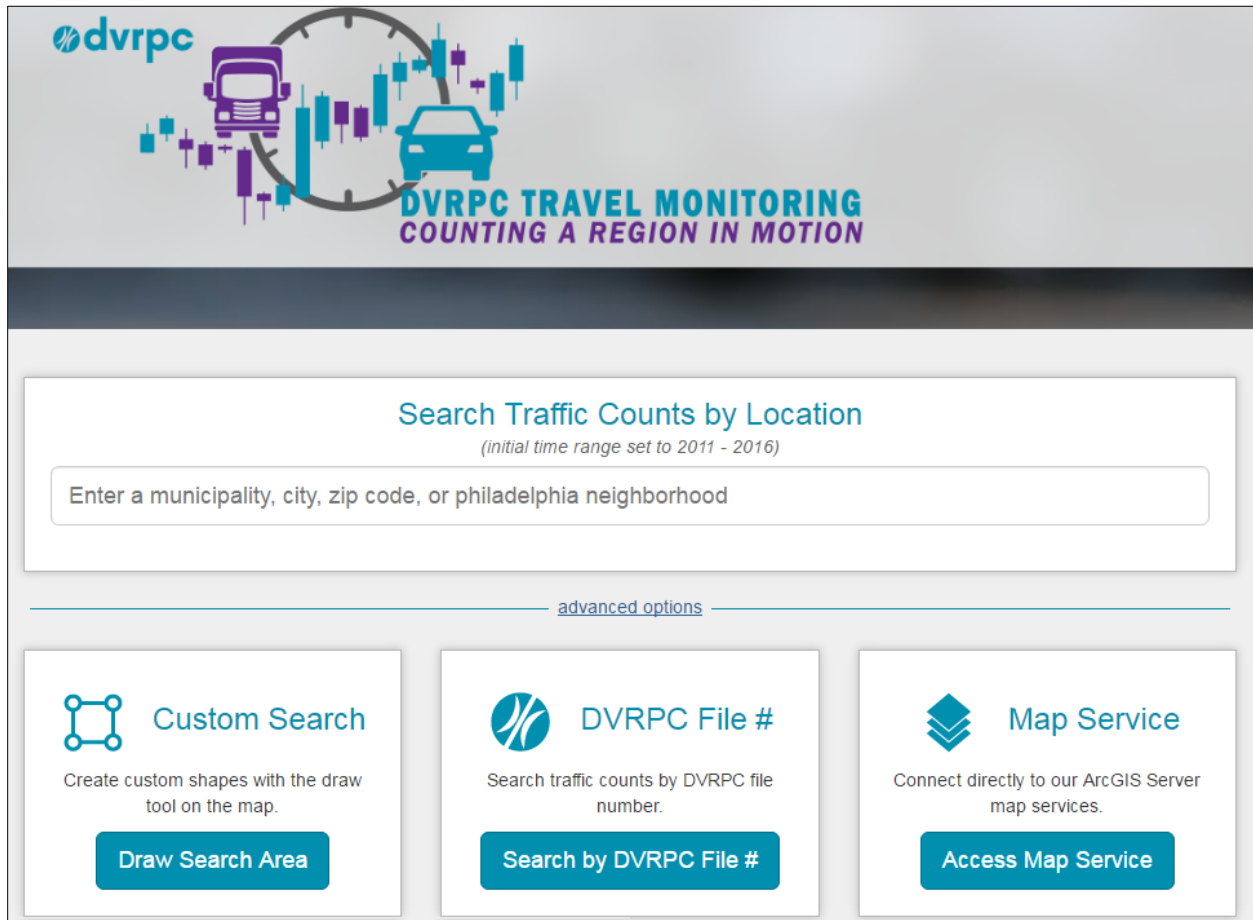
The webpage also offers two advanced search options: search counts by area and search counts by DVRPC file number. The following subsections describe these options, along with other functions of the Viewer.

