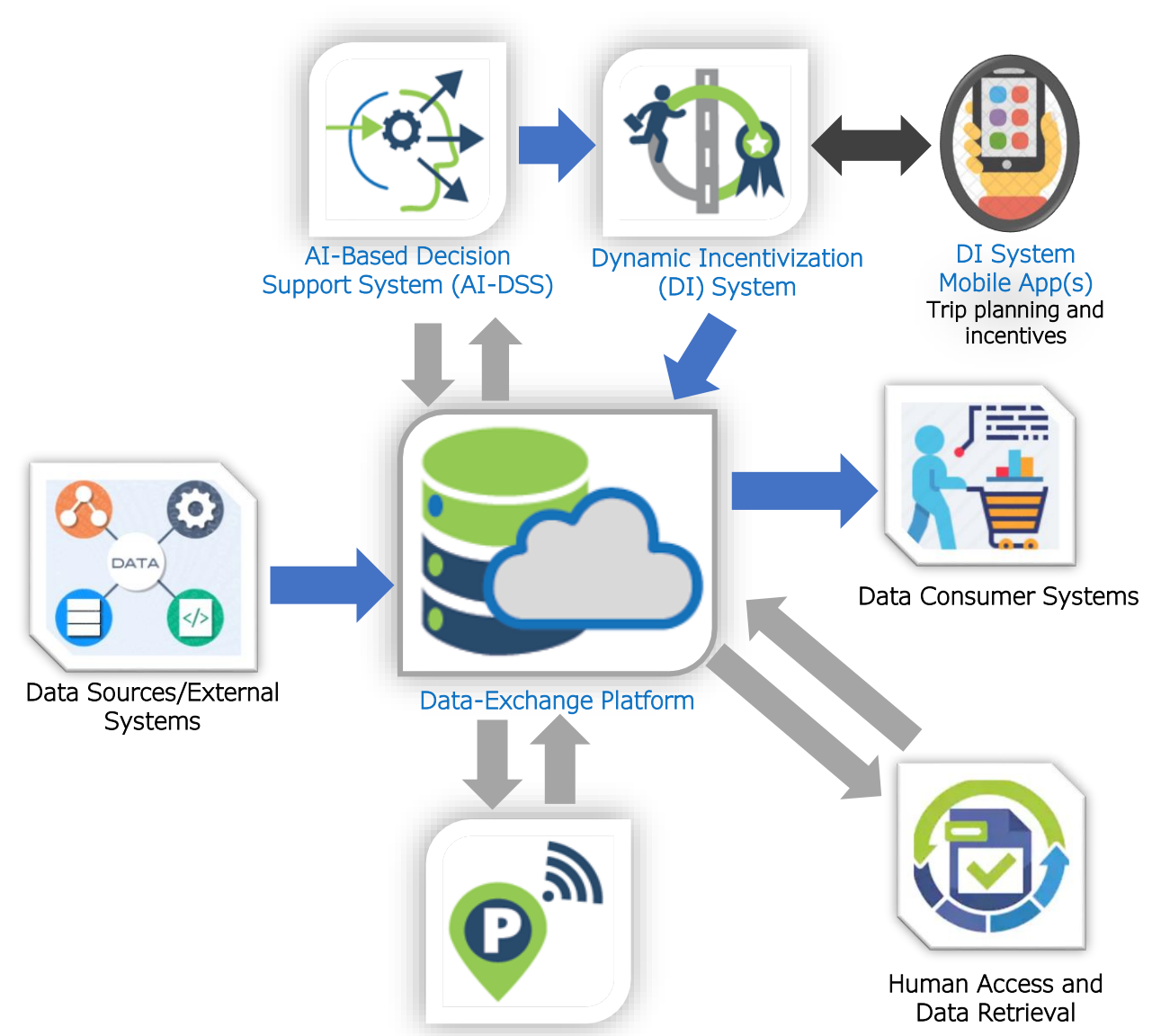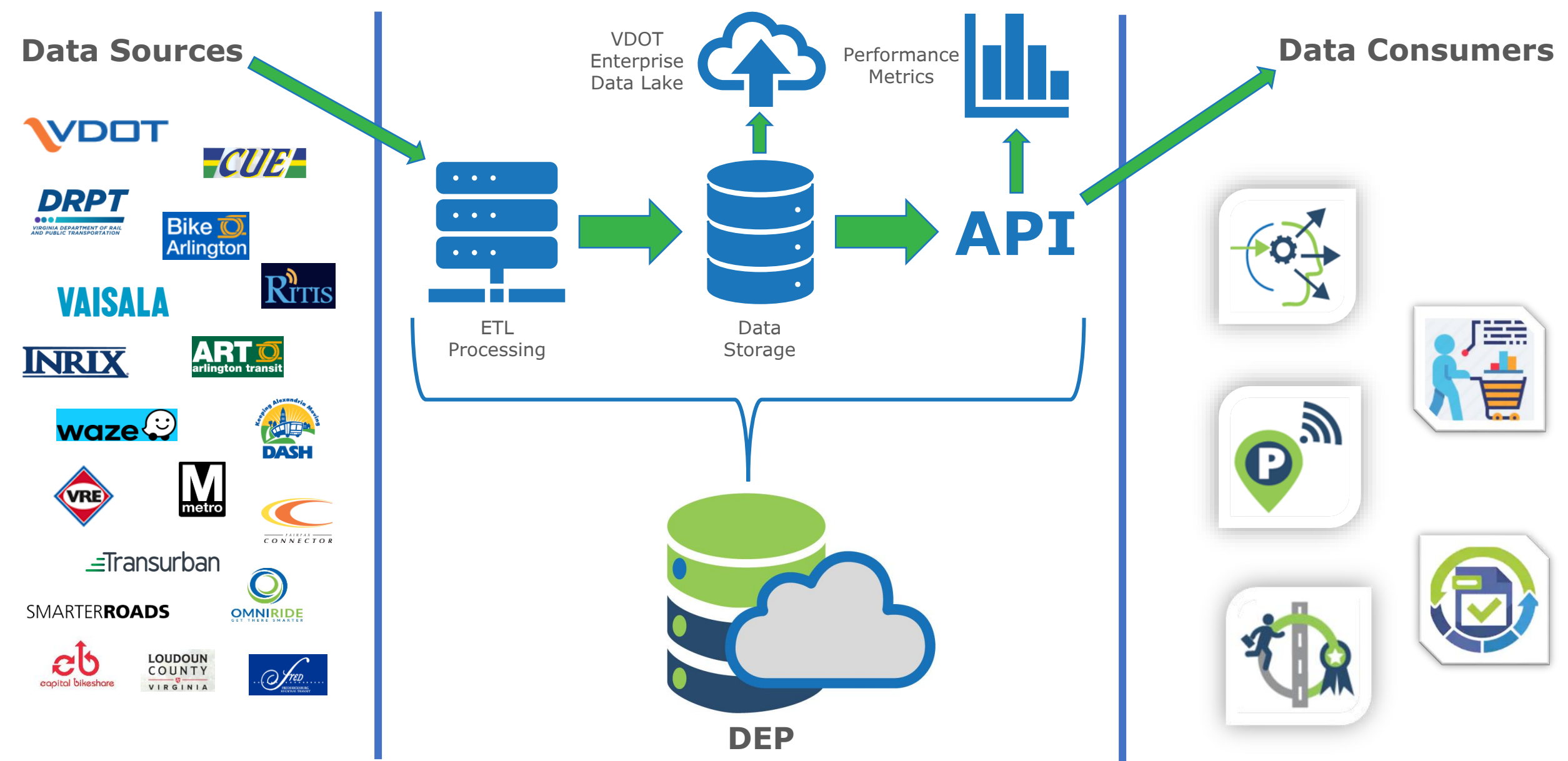# DEP Background

- Data-Exchange Platform (DEP) is RM3P's data ingestion, data consolidation, data storage and data distribution system.

- Interfaces with all other RM3P systems to provide and receive data.

- Interfaces with other Data Consumers to provide RM3P data

AI-Based Decision Support System (AI-DSS)

Dynamic Incentivization (DI) System

DI System Mobile App(s)
Trip planning and incentives

Data Sources/External Systems

Data-Exchange Platform

Data Consumer Systems

Human Access and Data Retrieval

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DEP High Level Architecture

Data Sources

Data Consumers

VDOT Enterprise Data Lake

Performance Metrics

ETL Processing

Data Storage

API

DEP

What is DEP?

✓ Expandable data ingestion system.

✓ Automated data consolidation and storage system.

✓ Powerful API for real-time and near real-time data distribution.

✓ Core data exchange platform supporting all other RM3P systems.

DEP

What DEP Isn't?

X It is not an analytical tool.

✓ Try RITIS Analytics Tools or upcoming AI-DSS analytical capabilities for operators

X It is not designed for mega project download.

✓ Try RITIS Event Query Tool, Detector Tools & PDA Massive Data Downloader.

X It is not designed for users to open files using common MS Office suites such as Excel.

✓ Developers need to understand and integrate API with existing software. Coding knowledge is helpful.

X It is not a document storage system.

✓ But there are documents explaining about the data

X Not all data is available to all.

✓ Some data has license constraints or sharing limitation based on data source owners' instructions.

Who may Access DEP and When?

Now ▶▶ *RM3P Procurement Awards* ▶▶ *After All RM3P Procurement Ends*

- VDOT Users

- Affiliate Agency Users (federal, state, regional and local public transportation agencies)

- AI-DSS Vendors upon award

- DI Vendors upon award
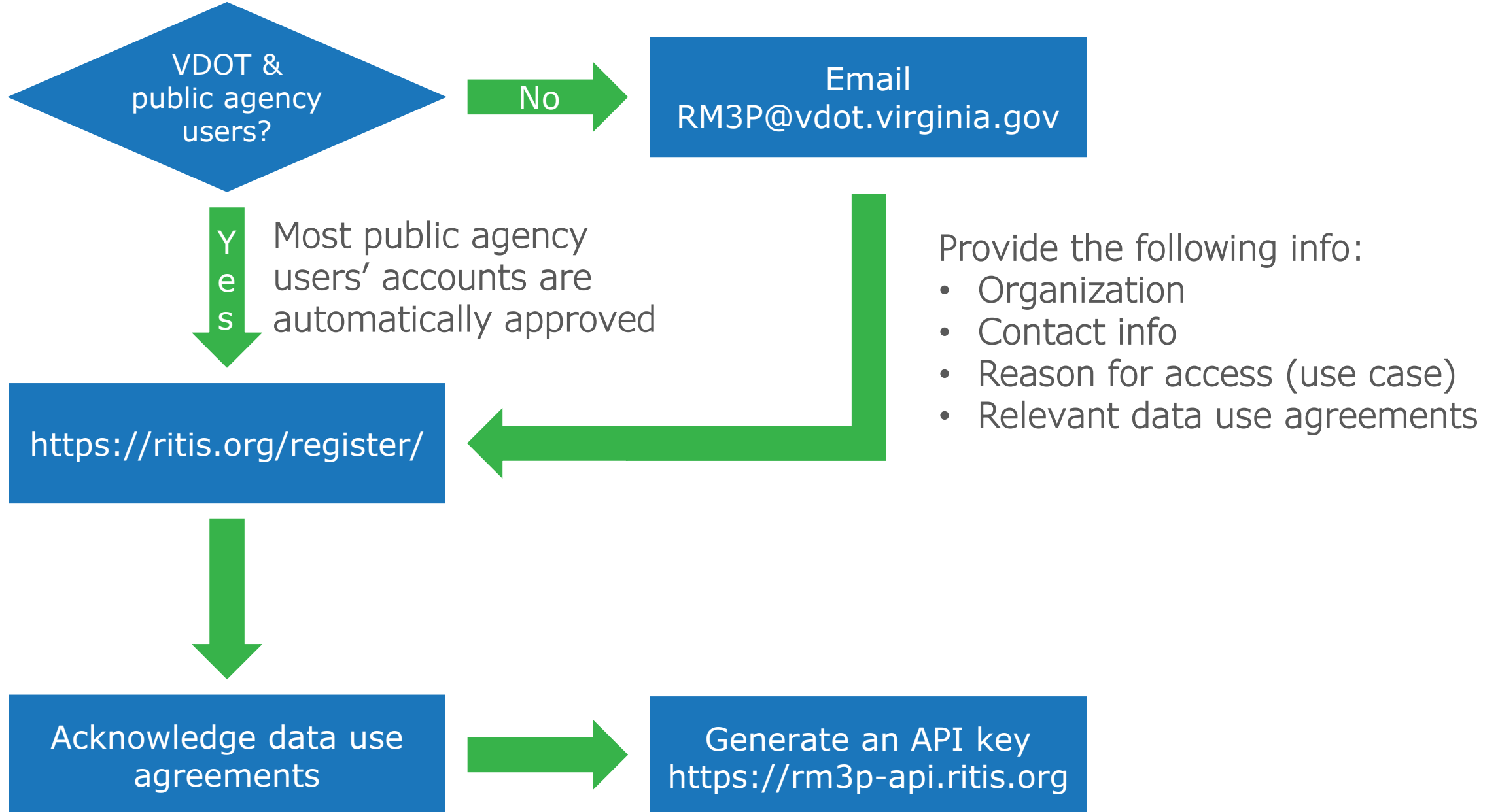
- Smart Parking Vendors upon award

- RM3P Targeted 3rd Party Vendors

- Contractors that use data from DEP to benefit VDOT's projects with proven use case

- Contractors that use data from DEP to benefit affiliate agencies' projects with proven use case

- Other App developers with proven use case

- University research personnel with proven use case

Support Public Agencies | **Support RM3P** | **Support repackaging of pertinent data for delivery to travelers. Support researchers and planners**

How to get access to DEP

VDOT & public agency users?

No → Email RM3P@vdot.virginia.gov

Yes — Most public agency users' accounts are automatically approved

Provide the following info:
- Organization
- Contact info
- Reason for access (use case)
- Relevant data use agreements

https://ritis.org/register/

Acknowledge data use agreements → Generate an API key https://rm3p-api.ritis.org

DEP API Reference Documentation

DEP Reference Page
https://rm3p-api.ritis.org/rm3p/reference

API Key

RM3P Data Exchange Portal API Reference

1.1. Authentication

RM3P Data Exchange Portal is restricted to authorized users. You are logged in as ▮▮▮▮▮▮▮▮. Your API Key is ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮.

To authenticate GET requests, add a parameter `api-key` with your API key as the value:

```
https://rm3p-api.ritis.org/rm3p/event/?api-key=your_api_key
```

To authenticate POST requests, add an HTTP header `X-RITIS-Filter-API-Key` with your API key as the value:

```
POST /event HTTP/1.1
Host: https://rm3p-api.ritis.
X-RITIS-Filter-API-Key: your_api_key
```

If you need an additional API key for your system, please email us at dep-support@ritis.org.

RM3P DEP Use Case Scenario

Goal: Monitor the real-time traffic conditions, detect anomalies, and recommend actions based on available options.