Search Counts by Area

When users select this option, the Viewer loads its main webpage (Figure 3), which includes two basic components: an interactive map and a traffic-count record report. Users can draw the area of interest on the map using custom shapes (lines). They can also pan, zoom in/out, and change the background view (for example, from street map to satellite view). Once the

user defines the search area, the system extracts from the database all the counts that fall within the selected region and displays them on the map (left part of Figure 3). The report next to the map (right part of Figure 3) lists the records associated with the selected counts.
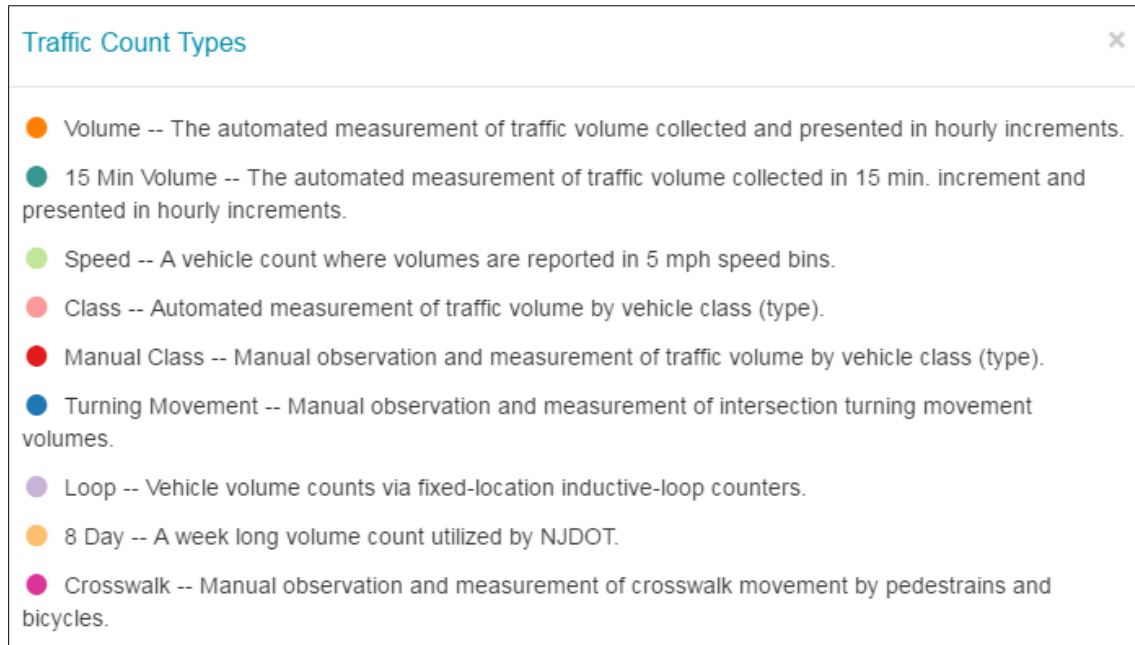
Figure 3. Main Webpage of Traffic Count Viewer.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/
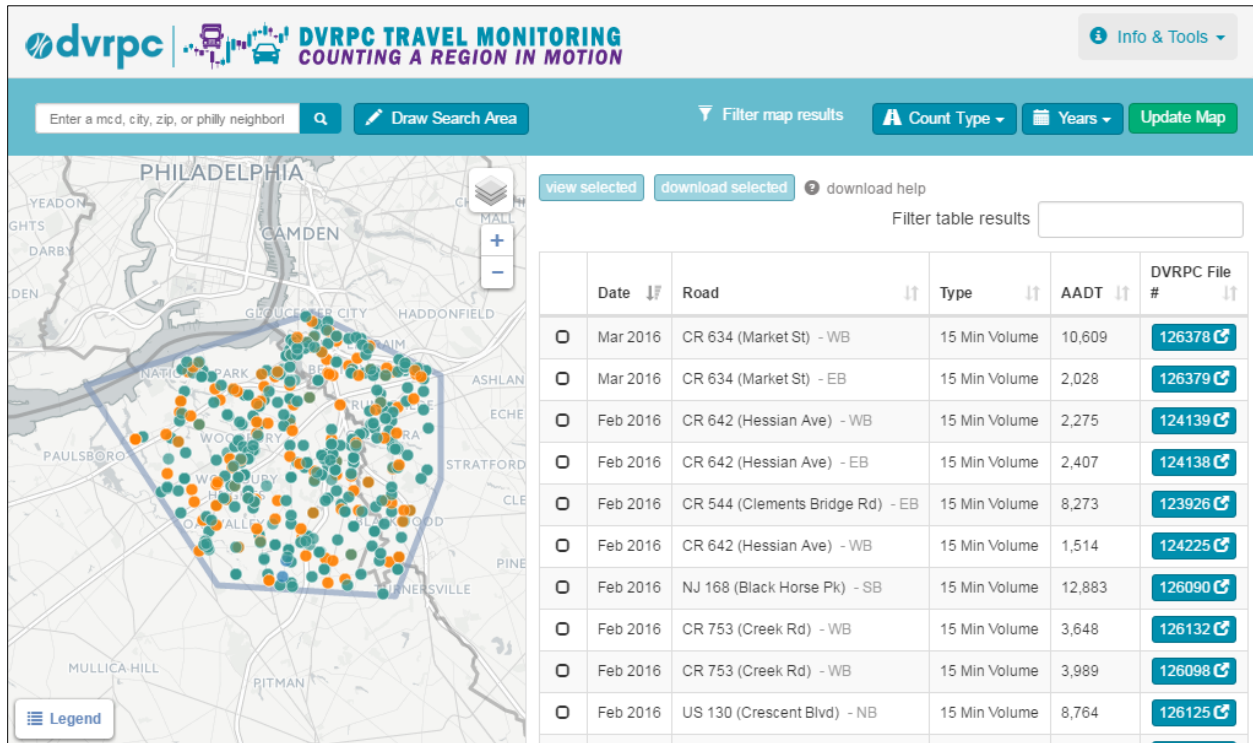
The system displays the counts as color-coded dots based on count type. DVRPC's database contains nine different types of counts, as Figure 4 illustrates.

Figure 4. Available Types of Traffic Counts.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/

By clicking on the legend located at the bottom left of the map, users can see the available types of counts within the selected area. When users hover the mouse pointer over a count, a label shows the name of the road. When users click on a count, the database records are highlighted and placed at the top of the report. The Viewer also offers two filters for selecting specific types of counts (Figure 5) and years of interest (Figure 6).

Figure 5. Count Type Selection.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/
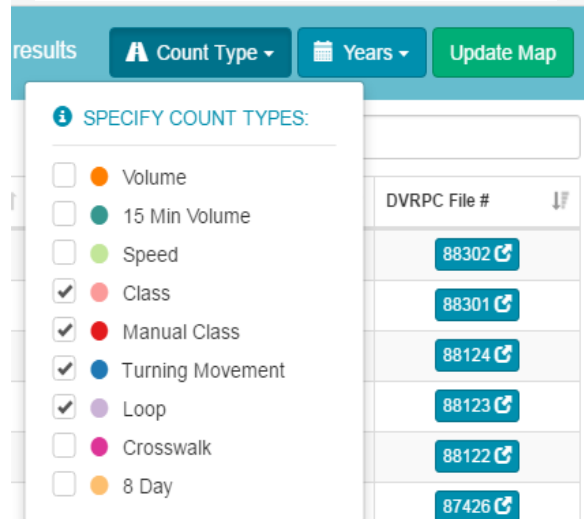
Figure 6. Year Selection.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/
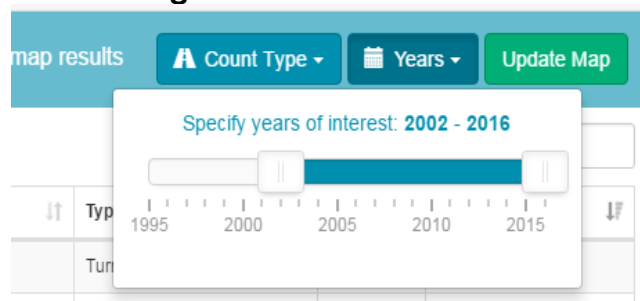
The report shows basic information for each count including its date, road name, count type, annual average daily traffic (AADT) value, and DVRPC file number (Figure 3).

Users can sort the retrieved records by any of these attributes. Further, by checking the boxes in the first column of the report, users can select one or multiple records and download their PDF files, as well as create a zoomed-in view of these records on the map.

Figure 7 shows a sample PDF file that contains data from a traffic volume count. The file includes traffic data aggregated at hourly intervals and shows additional information (for example, weather, speed limit, functional class, station ID, county, travel direction, seasonal adjustment factor, and axle adjustment factor) that may be of interest to users. Figure 8 shows the first page of a PDF file that contains turning movement data from a count taken at the intersection of NJ 47 and Cooper Street in New Jersey.

Figure 7. Example of PDF File (Traffic Volume Count).