Steps:

1. **Train an AI model**
2. **Monitor real-time conditions**
3. **Detect and verify anomalies**
4. **Suggest options**
5. **Implement response**
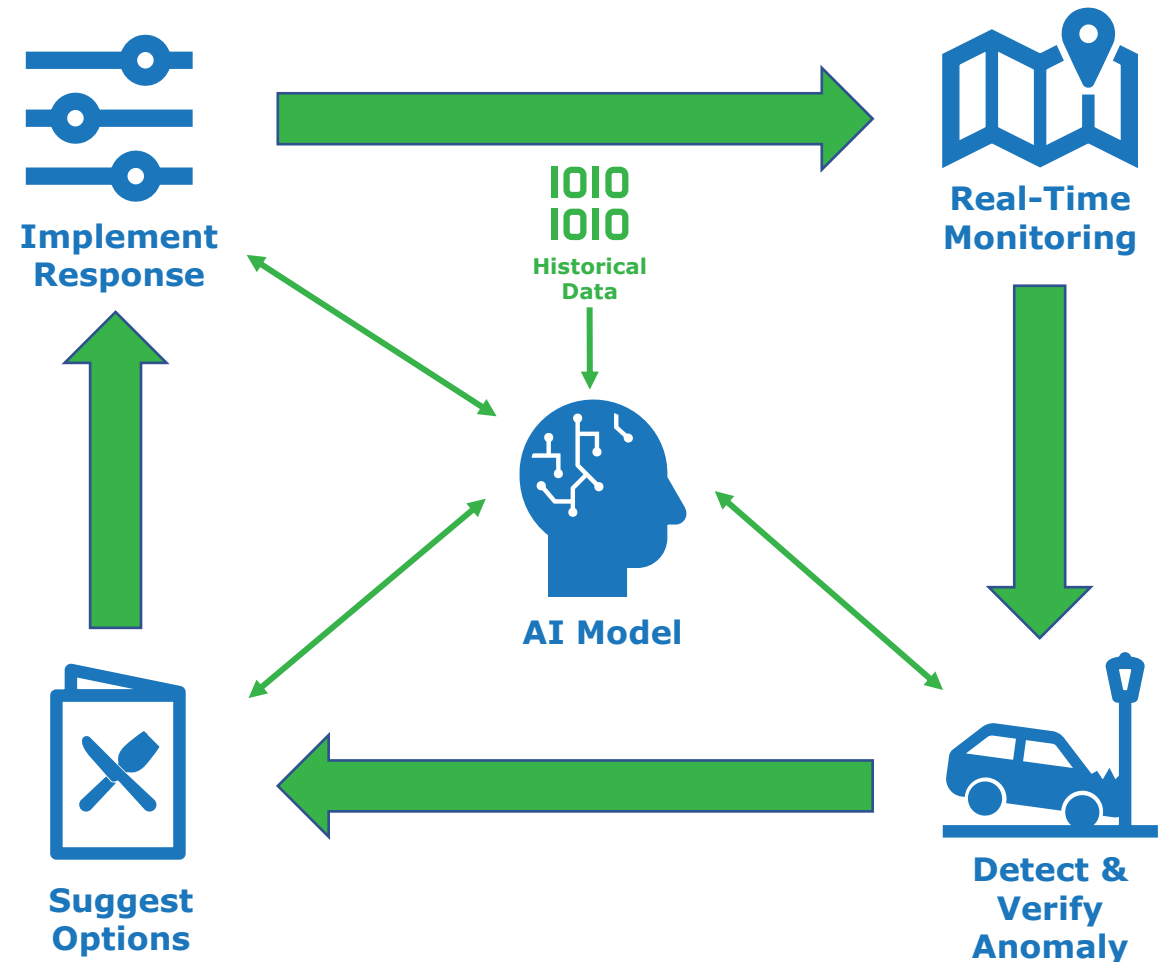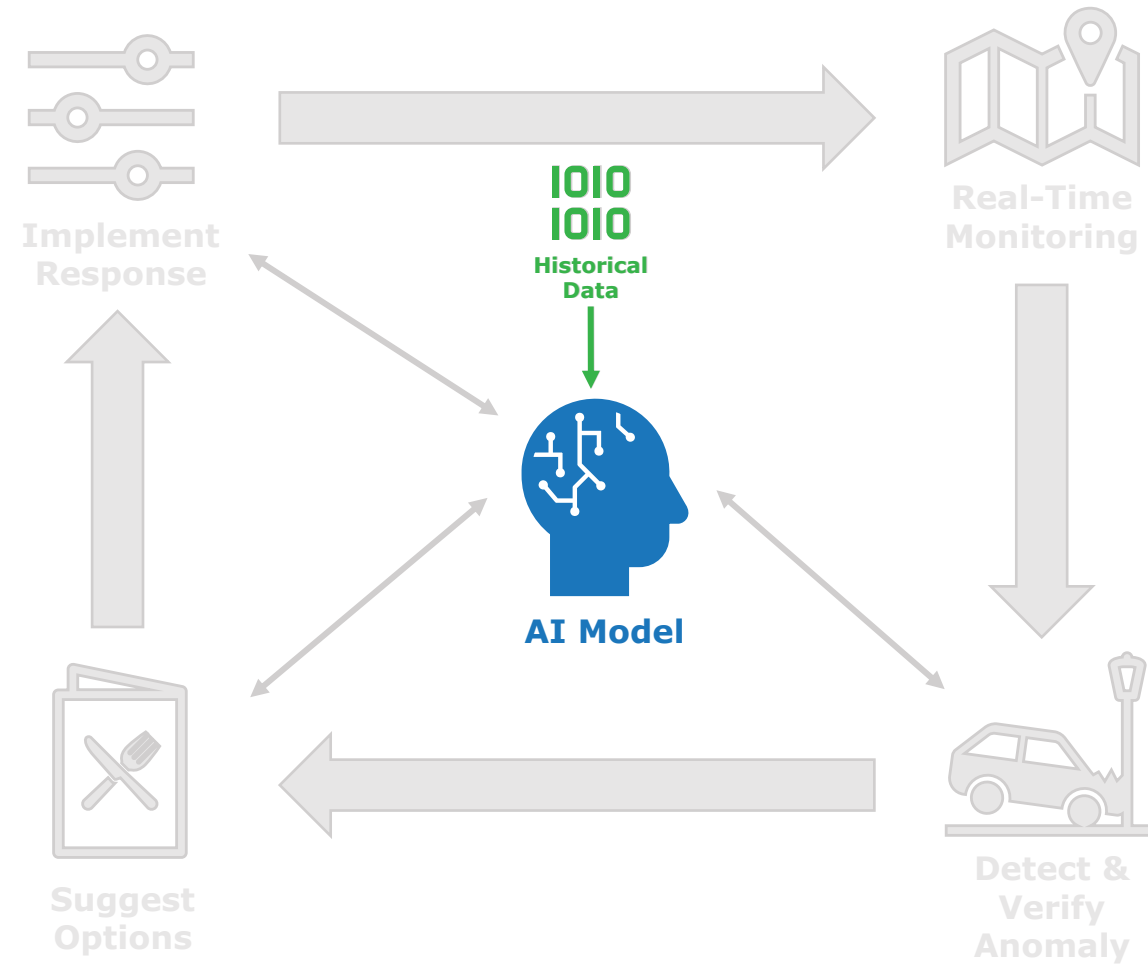
Let's collect historical data in the region

Data sets of interest:

- **Incident and event data**

- **Traffic detector data**

- **Probe vehicle data**

- **Weather station data**

DEP API is intended to serve near real-time data.

- Obtaining large archived data sets can be done several different ways:
  - VDOT's Enterprise Data Lake
  - RITIS Archive Tools
    - PDA Massive Data Downloader
    - Event Query Tool
    - Detector Tools
    - etc.
  - Custom data requests to **dep-support@ritis.org**
  - DEP API limited historical searching

There are two API request types in DEP:

1. **GET request**
2. **POST request**

NE

SW

GET request:

https://rm3p-api.ritis.org/rm3p/event/?system=vdot&road=I-95&sw-lat=38.693348&sw-lon=-77.241247&ne-lat=38.782900&ne-lon=-77.169343&start-time-min=2021-10-01&start-time-max=2021-11-01
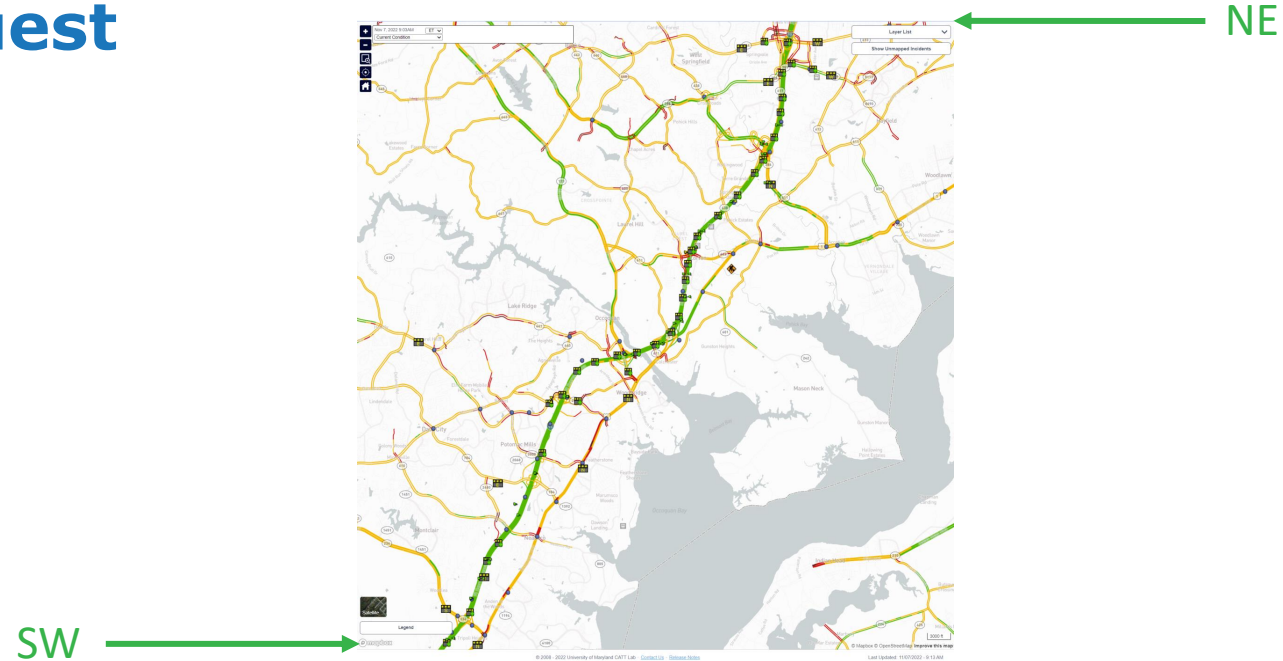
Requesting Historical Incident and Event Data (POST)

There are two ways to request

data in DEP:

1. **GET request**

2. **POST request**

POST request:

```xml
<event-filter xmlns="http://www.ritis.org/schema/filter">
    <systems>
        <system>vdot</system>
    </systems>
    <location-filters>
        <road-filters>
            <road>I-95</road>
        </road-filters>
        <lat-lon-box-filter>
            <sw-lat>38.693348</sw-lat>
            <sw-lon>-77.241247</sw-lon>
            <ne-lat>38.782900</ne-lat>
            <ne-lon>-77.169343</ne-lon>
        </lat-lon-box-filter>
    </location-filters>
    <time-filters>
        <start-time>
            <start>2021-10-01</start>
            <end>2021-11-01</end>
        </start-time>
    </time-filters>
</event-filter>
```

Incident and Event Data Response

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:advisoryInformation xmlns:ns2="https://filter.ritis.org/reference/schema/atis_tmdd/ATIS.xsd">
    <messageHeader>
        <sender>
            <agencyName>RITIS</agencyName>
        </sender>
        <messageID>0</messageID>
        <timeStamp>2022-11-07T10:02:02.088-05:00</timeStamp>
        <msgCount>0</msgCount>
        <localMessageHeader>
            <totalEvents>233</totalEvents>
            <filteredEvents>0</filteredEvents>
        </localMessageHeader>
    </messageHeader>
    <responseGroup>
        <incident>
            <head>
                <id>VDOT_INN04064362-10012021</id>
                <charSet>utf8</charSet>
                <issuingAgency>VADOT</issuingAgency>
                <updateTime>2021-10-01T10:53:21-04:00</updateTime>
            </head>
            <location>
                <locationName>I-95S south @ MM 164.000</locationName>
                <pointLocation>
                    <crossStreetsPoint>
                        <onStreetInfo>
                            <prefix>I</prefix>
                            <name>95</name>
                        </onStreetInfo>
                        <atStreetInfo>
                            <prefix>MP</prefix>
                            <name>164.00</name>
                        </atStreetInfo>
                        <geoLocation>
                            <latitude>38696983</latitude>
                            <longitude>-77225966</longitude>
                        </geoLocation>
                        <direction>south</direction>
                        <adminAreas>
                            <county>Fairfax (County)</county>
                            <state>Virginia</state>
                        </adminAreas>
                    </crossStreetsPoint>
                    <adminArea>
                        <county>Fairfax (County)</county>
                        <state>Virginia</state>
                    </adminArea>
                </pointLocation>
            </location>
            <typeEvent>
                <accidentsAndIncidents>disabled vehicle</accidentsAndIncidents>
            </typeEvent>
            <description>
                <text>2021-10-01 06:34:00-04 Motorists was using the phone, shoulder is clear. SSP 933 is clear.</text>
                <text>2021-10-01 06:32:00-04 SSP 933 has detected a disabled vehicle blocking the right shoulder.</text>
            </description>
```

```xml
<messageHeader>
    <sender>
        <agencyName>RITIS</agencyName>
    </sender>
    <messageID>0</messageID>
    <timeStamp>2022-11-07T09:33:45.623-05:00</timeStamp>
    <msgCount>0</msgCount>
    <localMessageHeader>
        <totalEvents>233</totalEvents>
        <filteredEvents>0</filteredEvents>
    </localMessageHeader>
</messageHeader>
```

Total number of events returned in response

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:advisoryInformation xmlns:ns2="https://filter.ritis.org/reference/schema/atis_tmdd/ATIS.xsd">
    <messageHeader>
        <sender>
            <agencyName>RITIS</agencyName>
        </sender>
        <messageID>0</messageID>
        <timeStamp>2022-11-07T10:02:02.088-05:00</timeStamp>
        <msgCount>0</msgCount>
        <localMessageHeader>
            <totalEvents>233</totalEvents>
            <filteredEvents>0</filteredEvents>
        </localMessageHeader>
    </messageHeader>
    <responseGroup>
        <incident>
            <head>
                <id>VDOT_INNO4064362-10012021</id>
                <charSet>utf8</charSet>
                <issuingAgency>VADOT</issuingAgency>
                <updateTime>2021-10-01T10:53:21-04:00</updateTime>
            </head>
            <location>
                <locationName>I-95S south @ MM 164.000</locationName>
                <pointLocation>
                    <crossStreetsPoint>
                        <onStreetInfo>
                            <prefix>I</prefix>
                            <name>95</name>
                        </onStreetInfo>
                        <atStreetInfo>
                            <prefix>MP</prefix>
                            <name>164.00</name>
                        </atStreetInfo>
                        <geoLocation>
                            <latitude>38696983</latitude>
                            <longitude>-77225966</longitude>
                        </geoLocation>
                        <direction>south</direction>
                        <adminAreas>
                            <county>Fairfax (County)</county>
                            <state>Virginia</state>
                        </adminAreas>
                    </crossStreetsPoint>
                    <adminArea>
                        <county>Fairfax (County)</county>
                        <state>Virginia</state>
                    </adminArea>
                </pointLocation>
            </location>
            <typeEvent>
                <accidentsAndIncidents>disabled vehicle</accidentsAndIncidents>
            </typeEvent>
            <description>
                <text>2021-10-01 06:34:00-04 Motorists was using the phone, shoulder is clear. SSP 933 is clear.</text>
                <text>2021-10-01 06:32:00-04 SSP 933 has detected a disabled vehicle blocking the right shoulder.</text>
            </description>
```

Enlarged detail:

```xml
<head>
    <id>VDOT_INNO4064362-10012021</id>
    <charSet>utf8</charSet>
    <issuingAgency>VADOT</issuingAgency>
    <updateTime>2021-10-01T10:53:21-04:00</updateTime>
</head>
```

Event ID

Updated time

37

Incident and Event Data Response (continued)

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:advisoryInformation xmlns:ns2="https://filter.ritis.org/reference/schema/atis_tmdd/ATIS.xsd">
    <messageHeader>
        <sender>
            <agencyName>RITIS</agencyName>
        </sender>
        <messageID>0</messageID>
        <timeStamp>2022-11-07T10:02:02.088-05:00</timeStamp>
        <msgCount>0</msgCount>
        <localMessageHeader>
            <totalEvents>233</totalEvents>
            <filteredEvents>0</filteredEvents>
        </localMessageHeader>
    </messageHeader>
    <responseGroup>
        <incident>
            <head>
                <id>VDOT_INN04064362-10012021</id>
                <charSet>utf8</charSet>
                <issuingAgency>VADOT</issuingAgency>
                <updateTime>2021-10-01T10:53:21-04:00</updateTime>
            </head>
            <location>
                <locationName>I-95S south @ MM 164.000</locationName>
                <pointLocation>
                    <crossStreetsPoint>
                        <onStreetInfo>
                            <prefix>I</prefix>
                            <name>95</name>
                        </onStreetInfo>
                        <atStreetInfo>
                            <prefix>MP</prefix>
                            <name>164.00</name>
                        </atStreetInfo>
                        <geoLocation>
                            <latitude>38696983</latitude>
                            <longitude>-77225966</longitude>
                        </geoLocation>
                        <direction>south</direction>
                        <adminAreas>
                            <county>Fairfax (County)</county>
                            <state>Virginia</state>
                        </adminAreas>
                    </crossStreetsPoint>
                    <adminArea>
                        <county>Fairfax (County)</county>
                        <state>Virginia</state>
                    </adminArea>
                </pointLocation>
            </location>
            <typeEvent>
                <accidentsAndIncidents>disabled vehicle</accidentsAndIncidents>
            </typeEvent>
            <description>
                <text>2021-10-01 06:34:00-04 Motorists was using the phone, shoulder is clear. SSP 933 is clear.</text>
                <text>2021-10-01 06:32:00-04 SSP 933 has detected a disabled vehicle blocking the right shoulder.</text>
            </description>
```

```xml
<location>
    <locationName>I-95S south @ MM 164.000</locationName>
    <pointLocation>
        <crossStreetsPoint>
            <onStreetInfo>
                <prefix>I</prefix>
                <name>95</name>
            </onStreetInfo>
            <atStreetInfo>
                <prefix>MP</prefix>
                <name>164.00</name>
            </atStreetInfo>
            <geoLocation>
                <latitude>38696983</latitude>
                <longitude>-77225966</longitude>
            </geoLocation>
            <direction>south</direction>
            <adminAreas>
                <county>Fairfax (County)</county>
                <state>Virginia</state>
            </adminAreas>
        </crossStreetsPoint>
        <adminArea>
            <county>Fairfax (County)</county>
            <state>Virginia</state>
        </adminArea>
    </pointLocation>
</location>
```
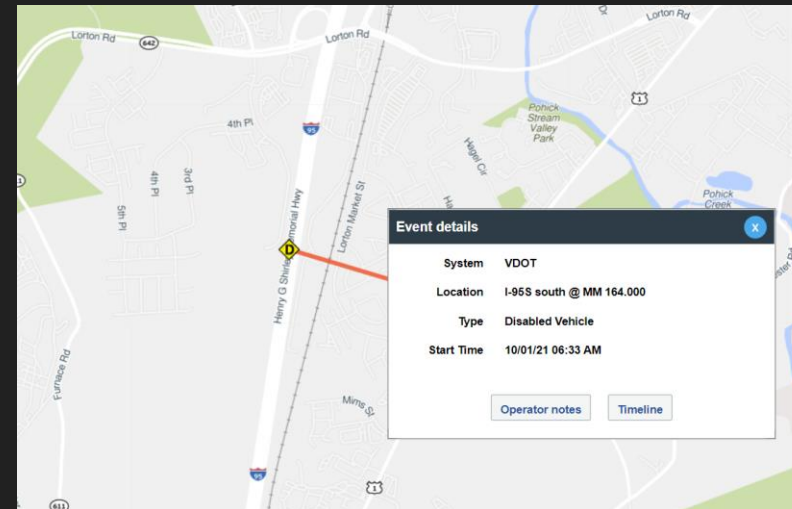
Location name

Latitude and Longitude

38

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:advisoryInformation xmlns:ns2="https://filter.ritis.org/reference/schema/atis_tmdd/ATIS.xsd">
    <messageHeader>
        <sender>
            <agencyName>RITIS</agencyName>
        </sender>
        <messageID>0</messageID>
        <timeStamp>2022-11-07T10:02:02.088-05:00</timeStamp>
        <msgCount>0</msgCount>
        <localMessageHeader>
            <totalEvents>233</totalEvents>
            <filteredEvents>0</filteredEvents>
        </localMessageHeader>
    </messageHeader>
    <responseGroup>
        <incident>
            <head>
                <id>VDOT_INN04064362-10012021</id>
                <charSet>utf8</charSet>
                <issuingAgency>VADOT</issuingAgency>
                <updateTime>2021-10-01T10:53:21-04:00</updateTime>
            </head>
            <location>
                <locationName>I-95S south @ MM 164.000</locationName>
                <pointLocation>
                    <crossStreetsPoint>
                        <onStreetInfo>
                            <prefix>I</prefix>
                            <name>95</name>
                        </onStreetInfo>
                        <atStreetInfo>
                            <prefix>MP</prefix>
                            <name>164.00</name>
                        </atStreetInfo>
                        <geoLocation>
                            <latitude>38696983</latitude>
                            <longitude>-77225966</longitude>
                        </geoLocation>
                        <direction>south</direction>
                        <adminAreas>
                            <county>Fairfax (County)</county>
                            <state>Virginia</state>
                        </adminAreas>
                    </crossStreetsPoint>
                    <adminArea>
                        <county>Fairfax (County)</county>
                        <state>Virginia</state>
                    </adminArea>
                </pointLocation>
            </location>
            <typeEvent>
                <accidentsAndIncidents>disabled vehicle</accidentsAndIncidents>
            </typeEvent>
            <description>
                <text>2021-10-01 06:34:00-04 Motorists was using the phone, shoulder is clear. SSP 933 is clear.</text>
                <text>2021-10-01 06:32:00-04 SSP 933 has detected a disabled vehicle blocking the right shoulder.</text>
            </description>
```


Event type

```xml
<typeEvent>
    <accidentsAndIncidents>disabled vehicle</accidentsAndIncidents>
</typeEvent>
```

Incident and Event Data Response (continued)

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:advisoryInformation xmlns:ns2="https://filter.ritis.org/reference/schema/atis_tmdd/ATIS.xsd">
    <messageHeader>
        <sender>
            <agencyName>RITIS</agencyName>
        </sender>
        <messageID>0</messageID>
        <timeStamp>2022-11-07T10:02:02.088-05:00</timeStamp>
        <msgCount>0</msgCount>
        <localMessageHeader>
            <totalEvents>233</totalEvents>
            <filteredEvents>0</filteredEvents>
        </localMessageHeader>
    </messageHeader>
    <responseGroup>
        <incident>
            <head>
                <id>VDOT_INNO4064362-10012021</id>
                <charSet>utf8</charSet>
                <issuingAgency>VADOT</issuingAgency>
                <updateTime>2021-10-01T10:53:21-04:00</updateTime>
            </head>
            <location>
                <locationName>I-95S south @ MM 164.000</locationName>
                <pointLocation>
                    <crossStreetsPoint>
                        <onStreetInfo>
                            <prefix>I</prefix>
                            <name>95</name>
                        </onStreetInfo>
                        <atStreetInfo>
                            <prefix>MP</prefix>
                            <name>164.00</name>
                        </atStreetInfo>
                        <geoLocation>
                            <latitude>38696983</latitude>
                            <longitude>-77225966</longitude>
                        </geoLocation>
                        <direction>south</direction>
                        <adminAreas>
                            <county>Fairfax (County)</county>
                            <state>Virginia</state>
                        </adminAreas>
                    </crossStreetsPoint>
                    <adminArea>
                        <county>Fairfax (County)</county>
                        <state>Virginia</state>
                    </adminArea>
                </pointLocation>
            </location>
            <typeEvent>
                <accidentsAndIncidents>disabled vehicle</accidentsAndIncidents>
            </typeEvent>
            <description>
                <text>2021-10-01 06:34:00-04 Motorists was using the phone, shoulder is clear. SSP 933 is clear.</text>
                <text>2021-10-01 06:32:00-04 SSP 933 has detected a disabled vehicle blocking the right shoulder.</text>
            </description>
```

```xml
<description>
    <text>2021-10-01 06:34:00-04 Motorists was using the phone, shoulder is clear. SSP 933 is clear.</text>
    <text>2021-10-01 06:32:00-04 SSP 933 has detected a disabled vehicle blocking the right shoulder.</text>
</description>
```

Incident and Event Data Response (continued)

```
            <totalEvents>233</totalEvents>
            <filteredEvents>0</filteredEvents>
        </localMessageHeader>
    </messageHeader>
    <responseGroup>
        <incident>
            <head>
                <id>VDOT_INNO4064362-10012021</id>
                <charSet>utf8</charSet>
                <issuingAgency>VADOT</issuingAgency>
                <updateTime>2021-10-01T10:53:21-04:00</updateTime>
            </head>
            <location>
                <locationName>I-95S south @ MM 164.000</locationName>
                <pointLocation>
                    <crossStreetsPoint>
                        <onStreetInfo>
                            <prefix>I</prefix>
                            <name>95</name>
                        </onStreetInfo>
                        <atStreetInfo>
                            <prefix>MP</prefix>
                            <name>164.00</name>
                        </atStreetInfo>
                        <geoLocation>
                            <latitude>38696983</latitude>
                            <longitude>-77225966</longitude>
                        </geoLocation>
                        <direction>south</direction>
                        <adminAreas>
                            <county>Fairfax (County)</county>
                            <state>Virginia</state>
                        </adminAreas>
                    </crossStreetsPoint>
                    <adminArea>
                        <county>Fairfax (County)</county>
                        <state>Virginia</state>
                    </adminArea>
                </pointLocation>
            </location>
            <typeEvent>
                <accidentsAndIncidents>disabled vehicle</accidentsAndIncidents>
            </typeEvent>
            <description>
                <text>2021-10-01 06:34:00-04 Motorists was using the phone, shoulder is clear. SSP 933 is clear.</text>
                <text>2021-10-01 06:32:00-04 SSP 933 has detected a disabled vehicle blocking the right shoulder.</text>
            </description>
            <startTime>2021-10-01T06:33:32-04:00</startTime>
            <clearTime>2021-10-01T10:53:00-04:00</clearTime>
            <localIncidentInformation>
                <endTime>2021-10-01T10:53:21-04:00</endTime>
                <tmcCode>110-04153</tmcCode>
                <regionalEvent>false</regionalEvent>
                <lane type="DD2000220002" status="000000000000" direction="111111100000" />
            </localIncidentInformation>
        </incident>
```

```
<localIncidentInformation>
    <endTime>2021-10-01T10:53:21-04:00</endTime>
    <tmcCode>110-04153</tmcCode>
    <regionalEvent>false</regionalEvent>
    <lane type="DD2000220002" status="000000000000" direction="111111100000" />
</localIncidentInformation>
```

Event type

Regional event flag

Lane closure status

41

Requesting Historical Detector Data

POST request to:

https://rm3p-api.ritis.org/rm3p/detector/historical_detector/

```
{
    "ids" : ["783233", "782536", "781808", "781958"],
    "startTime" : "2022-10-01",
    "endTime" :  "2022-11-01"
}
```

List of detector IDs of interest

Start and end dates
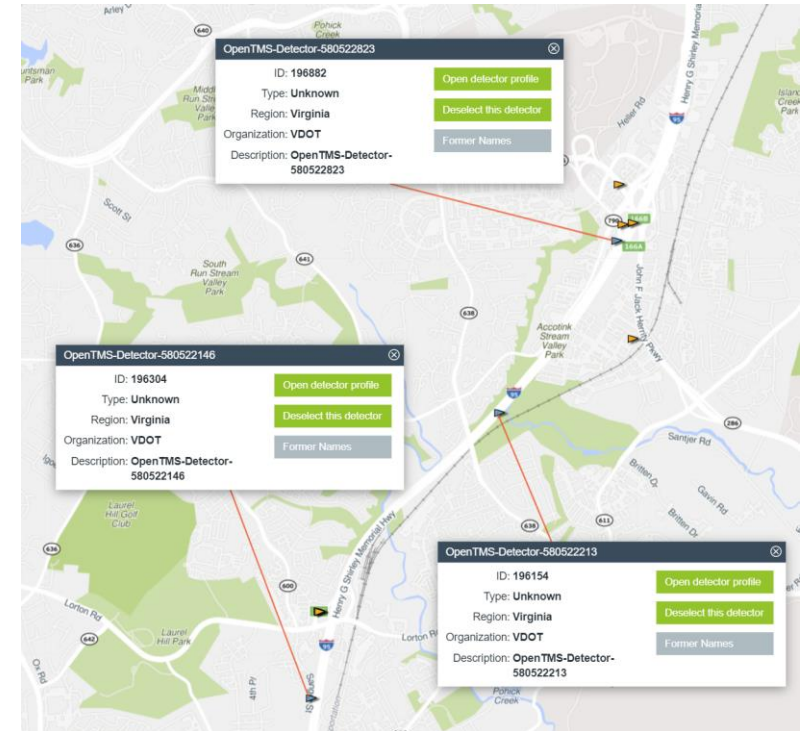
Detector Data Response

```xml
<zoneDataItem>
    <measurementStart>2022-10-12T11:45:12.000-04:00</measurementStart>
    <measurementEnd>2022-10-12T11:45:12.000-04:00</measurementEnd>
    <effectiveDate>2022-10-12T11:45:12.000-04:00</effectiveDate>
    <vehicleCount>36</vehicleCount>
    <speed>66</speed>
    <occupancy>3</occupancy>
    <quality>0</quality>
</zoneDataItem>
<zoneDataItem>
    <measurementStart>2022-10-12T11:46:12.000-04:00</measurementStart>
    <measurementEnd>2022-10-12T11:46:12.000-04:00</measurementEnd>
    <effectiveDate>2022-10-12T11:46:12.000-04:00</effectiveDate>
    <vehicleCount>19</vehicleCount>
    <speed>66</speed>
    <occupancy>2</occupancy>
    <quality>0</quality>
</zoneDataItem>
<zoneDataItem>
    <measurementStart>2022-10-12T11:47:12.000-04:00</measurementStart>
    <measurementEnd>2022-10-12T11:47:12.000-04:00</measurementEnd>
    <effectiveDate>2022-10-12T11:47:12.000-04:00</effectiveDate>
    <vehicleCount>42</vehicleCount>
    <speed>66</speed>
    <occupancy>4</occupancy>
    <quality>0</quality>
</zoneDataItem>
<zoneDataItem>
    <measurementStart>2022-10-12T11:48:13.000-04:00</measurementStart>
    <measurementEnd>2022-10-12T11:48:13.000-04:00</measurementEnd>
    <effectiveDate>2022-10-12T11:48:13.000-04:00</effectiveDate>
    <vehicleCount>31</vehicleCount>
    <speed>68</speed>
    <occupancy>3</occupancy>
    <quality>0</quality>
</zoneDataItem>
<zoneDataItem>
    <measurementStart>2022-10-12T11:49:12.000-04:00</measurementStart>
    <measurementEnd>2022-10-12T11:49:12.000-04:00</measurementEnd>
    <effectiveDate>2022-10-12T11:49:12.000-04:00</effectiveDate>
    <vehicleCount>25</vehicleCount>
    <speed>67</speed>
    <occupancy>2</occupancy>
    <quality>0</quality>
</zoneDataItem>
<zoneDataItem>
    <measurementStart>2022-10-12T11:50:12.000-04:00</measurementStart>
    <measurementEnd>2022-10-12T11:50:12.000-04:00</measurementEnd>
    <effectiveDate>2022-10-12T11:50:12.000-04:00</effectiveDate>
    <vehicleCount>28</vehicleCount>
    <speed>68</speed>
    <occupancy>2</occupancy>
    <quality>0</quality>
</zoneDataItem>
```