DVRPC - Travel Monitoring

TAKEN BY: JH	**DATE:** 9/9/2004	**PROJECT:** 543-310	**STATION ID:**
ROAD: NJ 41 HURFFVILLE RD			**SRI/MP:** 00000041__/2.35
FROM: CR 706 COOPER ST		**TO:** MAYFAIR AVE	
STATE: NJ	**COUNTY:** GLOUCESTER	**MCD:** 3401517710 - DEPTFORD TWP	
COUNT DIR: NORTH	**TRAFFIC DIR:** BOTH	**SPEED LIMIT:** 35	**FC:** 16
DVRPC FILE #: 50366	**COUNTER #:** 241	**WEATHER:** FAIR	**DATA SOURCE:** INTERNAL
COMMENTS:			

Hour Beginning	Wednesday 9/8/2004	Thursday 9/9/2004	Friday 9/10/2004	Saturday 9/11/2004	Sunday 9/12/2004	Monday 9/13/2004	Tuesday 9/14/2004
12 AM		20	33	85	86	31	32
1 AM		18	20	49	47	14	14
2 AM		17	20	33	31	14	18
3 AM		32	26	28	24	33	27
4 AM		57	68	39	30	71	71
5 AM		211	187	82	39	201	202
6 AM		663	592	151	73	613	620
7 AM		876	799	310	177	883	904
8 AM	673	793	660	402	312	684	701
9 AM	651	618	636	586	429	595	616
10 AM	568	571	647	724	647	594	579
11 AM	648	569	673	841	789	623	633
12 PM	687	618	711	885	817	620	
1 PM	674	608	745	758	820	663	
2 PM	580	584	655	801	851	560	
3 PM	562	616	655	779	734	576	
4 PM	613	671	644	740	576	591	
5 PM	560	623	643	658	502	582	
6 PM	628	665	671	622	412	559	
7 PM	569	548	626	553	414	533	
8 PM	420	311	428	427	274	369	
9 PM	210	229	317	291	167	195	
10 PM	137	110	219	199	104	110	
11PM	69	75	174	138	72	63	
Total		10,103					

AXLE CORR. FACTOR:	0.976	**AADT:**	9,308	**AM Peak %:**	8.7	**Hour Beginning:** 7:00 AM
SEASONAL FACTOR:	0.944			**PM Peak %:**	6.6	**Hour Beginning:** 4:00 PM

Source: http://www.dvrpc.org/webmaps/TrafficCounts/

Figure 8. Example of PDF File (Turning Movement Count).

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
OFFICE OF TRAVEL MONITORING

| COUNTY: | GLOUCESTER |
| MUNICIPALITY: | DEPTFORD |

| INTERSECTION: | North-South Street | & | East-West Street |
| STREETS: | NJ 47 | | COOPER ST |

DATE:	1/24/08
DAY:	THURSDAY
WEATHER:	FAIR

FILE NUMBER: 30AM

AM INTERVAL COUNTS

| | NJ 47 | | | | | | | | COOPER ST | | | | | | | | | | |
| STARTING | 1-NORTHBOUND | | | | 2-SOUTHBOUND | | | | 3-EASTBOUND | | | | 4-WESTBOUND | | | | N-S | E-W | |
TIME	L	S	R	TOTAL	L	S	R	TOTAL	L	S	R	TOTAL	L	S	R	TOTAL	TOTAL	TOTAL	TOTAL
6:00 6:15	6	65	4	75	2	18	2	22	9	34	2	45	4	38	16	58	97	103	200
6:15 6:30	7	193	11	211	12	47	9	68	43	70	14	127	9	106	31	146	279	273	552
6:30 6:45	15	224	4	243	16	53	7	76	36	104	11	151	5	148	33	186	319	337	656
6:45 7:00	13	237	17	267	36	47	8	91	51	85	5	141	13	159	30	202	358	343	701
7:00 7:15	8	164	3	175	39	38	2	79	29	63	5	97	8	94	27	129	254	226	480
7:15 7:30	14	120	3	137	17	56	6	79	21	68	2	91	7	131	41	179	216	270	486
7:30 7:45	13	184	9	206	14	123	10	147	43	109	8	160	7	123	34	164	353	324	677
7:45 8:00	6	156	5	167	23	98	6	127	30	57	1	88	9	113	24	146	294	234	528
8:00 8:15	16	118	4	138	22	65	11	98	19	63	2	84	10	105	19	134	236	218	454
8:15 8:30	32	142	12	186	17	87	11	115	21	103	5	129	15	101	21	137	301	266	567
8:30 8:45	22	135	19	176	21	68	7	96	22	76	7	105	11	134	32	177	272	282	554
8:45 9:00	23	181	24	228	20	124	12	156	30	87	7	124	19	105	11	135	384	259	643
TOTALS	175	1919	115	2209	239	824	91	1154	354	919	69	1342	117	1357	319	1793	3363	3135	6498

Source: http://www.dvrpc.org/webmaps/TrafficCounts/

Search Counts by DVRPC File Number

DVRPC assigns a unique number to each PDF file. Users can enter one or multiple DVRPC file numbers in the window shown in Figure 9. After users type the file number(s) of interest, the main page of the Viewer shows the selected counts.

Figure 9. Search Counts by DVRPC File Number.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/

ARCGIS SERVER MAP SERVICE

As the bottom right of Figure 2 illustrates, DVRPC offers open access to its ArcGIS server as a map service. When a user selects this option, a new window (Figure 10) appears that includes two URL links.

The first link provides access to DVRPC's ArcGIS server (an ESRI product) map services that include several transportation and non-transportation feature layers and tables (see Figure 11). The server provides these features in different formats that are compatible with various GIS platforms. One of the tables contains all short-duration counts. Depending on the count type, the map service provides some data in an aggregate form. However, DVRPC stores and maintains disaggregated data in its database and offers them to interested parties by request.

The second link provides access to the Representational State Transfer (REST) API of DVRPC's traffic counts. DVRPC provides the API mainly for developers and advanced users who are interested in more detailed technical information (for example, metadata) of each feature.

Figure 10. ArcGIS Server Map Services.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/

DVRPC uses two geographic reference systems to map each count on the transportation network. The first includes the geographic coordinates (latitude and longitude) of each count. The second reference system depends on whether a count is located on Pennsylvania or New Jersey's roadway network. For the Pennsylvania counts, DVRPC measures the offset from the beginning of a state route segment—for example, PA State Route 21, Segment 100, offset 1250 ft. For the New Jersey counts, DVRPC uses a state route identifier and a milepoint measured from the beginning of the route—for example, NJ State Route 21, milepoint 23.68 miles. Most local roads are included in the states' linear referencing system (LRS).

Figure 11. Feature Layers and Tables.

Source: http://www.dvrpc.org/webmaps/TrafficCounts/
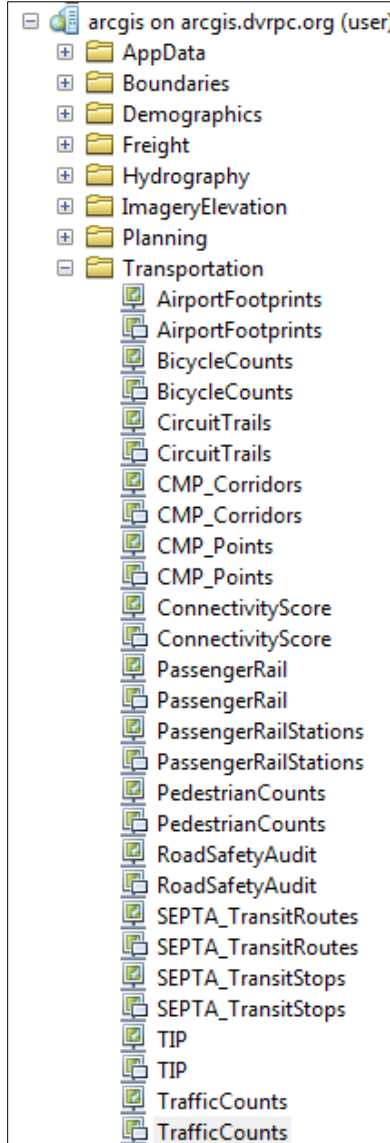
OTHER TRAFFIC DATA TYPES

In addition to Traffic Count Viewer, DVRPC has developed other web applications that show the following types of count data:

- Permanent pedestrian and bicycle counters. An interactive map (Figure 12) displays data from permanent bicycle and pedestrian counters that DVRPC operates. Trail use counters, located on circuit trails throughout the region, record use by direction and mode (walking versus bicycling) continuously throughout the year. This map provides a