```xml
<zoneDataItem>
    <measurementStart>2022-10-12T11:47:12.000-04:00</measurementStart>
    <measurementEnd>2022-10-12T11:47:12.000-04:00</measurementEnd>
    <effectiveDate>2022-10-12T11:47:12.000-04:00</effectiveDate>
    <vehicleCount>42</vehicleCount>
    <speed>66</speed>
    <occupancy>4</occupancy>
    <quality>0</quality>
</zoneDataItem>
```

Measurement timestamp

Measurements

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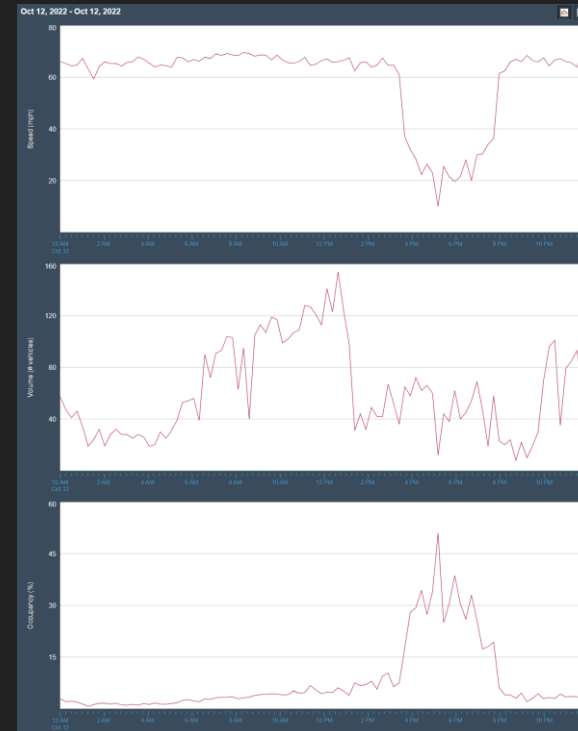
Requesting Weather Station Metadata

POST request to:

https://rm3p-api.ritis.org/rm3p/weather

```
<weather-filter xmlns="http://www.ritis.org/schema/filter">
    <systems>
        <system>vdot</system>
    </systems>
</weather-filter>
```

Requesting inventory of weather stations for VDOT

Requesting Weather Station Data

```
<site>
  <head>
    <id>VDOT_3369</id>
    <name>I-95 N @ Keene Mill (Site A)</name>
    <state-site-id>3369</state-site-id>
  </head>
  <stations>
    <station>
      <station-id>0</station-id>
      <station-code>3369</station-code>
      <location>
        <center>
          <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
            <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
          </ns2:Point>
        </center>
        <pointLocation>
          <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
            <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
          </ns2:Point>
          <onAddress>
            <state>Virginia</state>
            <country>USA</country>
          </onAddress>
        </pointLocation>
      </location>
      <rpu-phone>720-684-8596</rpu-phone>
      <rpu-ip>166.154.60.217</rpu-ip>
      <obs-coll-freq>5</obs-coll-freq>
      <sensors>
        <sensor>
          <sensor-id>11</sensor-id>
          <observation-type>Alarm Status</observation-type>
          <elevation-offset>279.0</elevation-offset>
          <observations>
            <observation>
              <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
              <metric-value>2</metric-value>
            </observation>
          </observations>
        </sensor>
        <sensor>
          <sensor-id>112</sensor-id>
          <observation-type>Level of Grip</observation-type>
          <elevation-offset>279.0</elevation-offset>
          <observations>
            <observation>
              <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
              <metric-value>82range</metric-value>
            </observation>
          </observations>
        </sensor>
        <sensor>
          <sensor-id>115</sensor-id>
          <observation-type>Ice Layer</observation-type>
          <elevation-offset>279.0</elevation-offset>
          <observations>
            <observation>
              <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
              <metric-value>0mm</metric-value>
            </observation>
          </observations>
        </sensor>
```
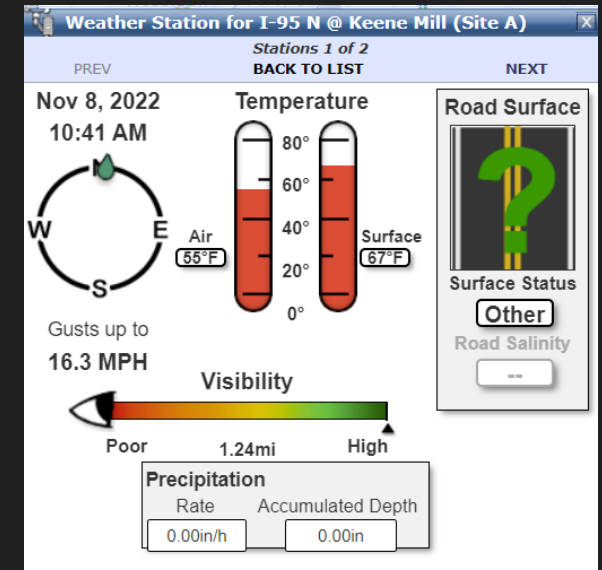
Basic station metadata

```
<head>
    <id>VDOT_3369</id>
    <name>I-95 N @ Keene Mill (Site A)</name>
    <state-site-id>3369</state-site-id>
</head>
```

Requesting Weather Station Data

```xml
<site>
    <head>
        <id>VDOT_3369</id>
        <name>I-95 N @ Keene Mill (Site A)</name>
        <state-site-id>3369</state-site-id>
    </head>
    <stations>
        <station>
            <station-id>0</station-id>
            <station-code>3369</station-code>
            <location>
                <center>
                    <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
                        <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
                    </ns2:Point>
                </center>
                <pointLocation>
                    <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
                        <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
                    </ns2:Point>
                    <onAddress>
                        <state>Virginia</state>
                        <country>USA</country>
                    </onAddress>
                </pointLocation>
            </location>
            <rpu-phone>720-684-8596</rpu-phone>
            <rpu-ip>166.154.60.217</rpu-ip>
            <obs-coll-freq>5</obs-coll-freq>
            <sensors>
                <sensor>
                    <sensor-id>11</sensor-id>
                    <observation-type>Alarm Status</observation-type>
                    <elevation-offset>279.0</elevation-offset>
                    <observations>
                        <observation>
                            <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
                            <metric-value>2</metric-value>
                        </observation>
                    </observations>
                </sensor>
                <sensor>
                    <sensor-id>112</sensor-id>
                    <observation-type>Level of Grip</observation-type>
                    <elevation-offset>279.0</elevation-offset>
                    <observations>
                        <observation>
                            <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
                            <metric-value>82range</metric-value>
                        </observation>
                    </observations>
                </sensor>
                <sensor>
                    <sensor-id>115</sensor-id>
                    <observation-type>Ice Layer</observation-type>
                    <elevation-offset>279.0</elevation-offset>
                    <observations>
                        <observation>
                            <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
                            <metric-value>0mm</metric-value>
                        </observation>
                    </observations>
                </sensor>
```

Basic station location metadata

```xml
<location>
    <center>
        <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
            <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
        </ns2:Point>
    </center>
    <pointLocation>
        <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
            <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
        </ns2:Point>
        <onAddress>
            <state>Virginia</state>
            <country>USA</country>
        </onAddress>
    </pointLocation>
</location>
<rpu-phone>720-684-8596</rpu-phone>
<rpu-ip>166.154.60.217</rpu-ip>
<obs-coll-freq>5</obs-coll-freq>
```

Requesting Weather Station Data

```xml
<site>
  <head>
    <id>VDOT_3369</id>
    <name>I-95 N @ Keene Mill (Site A)</name>
    <state-site-id>3369</state-site-id>
  </head>
  <stations>
    <station>
      <station-id>0</station-id>
      <station-code>3369</station-code>
      <location>
        <center>
          <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
            <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
          </ns2:Point>
        </center>
        <pointLocation>
          <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="3369">
            <ns2:pos srsDimension="2">-77.17864 38.77914</ns2:pos>
          </ns2:Point>
          <onAddress>
            <state>Virginia</state>
            <country>USA</country>
          </onAddress>
        </pointLocation>
      </location>
      <rpu-phone>720-684-8596</rpu-phone>
      <rpu-ip>166.154.60.217</rpu-ip>
      <obs-coll-freq>5</obs-coll-freq>
      <sensors>
        <sensor>
          <sensor-id>11</sensor-id>
          <observation-type>Alarm Status</observation-type>
          <elevation-offset>279.0</elevation-offset>
          <observations>
            <observation>
              <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
              <metric-value>2</metric-value>
            </observation>
          </observations>
        </sensor>
        <sensor>
          <sensor-id>112</sensor-id>
          <observation-type>Level of Grip</observation-type>
          <elevation-offset>279.0</elevation-offset>
          <observations>
            <observation>
              <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
              <metric-value>82range</metric-value>
            </observation>
          </observations>
        </sensor>
        <sensor>
          <sensor-id>115</sensor-id>
          <observation-type>Ice Layer</observation-type>
          <elevation-offset>279.0</elevation-offset>
          <observations>
            <observation>
              <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
              <metric-value>0mm</metric-value>
            </observation>
          </observations>
        </sensor>
```

```xml
<sensors>
  <sensor>
    <sensor-id>11</sensor-id>
    <observation-type>Alarm Status</observation-type>
    <elevation-offset>279.0</elevation-offset>
    <observations>
      <observation>
        <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
        <metric-value>2</metric-value>
      </observation>
    </observations>
  </sensor>
  <sensor>
    <sensor-id>112</sensor-id>
    <observation-type>Level of Grip</observation-type>
    <elevation-offset>279.0</elevation-offset>
    <observations>
      <observation>
        <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
        <metric-value>82range</metric-value>
      </observation>
    </observations>
  </sensor>
  <sensor>
    <sensor-id>115</sensor-id>
    <observation-type>Ice Layer</observation-type>
    <elevation-offset>279.0</elevation-offset>
    <observations>
      <observation>
        <timestamp>2022-11-07T22:11:00.000-05:00</timestamp>
        <metric-value>0mm</metric-value>
      </observation>
    </observations>
  </sensor>
</sensors>
```
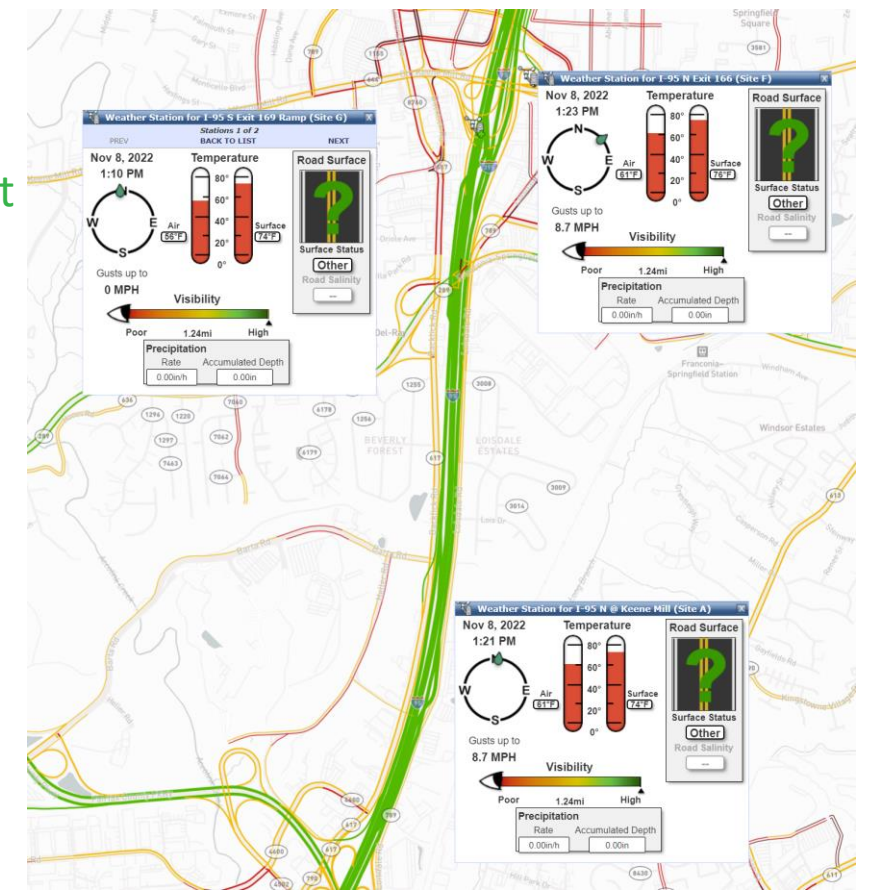
Various available sensors at the station

POST request to:

https://rm3p-api.ritis.org/rm3p/weather/historical_weather


```
{
  "ids" : ["VDOT_33694", "VDOT_3375"],
  "startTime" : "2022-01-01",
  "endTime" : "2022-02-01"
}
```

List of stations of interest

Date range of interest

Weather Station Data Response

```xml
<observation>
    <timestamp>2022-01-26T17:30:00-05:00</timestamp>
    <metric-value>-16°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T17:40:00-05:00</timestamp>
    <metric-value>-16.1°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T17:50:00-05:00</timestamp>
    <metric-value>-16.1°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T18:00:00-05:00</timestamp>
    <metric-value>-15.8°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T18:10:00-05:00</timestamp>
    <metric-value>-15.6°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T18:20:00-05:00</timestamp>
    <metric-value>-15.7°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T18:30:00-05:00</timestamp>
    <metric-value>-15.7°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T18:40:00-05:00</timestamp>
    <metric-value>-15.5°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T18:50:00-05:00</timestamp>
    <metric-value>-15.4°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T19:00:00-05:00</timestamp>
    <metric-value>-15.3°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T19:10:00-05:00</timestamp>
    <metric-value>-15.2°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T19:20:00-05:00</timestamp>
    <metric-value>-15.1°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T19:30:00-05:00</timestamp>
    <metric-value>-15.1°C</metric-value>
</observation>
<observation>
    <timestamp>2022-01-26T19:40:00-05:00</timestamp>
    <metric-value>-15°C</metric-value>
</observation>
```

Measurement for a given sensor and time period