snapshot of the data in a simple, user-friendly format, allowing users to explore counts from throughout the region.
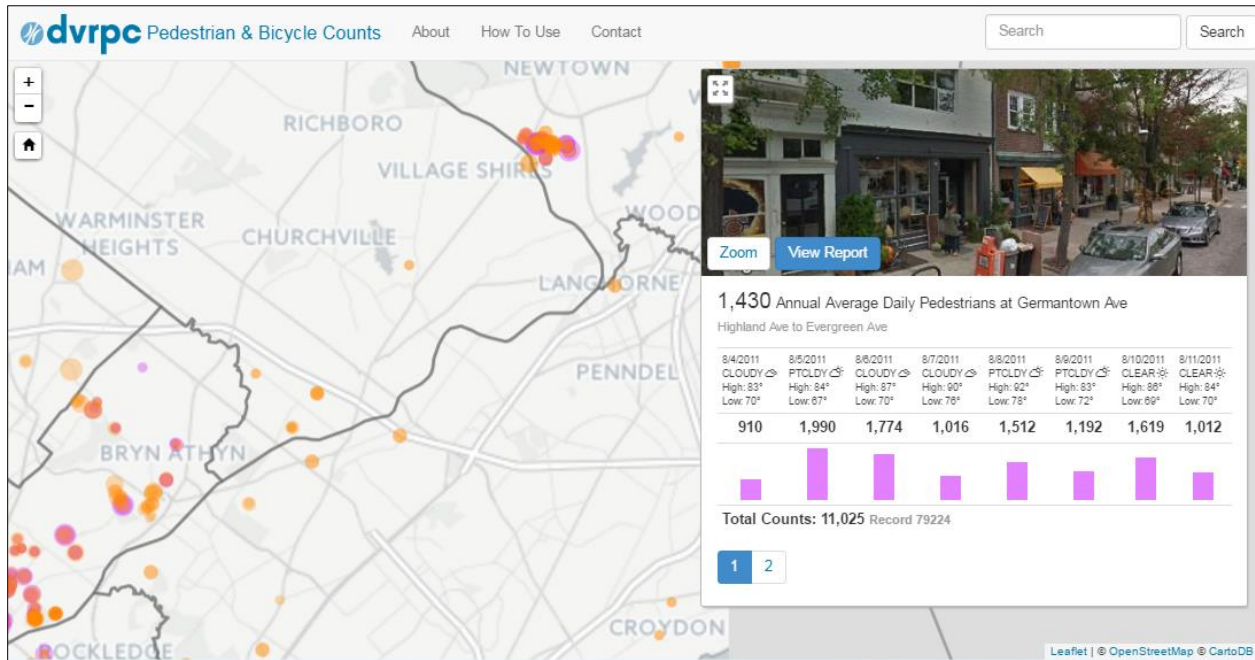
Figure 12. Permanent Bicycle and Pedestrian Counters.