```xml
<observation>
    <timestamp>2022-01-26T18:10:00-05:00</timestamp>
    <metric-value>-15.6°C</metric-value>
</observation>
```

Weather Station for I-95 N @ Keene Mill (Site A)

Observation Type	Time	Value	Com	Manu	Sens	Clim	Step	Like	Persi	IQR	Barn	Dew	Sea	Preci
Mobile Platform														
Detected Friction	1:21 PM	82%	●	●	●	--	--	--	--	--	--	--	--	--
Other														
Surface Water Depth	1:21 PM	0.0in	●	●	●	--	--	--	--	--	--	--	--	--
Pavement Sensor														
Surface Water Depth - Version 2	1:21 PM	0in	●	●	●	--	●	--	--	--	--	--	--	--
Surface Status	1:21 PM	Other	●	●	●	--	--	--	--	--	--	--	--	--
Surface Temperature	1:21 PM	73.58°F	●	●	●	●	●	●	●	--	●	--	--	--
Precipitation Sensor														
Precipitation Indicator	1:21 PM	0.0	●	●	●	--	--	--	--	--	--	--	--	--
Precipitation Situation	1:21 PM	Other	●	●	●	--	--	--	--	--	--	--	--	--
Rainfall or Water Equivalent of Snow	1:21 PM	0in/h	●	●	●	--	●	--	--	--	●	--	--	--
Total Precipitation Past One Hour	1:21 PM	0in	●	●	●	--	●	--	--	--	--	--	--	--
Total Precipitation Past Three Hours	1:21 PM	0in	●	●	●	--	●	--	--	--	--	--	--	--
Total Precipitation Past Six Hours	1:21 PM	0in	●	●	●	--	●	--	--	--	--	--	--	--
Total Precipitation Past Twelve Hours	1:21 PM	0in	●	●	●	--	●	--	--	--	--	--	--	--
Total Precipitation Past Twenty-Four Hours	1:21 PM	0in	●	●	●	--	●	--	--	--	--	--	--	--

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Requesting TMC Inventory

POST request to:

https://pda-api.ritis.org/tmc/search
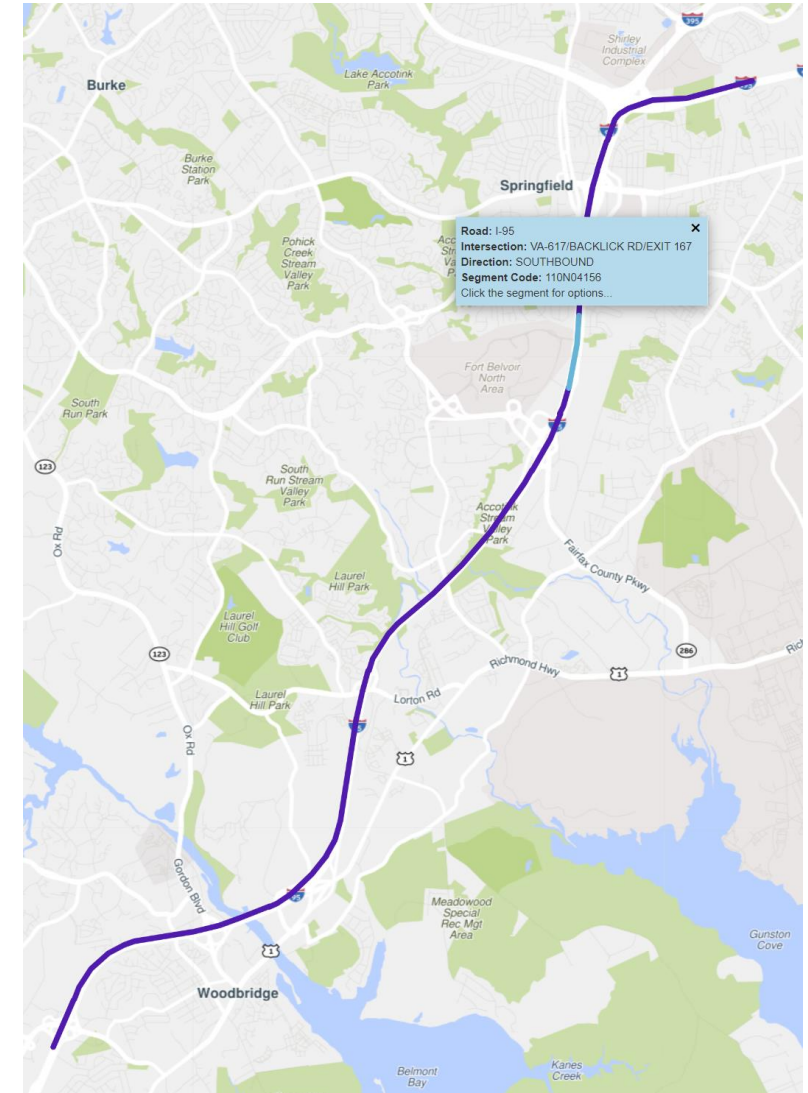
```
{
    "dataSourceId": "inrix_tmc",
    "state": ["VA"],
        "road": ["I-95"],
    "direction": ["SOUTHBOUND"]
}
```

TMC Inventory Response

```json
{
    "tmc": "110N04663",
    "type": "P1.3",
    "roadNumber": "I-95 (HOV)",
    "roadName": "I-95",
    "firstName": "VA-123/EXIT 160",
    "funcClass": "1",
    "county": "PRINCE WILLIAM",
    "state": "VA",
    "zip": "22191",
    "direction": "SOUTHBOUND",
    "roadClass": "Interstate",
    "nhsFClass": null,
    "startLatitude": 38.67193,
    "startLongitude": -77.24676,
    "endLatitude": 38.66865,
    "endLongitude": -77.26621,
    "length": 1.075919,
    "coordinates": [
        "-77.24676 38.67193,-77.24711 38.67182,-77.2474 38.67173,-77.24785 38.6716,-77.24896 38.67128,-77.24968 38.67109,-77.25059 38.67089,-77.25166 38.67067,-77.25241 38.67053,-77.
        25285 38.67045,-77.25304 38.67042,-77.25354 38.67033,-77.25405 38.67024,-77.25481 38.67012,-77.2565 38.66988,-77.25675 38.66985,-77.25755 38.66975,-77.25906 38.66956,-77.
        25997 38.66945,-77.26318 38.66907,-77.26452 38.6689,-77.26511 38.66882,-77.26538 38.66879,-77.26621 38.66865"
    ],
    "linearTmc": 11000123,
    "linearId": 11000123,
    "roadOrder": 12.0,
    "timezoneName": "America/New_York"
},
```

TMC Code

TMC Metadata

Segment Geometry

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Requesting Historical Probe Data

POST request to:

https://pda-api.ritis.org/submit/export

```
{
    "addNullRecords": false,
    "averagingWindow": 0,
    "dataSourceFields": [
        {
            "columns": [
                "SPEED",
                "AVERAGE_SPEED",
                "REFERENCE_SPEED",
                "TRAVEL_TIME_MINUTES",
                "CVALUE",
                "CONFIDENCE_SCORE"
            ],
            "dataSource": "inrix_tmc",
            "qualityFilter": {
                "includeIncalculable": true,
                "max": 1,
                "min": 0,
                "thresholds": [30, 20, 10]
            }
        }
    ],
    "dates": [
        {
            "end": "2022-10-02",
            "start": "2022-10-01"
        }
    ],
    "dow": [0, 1, 2, 3, 4, 5, 6],
    "dsFields": [
        {
            "columns": [
                "SPEED",
                "AVERAGE_SPEED",
                "REFERENCE_SPEED",
                "TRAVEL_TIME_MINUTES",
                "CVALUE",
                "CONFIDENCE_SCORE"
            ],
            "dataSource": "inrix_tmc",
            "qualityFilter": {
                "includeIncalculable": true,
                "max": 1,
                "min": 0,
                "thresholds": [30, 20, 10]
            }
        }
    ],
    "granularity": {
        "type": "minutes",
        "value": 0
    },
    "mergeFiles": true,
    "times": [
        {
            "end": "12:00:00.000",
            "start": "00:00:00.000"
        }
    ],
    "tmcs": ["110P04660", "110P04661", "110P04662",
        "04663", "110P04658", "110P04669", "110+04664"
    ],
    "travelTimeUnits": "SECONDS",
    "uuid": "rm3p-dep-historic"
}
```

Requesting Historical Probe Data

```
{
"addNullRecords": false,
"averagingWindow": 0,
"dataSourceFields": [
  {
    "columns": [
      "SPEED",
      "AVERAGE_SPEED",
      "REFERENCE_SPEED",
      "TRAVEL_TIME_MINUTES",
      "CVALUE",
      "CONFIDENCE_SCORE"
    ],
    "dataSource": "inrix_tmc",
    "qualityFilter": {
      "includeIncalculable": true,
      "max": 1,
      "min": 0,
      "thresholds": [30, 20, 10]
    }
  }
],
"dates": [
  {
    "end": "2022-10-02",
    "start": "2022-10-01"
  }
],
"dow": [0, 1, 2, 3, 4, 5, 6],
"dsFields": [
  {
    "columns": [
      "SPEED",
      "AVERAGE_SPEED",
      "REFERENCE_SPEED",
      "TRAVEL_TIME_MINUTES",
      "CVALUE",
      "CONFIDENCE_SCORE"
    ],
    "dataSource": "inrix_tmc",
    "qualityFilter": {
      "includeIncalculable": true,
      "max": 1,
      "min": 0,
      "thresholds": [30, 20, 10]
    }
  }
],
"granularity": {
  "type": "minutes",
  "value": 0
},
"mergeFiles": true,
"times": [
  {
    "end": "12:00:00.000",
    "start": "00:00:00.000"
  }
],
"tmcs": ["110P04660", "110P04661", "110P04662",
  +04663", "110P04658", "110P04669", "110+04664"]
"travelTimeUnits": "SECONDS",
"uuid": "rm3p-dep-historic"
}
```

```
"dataSourceFields": [
  {
    "columns": [
      "SPEED",
      "AVERAGE_SPEED",
      "REFERENCE_SPEED",
      "TRAVEL_TIME_MINUTES",
      "CVALUE",
      "CONFIDENCE_SCORE"
    ],
```

Desired measurements

Requesting Historical Probe Data

```
{
    "addNullRecords": false,
    "averagingWindow": 0,
    "dataSourceFields": [
        {
            "columns": [
                "SPEED",
                "AVERAGE_SPEED",
                "REFERENCE_SPEED",
                "TRAVEL_TIME_MINUTES",
                "CVALUE",
                "CONFIDENCE_SCORE"
            ],
            "dataSource": "inrix_tmc",
            "qualityFilter": {
                "includeIncalculable": true,
                "max": 1,
                "min": 0,
                "thresholds": [30, 20, 10]
            }
        }
    ],
    "dates": [
        {
            "end": "2022-10-02",
            "start": "2022-10-01"
        }
    ],
    "dow": [0, 1, 2, 3, 4, 5, 6],
    "dsFields": [
        {
            "columns": [
                "SPEED",
                "AVERAGE_SPEED",
                "REFERENCE_SPEED",
                "TRAVEL_TIME_MINUTES",
                "CVALUE",
                "CONFIDENCE_SCORE"
            ],
            "dataSource": "inrix_tmc",
            "qualityFilter": {
                "includeIncalculable": true,
                "max": 1,
                "min": 0,
                "thresholds": [30, 20, 10]
            }
        }
    ],
    "granularity": {
        "type": "minutes",
        "value": 0
    },
    "mergeFiles": true,
    "times": [
        {
            "end": "12:00:00.000",
            "start": "00:00:00.000"
        }
    ],
    "tmcs": ["110P04660", "110P04661", "110P04662",
        +04663", "110P04658", "110P04669", "110+04664"]
    "travelTimeUnits": "SECONDS",
    "uuid": "rm3p-dep-historic"
}
```

```
"dataSource": "inrix_tmc",
"qualityFilter": {
    "includeIncalculable": true,
    "max": 1,
    "min": 0,
    "thresholds": [30, 20, 10]
}
```

Data source and quality filters

Requesting Historical Probe Data

```json
{
"addNullRecords": false,
"averagingWindow": 0,
"dataSourceFields": [
    {
        "columns": [
            "SPEED",
            "AVERAGE_SPEED",
            "REFERENCE_SPEED",
            "TRAVEL_TIME_MINUTES",
            "CVALUE",
            "CONFIDENCE_SCORE"
        ],
        "dataSource": "inrix_tmc",
        "qualityFilter": {
            "includeIncalculable": true,
            "max": 1,
            "min": 0,
            "thresholds": [30, 20, 10]
        }
    }
],
"dates": [
    {
        "end": "2022-10-02",
        "start": "2022-10-01"
    }
],
"dow": [0, 1, 2, 3, 4, 5, 6],
"dsFields": [
    {
        "columns": [
            "SPEED",
            "AVERAGE_SPEED",
            "REFERENCE_SPEED",
            "TRAVEL_TIME_MINUTES",
            "CVALUE",
            "CONFIDENCE_SCORE"
        ],
        "dataSource": "inrix_tmc",
        "qualityFilter": {
            "includeIncalculable": true,
            "max": 1,
            "min": 0,
            "thresholds": [30, 20, 10]
        }
    }
],
"granularity": {
    "type": "minutes",
    "value": 0
},
"mergeFiles": true,
"times": [
    {
        "end": "12:00:00.000",
        "start": "00:00:00.000"
    }
],
"tmcs": ["110P04660", "110P04661", "110P04662",
    "+04663", "110P04658", "110P04669", "110+04664"
"travelTimeUnits": "SECONDS",
"uuid": "rm3p-dep-historic"
}
```

```json
"dates": [
    {
        "end": "2022-10-02",
        "start": "2022-10-01"
    }
],
"dow": [0, 1, 2, 3, 4, 5, 6],
```

Start and end dates, and days of week of interest

```json
{
  "addNullRecords": false,
  "averagingWindow": 0,
  "dataSourceFields": [
    {
      "columns": [
        "SPEED",
        "AVERAGE_SPEED",
        "REFERENCE_SPEED",
        "TRAVEL_TIME_MINUTES",
        "CVALUE",
        "CONFIDENCE_SCORE"
      ],
      "dataSource": "inrix_tmc",
      "qualityFilter": {
        "includeIncalculable": true,
        "max": 1,
        "min": 0,
        "thresholds": [30, 20, 10]
      }
    }
  ],
  "dates": [
    {
      "end": "2022-10-02",
      "start": "2022-10-01"
    }
  ],
  "dow": [0, 1, 2, 3, 4, 5, 6],
  "dsFields": [
    {
      "columns": [
        "SPEED",
        "AVERAGE_SPEED",
        "REFERENCE_SPEED",
        "TRAVEL_TIME_MINUTES",
        "CVALUE",
        "CONFIDENCE_SCORE"
      ],
      "dataSource": "inrix_tmc",
      "qualityFilter": {
        "includeIncalculable": true,
        "max": 1,
        "min": 0,
        "thresholds": [30, 20, 10]
      }
    }
  ],
  "granularity": {
    "type": "minutes",
    "value": 0
  },
  "mergeFiles": true,
  "times": [
    {
      "end": "12:00:00.000",
      "start": "00:00:00.000"
    }
  ],
  "tmcs": ["110P04660", "110P04661", "110P04662",
    +04663", "110P04658", "110P04669", "110+04664"],
  "travelTimeUnits": "SECONDS",
  "uuid": "rm3p-dep-historic"
}
```

Zoomed detail:

```json
"granularity": {
  "type": "minutes",
  "value": 0
},
"mergeFiles": true,
"times": [
  {
    "end": "12:00:00.000",
    "start": "00:00:00.000"
  }
],
```

Temporal granularity, and start and end times of day

Requesting Historical Probe Data

```json
{
  "addNullRecords": false,
  "averagingWindow": 0,
  "dataSourceFields": [
    {
      "columns": [
        "SPEED",
        "AVERAGE_SPEED",
        "REFERENCE_SPEED",
        "TRAVEL_TIME_MINUTES",
        "CVALUE",
        "CONFIDENCE_SCORE"
      ],
      "dataSource": "inrix_tmc",
      "qualityFilter": {
        "includeIncalculable": true,
        "max": 1,
        "min": 0,
        "thresholds": [30, 20, 10]
      }
    }
  ],
  "dates": [
    {
      "end": "2022-10-02",
      "start": "2022-10-01"
    }
  ],
  "dow": [0, 1, 2, 3, 4, 5, 6],
  "dsFields": [
    {
      "columns": [
        "SPEED",
        "AVERAGE_SPEED",
        "REFERENCE_SPEED",
        "TRAVEL_TIME_MINUTES",
        "CVALUE",
        "CONFIDENCE_SCORE"
      ],
      "dataSource": "inrix_tmc",
      "qualityFilter": {
        "includeIncalculable": true,
        "max": 1,
        "min": 0,
        "thresholds": [30, 20, 10]
      }
    }
  ],
  "granularity": {
    "type": "minutes",
    "value": 0
  },
  "mergeFiles": true,
  "times": [
    {
      "end": "12:00:00.000",
      "start": "00:00:00.000"
    }
  ],
  "tmcs": ["110P04660", "110P04661", "110P04662",
    "+04663", "110P04658", "110P04669", "110+04664"
  "travelTimeUnits": "SECONDS",
  "uuid": "rm3p-dep-historic"
```

```json
"tmcs": ["110P04660", "110P04661", "110P04662",
    +04663", "110P04658", "110P04669", "110+04664"
"travelTimeUnits": "SECONDS",
"uuid": "rm3p-dep-historic"
```

List of TMCs of interest

Travel time units

UUID to track the job

57

GET request to:

https://pda-api.ritis.org/jobs/status/?jobId=application_1622902841046_213123

```
"id": "application_1622902841046_213123",
"startTime": "Nov 8, 2022 3:52:28 PM",
"errorMessage": null
```

```
"id": "application_1622902841046_213123",
"queue": "root.users.hdfs",
"progress": 100.0,          ← Job % complete
"startTime": "Nov 8, 2022 3:52:28 PM",
"endTime": "Nov 8, 2022 3:53:56 PM",
"state": "SUCCEEDED"        ← Job state
```

GET request to:

https://pda-api.ritis.org/results/export?uuid=rm3p-dep-historic

Now we can monitor the live traffic and look for anomalies

Implement
Response

I0I0
I0I0
**Historical
Data**

**Real-Time
Monitoring**

AI Model

Suggest
Options

Detect &
Verify
Anomaly
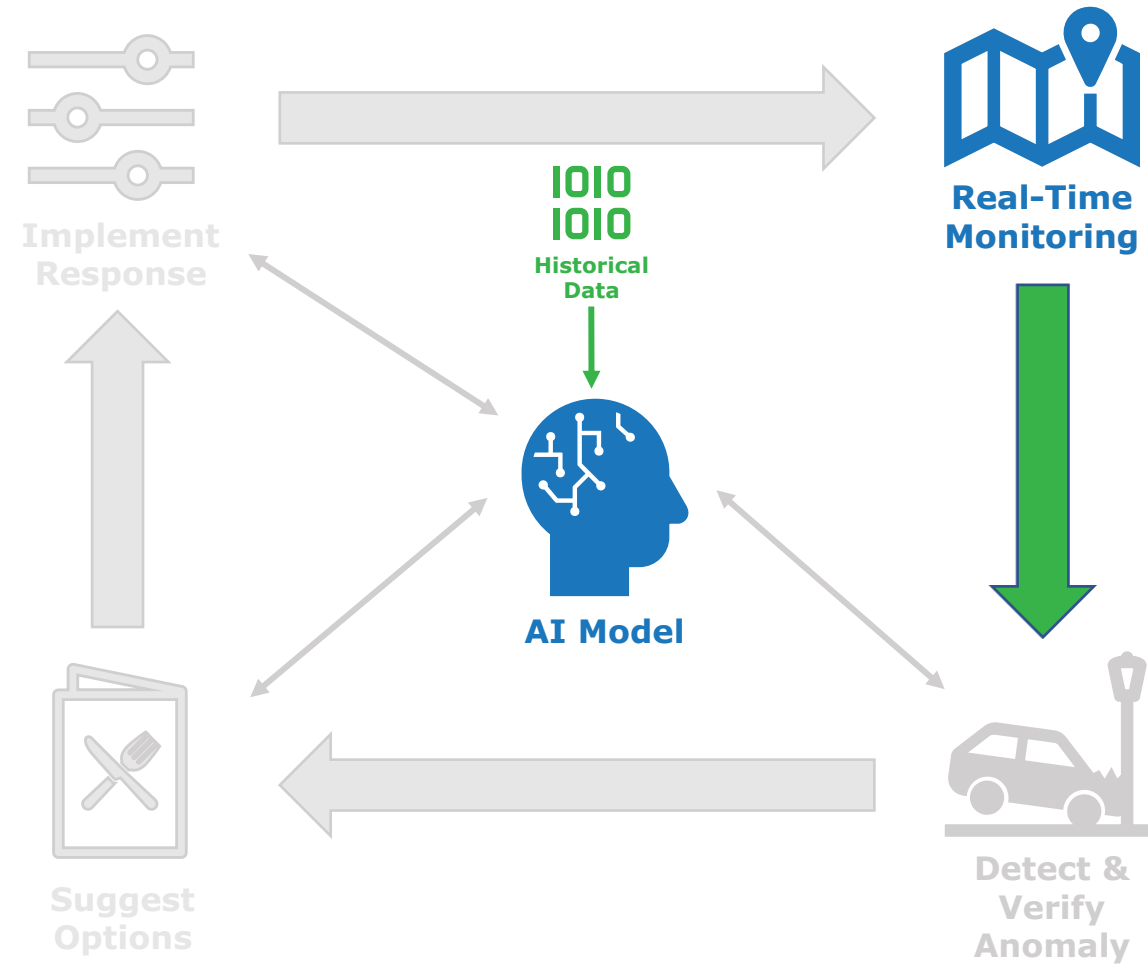
Detected sudden drop in probe speed data

GET request to:

https://rm3p-api.ritis.org/rm3p/dep_speed_tt_tmc

OR

https://rm3p-api.ritis.org/rm3p/dep_speed_tt_xd

Detected sudden drop in probe speed data

```
{
    "id": "110+19100",
    "speed": 21,
    "tt": 32.75
},
{
    "id": "110+08447",
    "speed": 17,
    "tt": 47.77
},
{
    "id": "110+08448",
    "speed": 22,
    "tt": 70.27
},
{
    "id": "110+08449",
    "speed": 26,
    "tt": 72.3
},
{
    "id": "110+07112",
    "speed": 10,
    "tt": 241.33
},
{
    "id": "110+08443",
    "speed": 7,
    "tt": 53.56
},
{
    "id": "110+08444",
    "speed": 12,
    "tt": 27.93
},
{
    "id": "110+08446",
    "speed": 14,
    "tt": 77.07
},
{
    "id": "110+08440",
    "speed": 59,
    "tt": 358.29
},
```

```
{
    "id": "110+08447",
    "speed": 17,
    "tt": 47.77
},
```

Speed drop on a TMC segment

```
{
    "id": "135530519",
    "speed": 22,
    "tt": 18.42
},
{
    "id": "135530514",
    "speed": 23,
    "tt": 11.92
},
{
    "id": "135268375",
    "speed": 9,
    "tt": 13.05
},
{
    "id": "1310477847",
    "speed": 45,
    "tt": 39.78
},
{
    "id": "1310477841",
    "speed": 61,
    "tt": 17.26
},
{
    "id": "135530500",
    "speed": 22,
    "tt": 3.44
},
{
    "id": "135268354",
    "speed": 22,
    "tt": 2.49
},
{
    "id": "135006239",
    "speed": 25,
    "tt": 1.71
},
{
    "id": "1310477834",
    "speed": 24,
    "tt": 134.48
},
```

```
{
    "id": "135530514",
    "speed": 23,
    "tt": 11.92
},
```

Speed drop on an XD segment

INRIX Probe Data

I-95 S(I-95) Southbound @ VA-123/EXIT ...
TMC 110-04152
Fairfax County, VA 22079 (Nov 8, 2022 - 2:05 PM)

Length	Speed	Avg. Speed	Ref. Speed	Conf Score	Travel Time
0.42 mi	12 mph	18 mph	63 mph	High	2:08 min

Click and Drag to Zoom. Double-Click to Reset.

Confidence Score ▬ Reference Speed ▬ Average Speed ▬ Speed
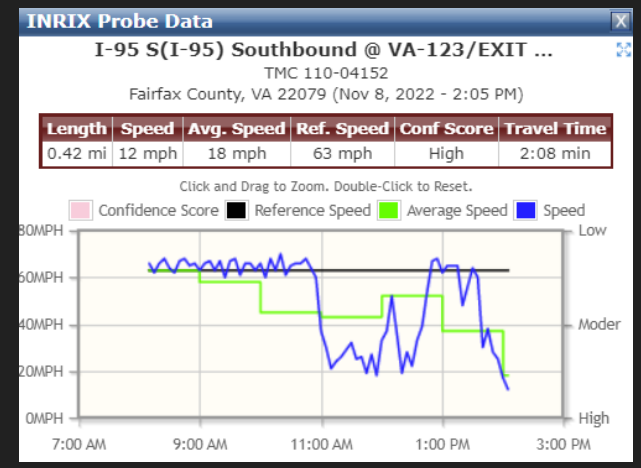
Verify speed drop and determine volume of traffic impacted

POST request to:

https://rm3p-api.ritis.org/rm3p/**detector/**

```xml
<detector-filter xmlns="http://www.ritis.org/schema/filter">
    <systems>
        <system>vdot_rm3p</system>
    </systems>
</detector-filter>
```

```xml
<collection-period-item>
    <detection-time-stamp>2022-11-08T17:00:05.000-05:00</detection-time-stamp>
    <zone-reports>
        <zone-report>
            <detector-id>RM3P_783072</detector-id>
            <zone-data>
                <zone-data-item>
                    <zone-number>197418</zone-number>
                    <zone-vehicle-count>82</zone-vehicle-count>
                    <occupancy>29</occupancy>
                    <zone-vehicle-speed>22</zone-vehicle-speed>
                    <zone-status>1</zone-status>
                </zone-data-item>
            </zone-data>
        </zone-report>
    </zone-reports>
</collection-period-item>
<collection-period-item>
```

Volume → `<zone-vehicle-count>82</zone-vehicle-count>`

Speed drop → `<zone-vehicle-speed>22</zone-vehicle-speed>`

Verify an Incident using Agency Data

POST request to:

https://rm3p-api.ritis.org/rm3p/event/

```
<event-filter xmlns="http://www.ritis.org/schema/filter">
····<systems>
····|····<system>vdot</system>
····</systems>
</event-filter>
```
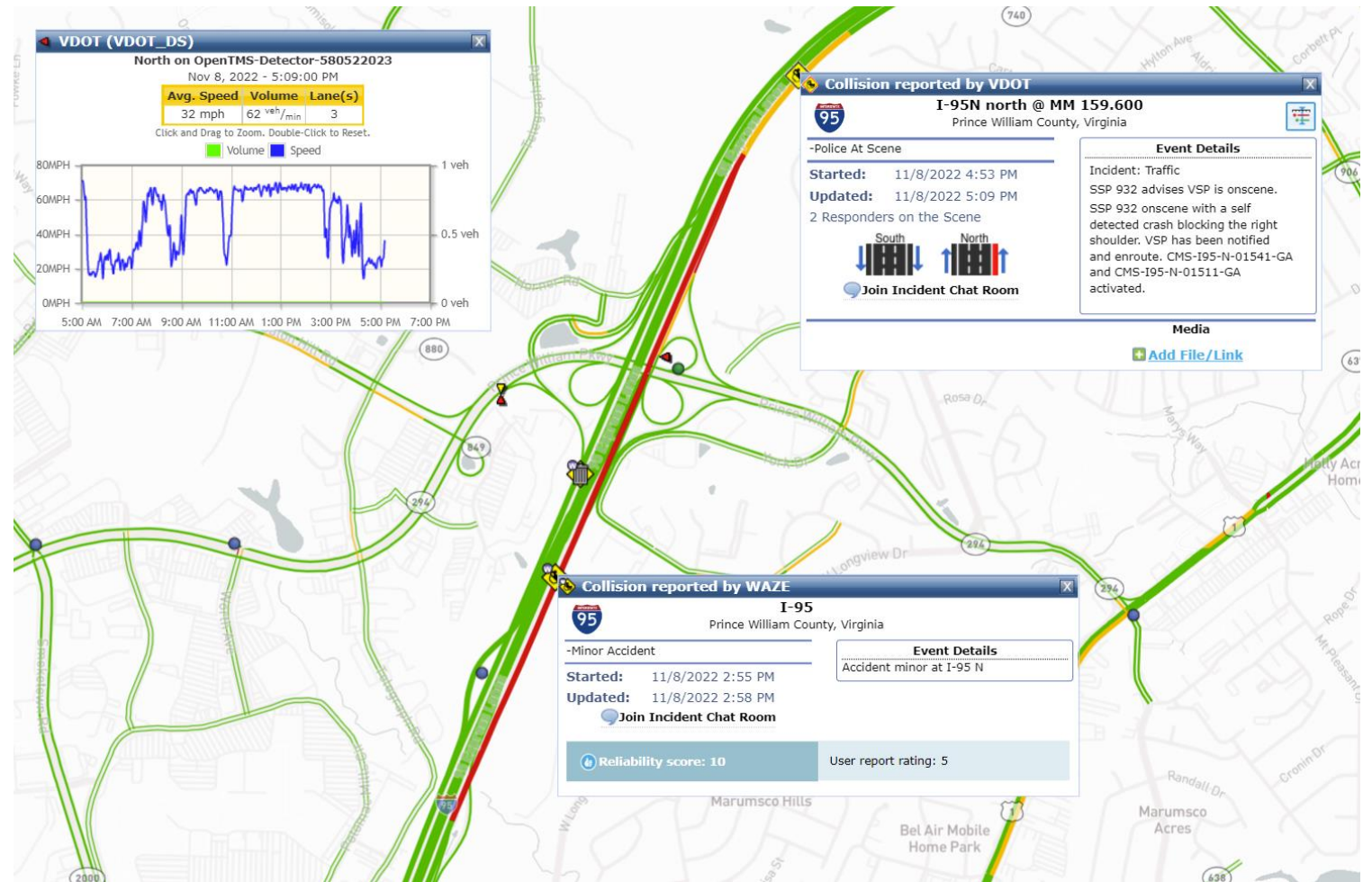
Agency Source

VDOT Recorded Incident

```xml
<event>
    <head>
        <id>VDOT_INN05774240946-11082022</id>
        <charSet>utf8</charSet>
        <issuingAgency>VADOT</issuingAgency>
        <updateTime>2022-11-08T17:09:50-05:00</updateTime>
    </head>
    <location>
        <locationName>I-95N north @ MM 159.600</locationName>
        <pointLocation>
            <crossStreetsPoint>
                <onStreetInfo>
                    <prefix>I</prefix>
                    <name>95</name>
                </onStreetInfo>
                <atStreetInfo>
                    <prefix>MP</prefix>
                    <name>159.60</name>
                </atStreetInfo>
                <geoLocation>
                    <latitude>38665140</latitude>
                    <longitude>-77273520</longitude>
                </geoLocation>
                <direction>north</direction>
                <adminAreas>
                    <city>Marumsco Cdp</city>
                    <county>Prince William</county>
                    <state>Virginia</state>
                </adminAreas>
            </crossStreetsPoint>
            <adminArea>
                <city>Marumsco Cdp</city>
                <county>Prince William</county>
                <state>Virginia</state>
            </adminArea>
        </pointLocation>
    </location>
    <typeEvent>
        <warningAdvice>police at scene</warningAdvice>
    </typeEvent>
    <description>
        <text>2022-11-08 05:09:00-05 SSP 932 advises VSP is onscene.</text>
        <text>2022-11-08 04:53:00-05 SSP 932 onscene with a self detected crash blocking the right shoulder. VSP has been notified and enroute. CMS-I95-N-01541-GA and
            CMS-I95-N-01511-GA activated.</text>
    </description>
    <affectedLanes>
        <lanesAffected>1</lanesAffected>
        <laneTotalCnt>5</laneTotalCnt>
        <types>
            <type>right shoulder</type>
        </types>
        <location>north</location>
        <condition>closed</condition>
        <direction>one Direction</direction>
    </affectedLanes>
    <startTime>2022-11-08T16:53:55-05:00</startTime>
    <localEventInformation>
        <tmcCode>110+04152</tmcCode>
        <regionalEvent>false</regionalEvent>
        <lane type="2000220002" status="0000000002" direction="1111100000" />
        <resource notified="2022-11-08T16:53:00-05:00" arrived="2022-11-08T16:53:00-05:00" name="SSP Wayne McKenzie 932 (546458)" type="freeway service patrols" />
        <resource notified="2022-11-08T16:53:00-05:00" arrived="2022-11-08T17:09:00-05:00" name="VSP - Division 7 Headquarters" type="state police units" />
    </localEventInformation>
</event>
```
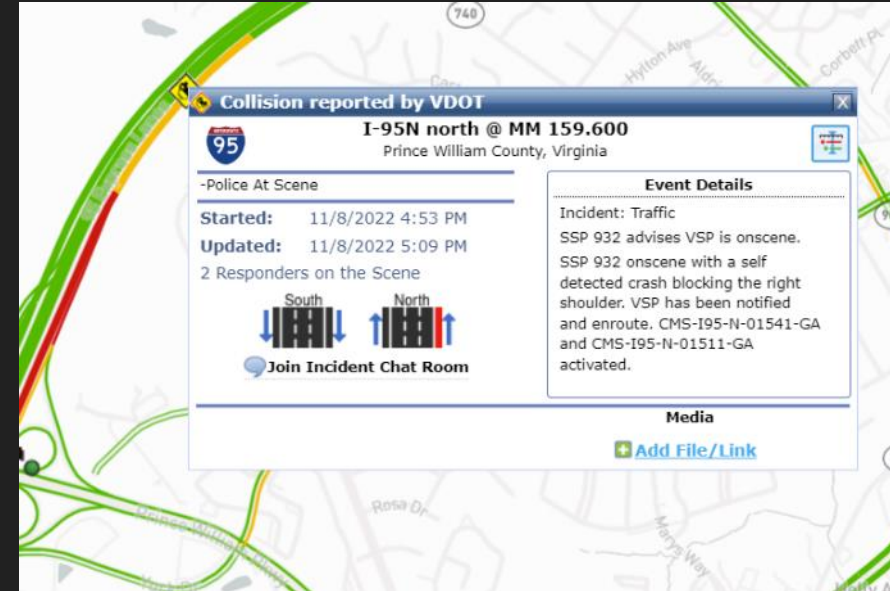
Verify an Incident using Crowdsourced Data

POST request to:

https://rm3p-api.ritis.org/rm3p/event/