Source: http://www.dvrpc.org/webmaps/PermBikePed/
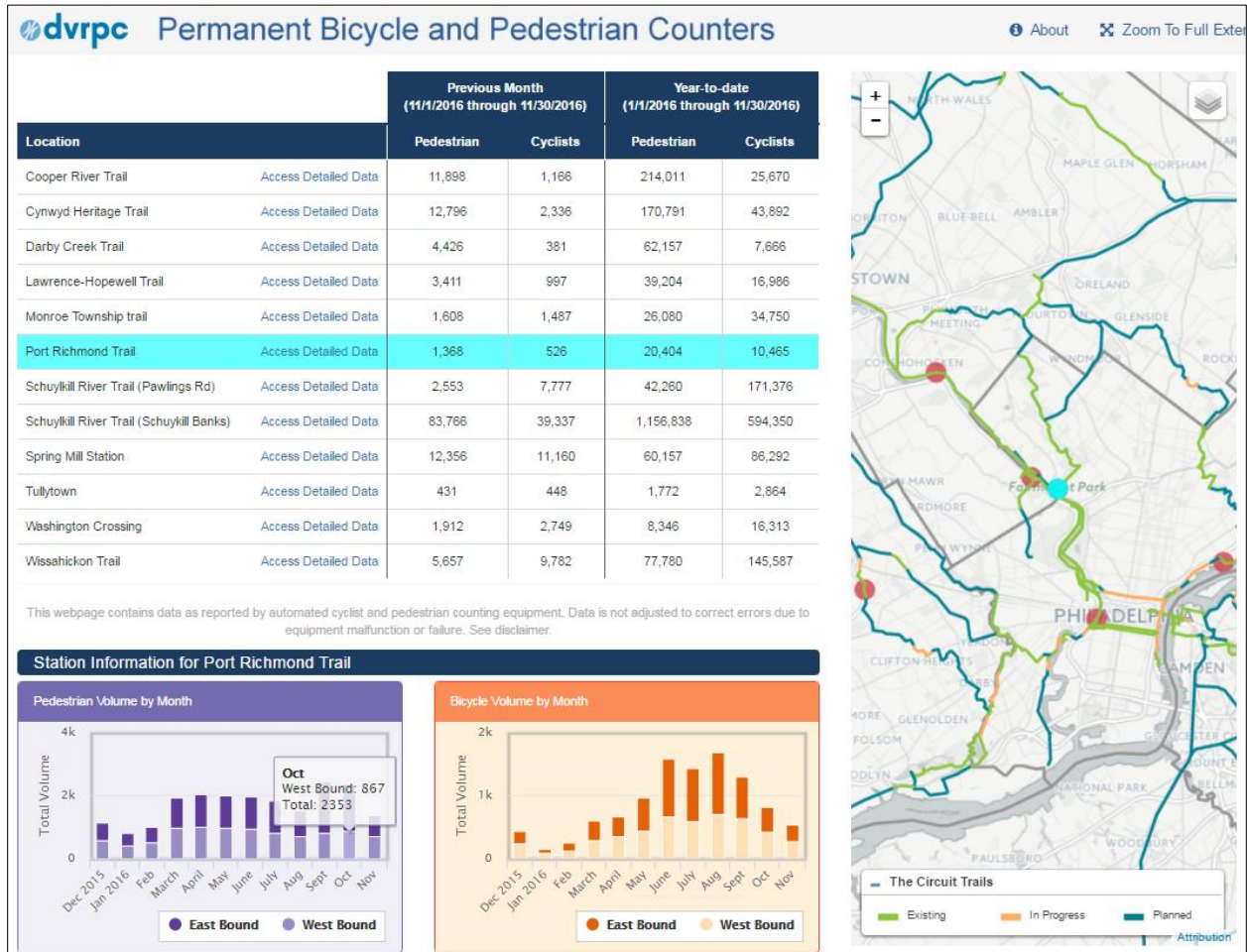
- Short-duration pedestrian and bicycle counts. An interactive map (Figure 13) displays short-duration pedestrian and bicycle count data within and surrounding the DVRPC region. Users can review detailed hourly reports, location information, and daily estimates of pedestrian and bicycle traffic at select locations. DVRPC provides the data as a public service.

Figure 13. Short-Duration Pedestrian and Bicycle Counts.

Source: http://www.dvrpc.org/webmaps/PermBikePed/

- Permanent bicycle and pedestrian station data. A PDF report (Figure 14) shows total annual volumes of pedestrian and bicycle traffic on the most used trails, where permanent counters exist.

Figure 14. Permanent Bicycle and Pedestrian Station Data.