```
<event-filter xmlns="http://www.ritis.org/schema/filter">
    <systems>
        <system>waze</system>
    </systems>
    <location-filters>
        <state>VA</state>
        <tmc-filter>
            <tmc>110+04151</tmc>
        </tmc-filter>
    </location-filters>
</event-filter>
```
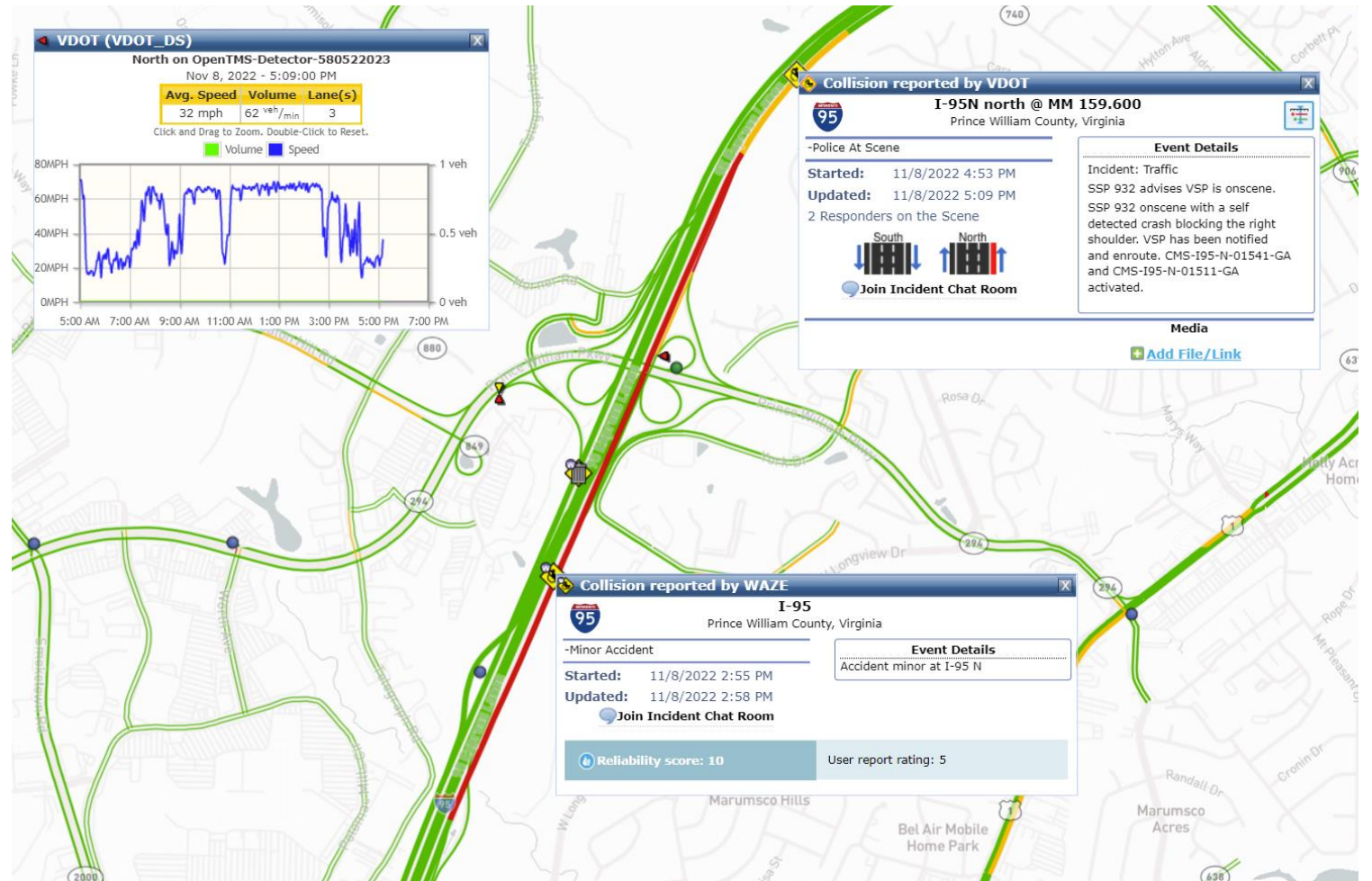
Waze Source

Incidents on a specific TMC

VDOT (VDOT_DS)
North on OpenTMS-Detector-580522023
Nov 8, 2022 - 5:09:00 PM

Avg. Speed	Volume	Lane(s)
32 mph	62 veh/min	3

Click and Drag to Zoom. Double-Click to Reset.
Volume Speed

Collision reported by VDOT
I-95N north @ MM 159.600
Prince William County, Virginia

-Police At Scene
Started: 11/8/2022 4:53 PM
Updated: 11/8/2022 5:09 PM
2 Responders on the Scene
South North
Join Incident Chat Room

Event Details
Incident: Traffic
SSP 932 advises VSP is onscene.
SSP 932 onscene with a self detected crash blocking the right shoulder. VSP has been notified and enroute. CMS-I95-N-01541-GA and CMS-I95-N-01511-GA activated.

Media
Add File/Link

Collision reported by WAZE
I-95
Prince William County, Virginia

-Minor Accident
Started: 11/8/2022 2:55 PM
Updated: 11/8/2022 2:58 PM
Join Incident Chat Room

Event Details
Accident minor at I-95 N

Reliability score: 10   User report rating: 5

66

Waze Recorded Incident

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:advisoryInformation xmlns:ns2="https://filter.ritis.org/reference/schema/atis_tmdd/ATIS.xsd">
    <messageHeader>
        <sender>
            <agencyName>RITIS</agencyName>
        </sender>
        <messageID>0</messageID>
        <timeStamp>2022-11-08T17:32:38.889-05:00</timeStamp>
        <msgCount>0</msgCount>
        <localMessageHeader>
            <totalEvents>1</totalEvents>
            <filteredEvents>0</filteredEvents>
        </localMessageHeader>
    </messageHeader>
    <responseGroup>
        <event>
            <head>
                <id>WAZE_f7f68d3f-5566-4cca-8803-fb1f23138d92</id>
                <charSet>utf8</charSet>
                <issuingAgency>Waze</issuingAgency>
                <updateTime>2022-11-08T14:58:34.697-05:00</updateTime>
            </head>
            <location>
                <locationName>I-95</locationName>
                <pointLocation>
                    <geoLocationPoint>
                        <latitude>38650341</latitude>
                        <longitude>-77282745</longitude>
                    </geoLocationPoint>
                    <adminArea>
                        <city>Marumsco Cdp</city>
                        <county>Prince William</county>
                        <state>Virginia</state>
                    </adminArea>
                </pointLocation>
            </location>
            <typeEvent>
                <accidentsAndIncidents>incident</accidentsAndIncidents>
            </typeEvent>
            <startTime>2022-11-08T14:55:39-05:00</startTime>
            <localEventInformation>
                <tmcCode>110+04151</tmcCode>
                <regionalEvent>false</regionalEvent>
            </localEventInformation>
        </event>
    </responseGroup>
</ns2:advisoryInformation>
```
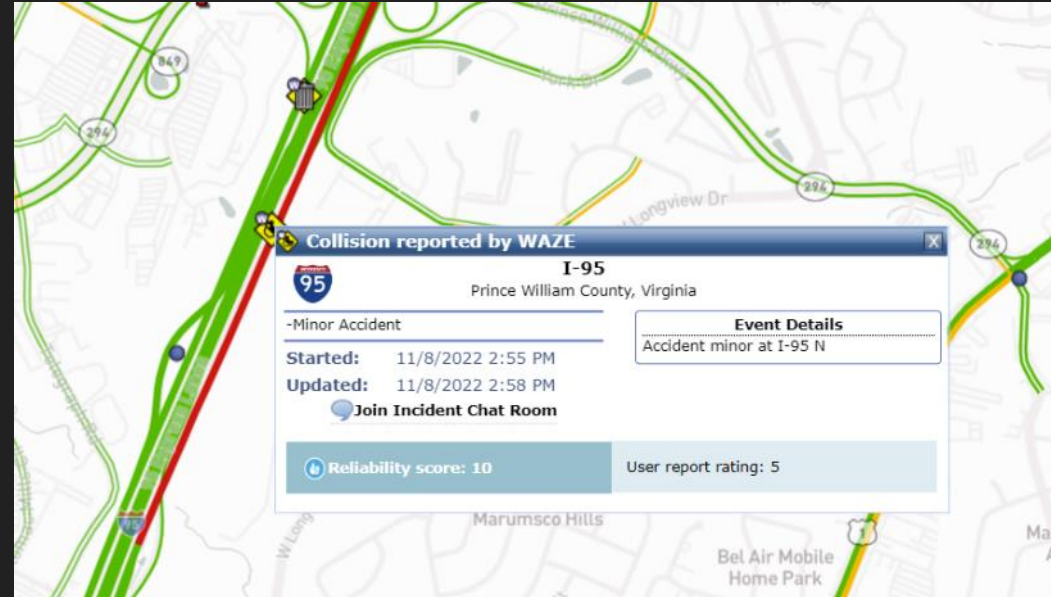
POST request to:

https://rm3p-api.ritis.org/rm3p/device/

```
<device-filter xmlns="http://www.ritis.org/schema/filter">
    <type>device_cctv</type>
    <systems>
        <system>vdot</system>
    </systems>
</device-filter>
```

Visualize Impacts using CCTV Feeds

```xml
<device>
    <device-type>CCTV</device-type>
    <device-id>VDOT_98992</device-id>
    <device-status>on</device-status>
    <cctv-info>
        <lastUpdate>2022-11-08T19:07:08.301257-05:00</lastUpdate>
        <feedID>98992</feedID>
        <urls>
            <url type="m3u8" access="public">http://s17.us-east-1.skyvdn.com:1935/rtplive/FairfaxVideo0470/playlist.m3u8</url>
            <url type="rtmp" access="public">rtmp://s17.us-east-1.skyvdn.com:1935/rtplive/FairfaxVideo0470</url>
            <url type="rtsp" access="public">rtsp://s17.us-east-1.skyvdn.com:554/rtplive/FairfaxVideo0470</url>
        </urls>
    </cctv-info>
    <location>
        <id>VDOT_98992_0</id>
        <description>I-95 MM 158 NB Exit 158, Route 294 - Prince William Pkwy</description>
        <center>
            <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="VDOT_98992_0_c">
                <ns2:pos srsDimension="2">-77.278145 38.6565</ns2:pos>
            </ns2:Point>
        </center>
        <pointLocation>
            <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="VDOT_98992_0_p1">
                <ns2:pos srsDimension="2">-77.278145 38.6565</ns2:pos>
            </ns2:Point>
            <onAddress>
                <road>
                    <prefix>I</prefix>
                    <route>95</route>
                    <direction>north</direction>
                    <milemarker>158</milemarker>
                </road>
                <state>Virginia</state>
                <country>USA</country>
            </onAddress>
        </pointLocation>
    </location>
</device>
```
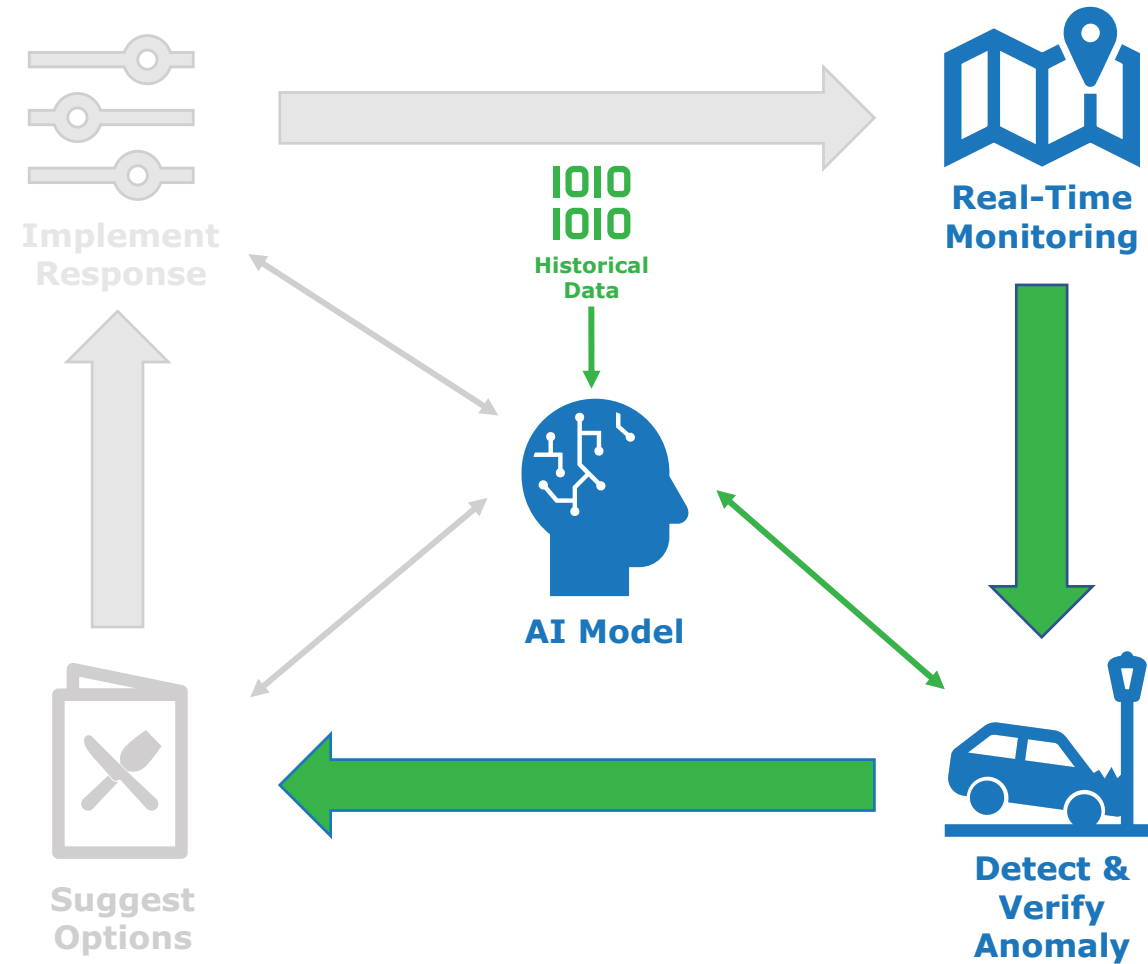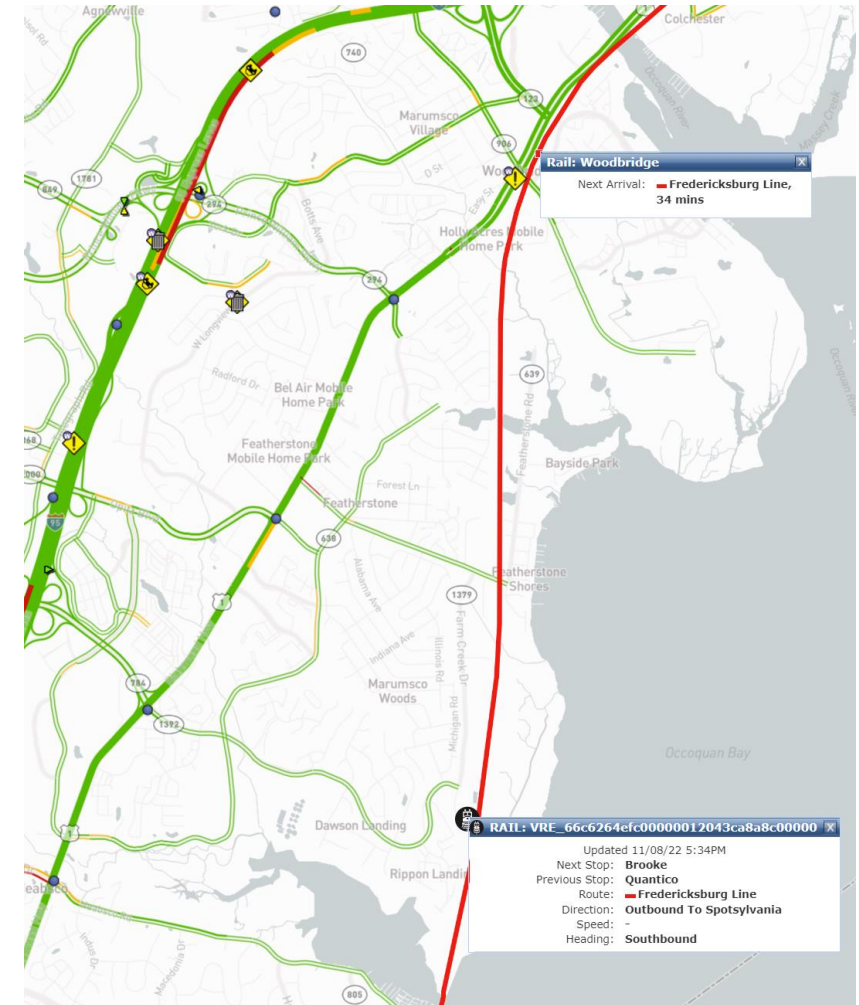
Stream URLs ←