Source: http://www.dvrpc.org/webmaps/PermBikePed/
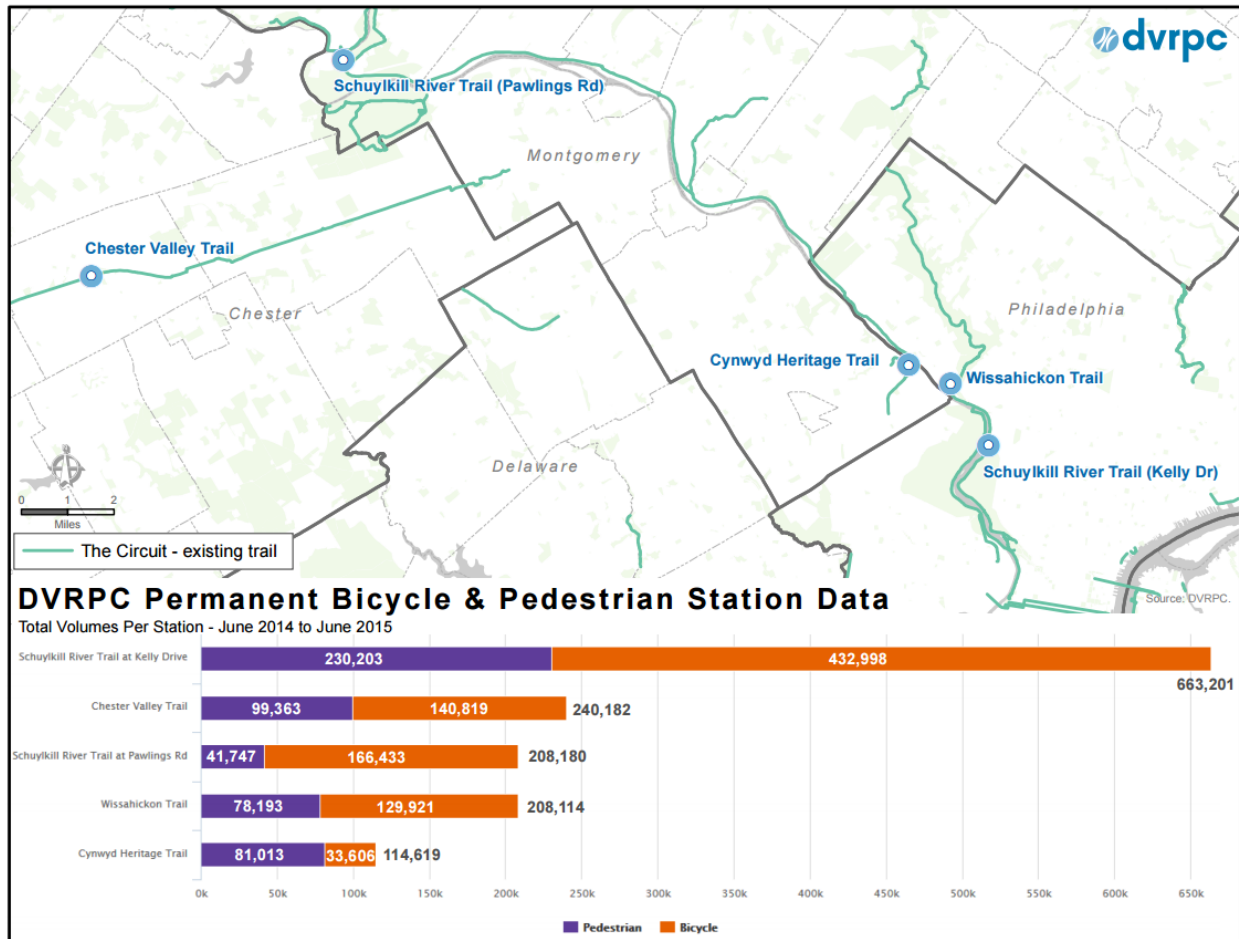
APPLICABILITY TO OTHER AGENCIES

DVRPC is innovative, creative, and proactive when it comes to implementing new strategies. This practice is part of DVRPC's culture and accompanies its strategy of coordinating with business areas and information technology to incorporate user needs and ideas when developing data and information systems. DVRPC's ideas, strategies, and lessons learned from its data collection program and its use of various web-based tools, including Traffic Count Viewer, can benefit other stakeholders. Lessons learned regarding traffic data collection, data sharing, and web development include the following:

- Consider ways to collect data once with elements that meet the evolving needs of different users.

- Try to gather traffic data from various sources and create a central data repository while making sure the data meet the needs of as many users and agency functions as possible.

- Consider using open-source code and data libraries to develop tools that can have multiple end-users within and outside the organization.

- Try to have people with a background in GIS and database administration, which can benefit tool development and implementation.

- Inform managers and executives on cost savings and other benefits achieved through more-efficient processes.

- Foster people's willingness to change existing systems and business practices, learn how to use new technologies, and adapt to new, fast-evolving environments.

- Seek to have the right people in the room, which helps with decision-making.

- Involve all data users from various business areas and consider the needs and preferences of different agency functions. This helps secure broad buy-in and support.

- Relate the costs for data collection and management to the hidden cost of not having data or a data warehouse.

DVRPC plans to continue improving Traffic Count Viewer, considering its increased popularity with and positive feedback from users. One of the improvements will be to expand functionality to allow New Jersey DOT, Pennsylvania DOT, and local governments to request new count data through the Viewer and track the status of each request. Users will be able to select the location of a new count on a map and indicate the desired type of count (for example, total volume or classification count). The Viewer will provide users with the estimated cost of each count by considering the time, resources, and equipment needed. It will also allow users to save and edit project requests by adding and removing counts, as well as to track the status of each

count (in other words, pending, processing, or completed) over time. Once DVRPC staff accepts a request, the system will notify field personnel to take a count at the location requested.

In addition, DVRPC staff is considering adding new advanced search options such as searching traffic counts by address and intersection. The staff is also examining the need to allow users to upload counts directly through the Viewer. Other agencies can benefit from DVRPC's example of gathering and archiving data from various sources and developing open-source code applications and modern visualization tools to promote data sharing, reduce data collection costs, improve data collection efficiency, and improve collaboration with other agencies.

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