Implement Response

Historical Data

Real-Time Monitoring

AI Model

Suggest Options

Detect & Verify Anomaly

Available Parking Capacity at VRE Stations

POST request to:

https://rm3p-api.ritis.org/rm3p/parking/

```
<parking-filter xmlns="http://www.ritis.org/schema/filter">
    <systems>
        <system>vre</system>
    </systems>
    <id-filters>
        <id>VRE_Woodbridge_Station_0</id>
    </id-filters>
</parking-filter>
```


Rail: Woodbridge

Next Arrival: Fredericksburg Line, 34 mins

RAIL: VRE_66c6264efc00000012043ca8a8c00000

Updated 11/08/22 5:34PM
Next Stop: Brooke
Previous Stop: Quantico
Route: Fredericksburg Line
Direction: Outbound To Spotsylvania
Speed: -
Heading: Southbound

Available Parking Capacity at VRE Stations

```xml
<parkingLot>
    <id>VRE_Woodbridge_Station</id>
    <name>Woodbridge Station</name>
    <totalSpaces>738</totalSpaces>                            ← Total parking capacity at this VRE station
    <location>
        <id>VRE_Woodbridge_Station_0</id>
        <center>
            <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="VRE_Woodbridge_Station_0_c">
                <ns2:pos srsDimension="2">-77.24634 38.660179</ns2:pos>
            </ns2:Point>
        </center>
        <pointLocation>
            <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="VRE_Woodbridge_Station_0_p1">
                <ns2:pos srsDimension="2">-77.24634 38.660179</ns2:pos>
            </ns2:Point>
            <onAddress>
                <road>
                    <name>1040 Express Way</name>
                </road>
                <city>Woodbridge</city>
                <zipcode>22191</zipcode>
                <state>Virginia</state>
                <country>USA</country>
            </onAddress>
        </pointLocation>
    </location>
    <status>
        <timestamp>2022-11-08T17:36:21.000-05.00</timestamp>
        <freeSpaces>692</freeSpaces>                          ← Currently free spaces
        <occupancyPercent>6</occupancyPercent>                ← Occupied %
        <availability>1</availability>                        ← Availability code (color)
    </status>
</parkingLot>
```

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POST request to:

https://rm3p-api.ritis.org/rm3p/transit/

```
<transit-filter xmlns="http://www.ritis.org/schema/filter">
    <systems>
        <system>prtc_va</system>
    </systems>
    <type>stop</type>
</transit-filter>
```
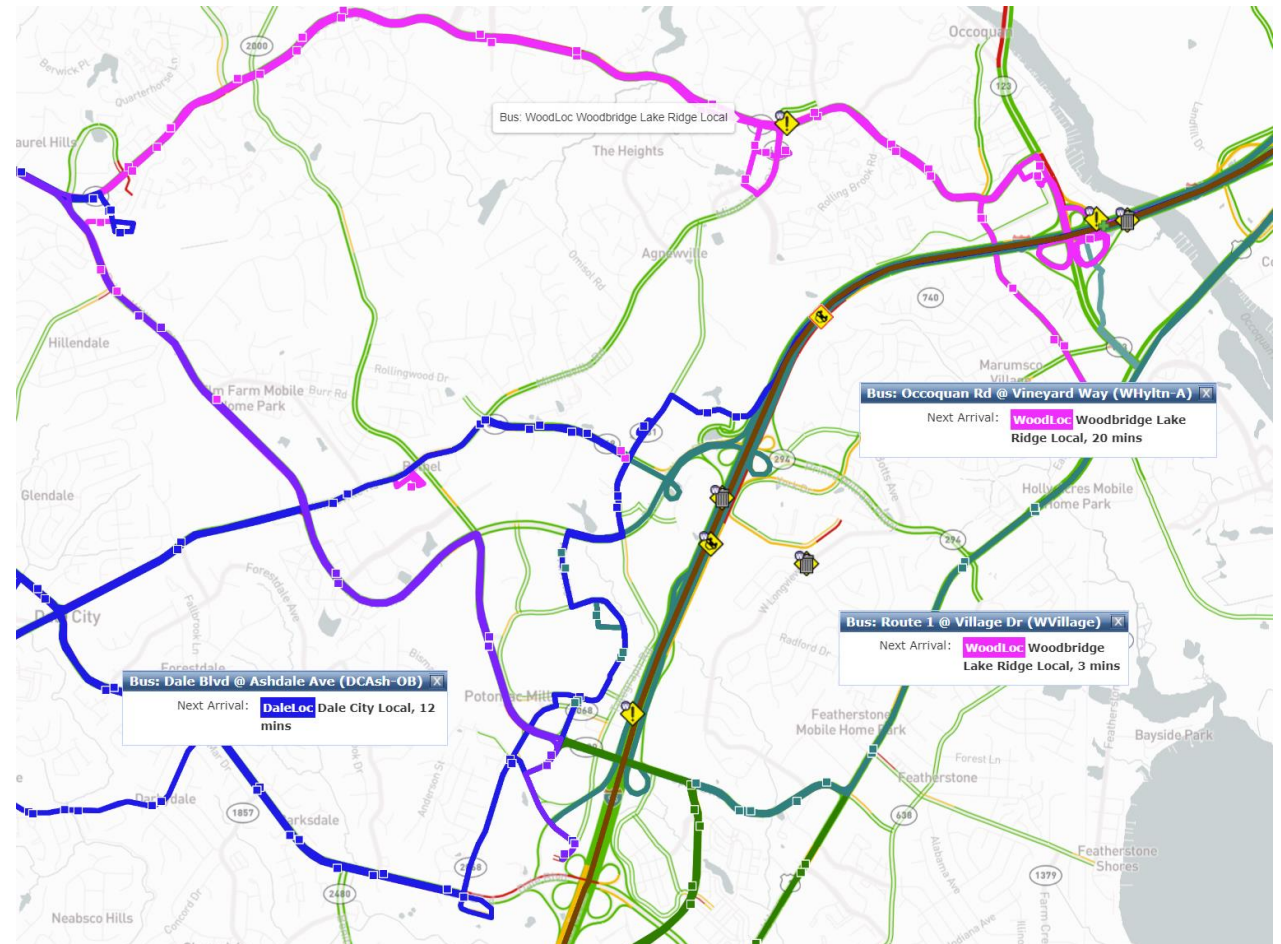
Local Transit System Status

```xml
<stop>
    <head>
        <id>PRTC_VA_1716</id>
        <agency>PRTC_VA</agency>
        <code>DCOpal</code>
        <name>Dale Blvd @ Opal Ln</name>
        <description>Dale City OmniLink / PRTC Transit Center</description>
        <type>Bus</type>
        <typeId>3</typeId>
    </head>
    <locationType>stop</locationType>
    <location>
        <id>PRTC_VA_1716_0</id>
        <center>
            <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="PRTC_VA_1716_0_c">
                <ns2:pos srsDimension="2">-77.395422 38.671302</ns2:pos>
            </ns2:Point>
        </center>
        <pointLocation>
            <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="PRTC_VA_1716_0_p1">
                <ns2:pos srsDimension="2">-77.395422 38.671302</ns2:pos>
            </ns2:Point>
        </pointLocation>
    </location>
    <schedules>
        <schedule>
            <tripID>PRTC_VA_176005</tripID>
            <routeID>PRTC_VA_3948</routeID>
            <routeLongName>Dale City Local</routeLongName>
            <routeShortName>DaleLoc</routeShortName>
            <routeColor>0000E6</routeColor>
            <description>Dale City OmniLink / PRTC Transit Center</description>
            <arrivalTime>2022-11-08T18:11:21-05:00</arrivalTime>
            <departureTime>2022-11-08T18:11:21-05:00</departureTime>
        </schedule>
        <schedule>
            <tripID>PRTC_VA_176051</tripID>
            <routeID>PRTC_VA_3948</routeID>
            <routeLongName>Dale City Local</routeLongName>
            <routeShortName>DaleLoc</routeShortName>
            <routeColor>0000E6</routeColor>
            <description>Dale City OmniLink / PRTC Transit Center</description>
            <arrivalTime>2022-11-08T18:11:21-05:00</arrivalTime>
            <departureTime>2022-11-08T18:11:21-05:00</departureTime>
        </schedule>
        <schedule>
            <tripID>PRTC_VA_176025</tripID>
            <routeID>PRTC_VA_3948</routeID>
            <routeLongName>Dale City Local</routeLongName>
            <routeShortName>DaleLoc</routeShortName>
            <routeColor>0000E6</routeColor>
            <description>Dale City OmniLink / PRTC Transit Center</description>
            <arrivalTime>2022-11-08T18:42:29-05:00</arrivalTime>
            <departureTime>2022-11-08T18:42:29-05:00</departureTime>
        </schedule>
        <schedule>
            <tripID>PRTC_VA_176071</tripID>
            <routeID>PRTC_VA_3948</routeID>
            <routeLongName>Dale City Local</routeLongName>
            <routeShortName>DaleLoc</routeShortName>
            <routeColor>0000E6</routeColor>
            <description>Dale City OmniLink / PRTC Transit Center</description>
            <arrivalTime>2022-11-08T18:42:29-05:00</arrivalTime>
            <departureTime>2022-11-08T18:42:29-05:00</departureTime>
        </schedule>
        <schedule>
            <tripID>PRTC_VA_176097</tripID>
            <routeID>PRTC_VA_3948</routeID>
            <routeLongName>Dale City Local</routeLongName>
            <routeShortName>DaleLoc</routeShortName>
            <routeColor>0000E6</routeColor>
            <description>Dale City OmniLink / PRTC Transit Center</description>
            <arrivalTime>2022-11-08T19:01:58-05:00</arrivalTime>
            <departureTime>2022-11-08T19:01:58-05:00</departureTime>
        </schedule>
    </schedules>
</stop>
```

```xml
<schedule>
    <tripID>PRTC_VA_176005</tripID>
    <routeID>PRTC_VA_3948</routeID>
    <routeLongName>Dale City Local</routeLongName>
    <routeShortName>DaleLoc</routeShortName>
    <routeColor>0000E6</routeColor>
    <description>Dale City OmniLink / PRTC Transit Center</description>
    <arrivalTime>2022-11-08T18:11:21-05:00</arrivalTime>
    <departureTime>2022-11-08T18:11:21-05:00</departureTime>
</schedule>
```

Current schedule at the given station

POST request to:

https://rm3p-api.ritis.org/rm3p/bike

```xml
<bike-filter xmlns="http://www.ritis.org/schema/filter">
    <system>capital_bikeshare</system>
    <type>free_bike_status</type>
</bike-filter>
```

Checking Available Bicycles from Capital Bikeshare

```
<freeBikeStatuses>
    <header>
        <sender>RITIS Filter</sender>
        <timestamp>2022-11-08T17:59:29.941-05:00</timestamp>
        <totalEntries>173</totalEntries>
        <filteredEntries>0</filteredEntries>
    </header>
    <statuses>
        <status>
            <id>CAPITAL_BIKESHARE_BIKE_02478c834cb3abae4350b5cc538a92f0</id>
            <updated>2022-11-08T17:57:31-05:00</updated>
            <type>electric_bike</type>                    ⟵ Type of bike available
            <location>
                <center>
                    <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="CAPITAL_BIKESHARE_BIKE_02478c834cb3abae4350b5cc538a92f0_c">   ⟵ Bike's location
                        <ns2:pos srsDimension="2">-76.986661 38.89977</ns2:pos>
                    </ns2:Point>
                </center>
                <pointLocation>
                    <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="CAPITAL_BIKESHARE_BIKE_02478c834cb3abae4350b5cc538a92f0_p1">
                        <ns2:pos srsDimension="2">-76.986661 38.89977</ns2:pos>
                    </ns2:Point>
                    <onAddress>
                        <county>District of Columbia</county>
                        <countyFull>District of Columbia</countyFull>
                        <state>District of Columbia</state>
                        <country>USA</country>
                    </onAddress>
                </pointLocation>
            </location>
            <reserved>false</reserved>                    ⟵ Bike status
            <disabled>false</disabled>
        </status>
        <status>
            <id>CAPITAL_BIKESHARE_BIKE_03b4fd469e5276e639f55091a03fda2b</id>
            <updated>2022-11-08T17:55:52-05:00</updated>
            <type>electric_bike</type>
            <location>
                <center>
                    <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="CAPITAL_BIKESHARE_BIKE_03b4fd469e5276e639f55091a03fda2b_c">
                        <ns2:pos srsDimension="2">-77.034796 38.900308</ns2:pos>
                    </ns2:Point>
                </center>
                <pointLocation>
                    <ns2:Point xmlns:ns2="http://www.opengis.net/gml/3.2" srsName="EPSG:4326" ns2:id="CAPITAL_BIKESHARE_BIKE_03b4fd469e5276e639f55091a03fda2b_p1">
                        <ns2:pos srsDimension="2">-77.034796 38.900308</ns2:pos>
                    </ns2:Point>
                    <onAddress>
                        <county>District of Columbia</county>
                        <countyFull>District of Columbia</countyFull>
                        <state>District of Columbia</state>
                        <country>USA</country>
                    </onAddress>
                </pointLocation>
            </location>
            <reserved>false</reserved>
            <disabled>false</disabled>
        </status>
```

Checking the Current Toll Rates on Express Lanes

POST request to:

https://rm3p-api.ritis.org/rm3p/toll/

```
<toll-filter xmlns="http://www.ritis.org/schema/filter">
    <systems>
        <system>vdot</system>
    </systems>
</toll-filter>
```

```xml
<rate>
    <odPair>GARRISONVILLE TO GORDON BLVD VIA I-95</odPair>
    <startZone>1-1 NB TP</startZone>
    <endZone>2N-2 NB TP</endZone>
    <rate>4.75</rate>          <-------------------- Current toll rate
    <startTime>2022-06-23T19:53:33-04:00</startTime>
    <endTime>2022-06-23T20:03:33-04:00</endTime>
    <calculatedTime>2022-06-23T20:00:07-04:00</calculatedTime>
    <location>
        <pointLocation>
            <onAddress>
                <road>
                    <prefix>I</prefix>
                    <route>95</route>
                    <name>I-95-SB</name>
                </road>
                <state>Virginia</state>
                <country>USA</country>
            </onAddress>
        </pointLocation>
    </location>
</rate>
```
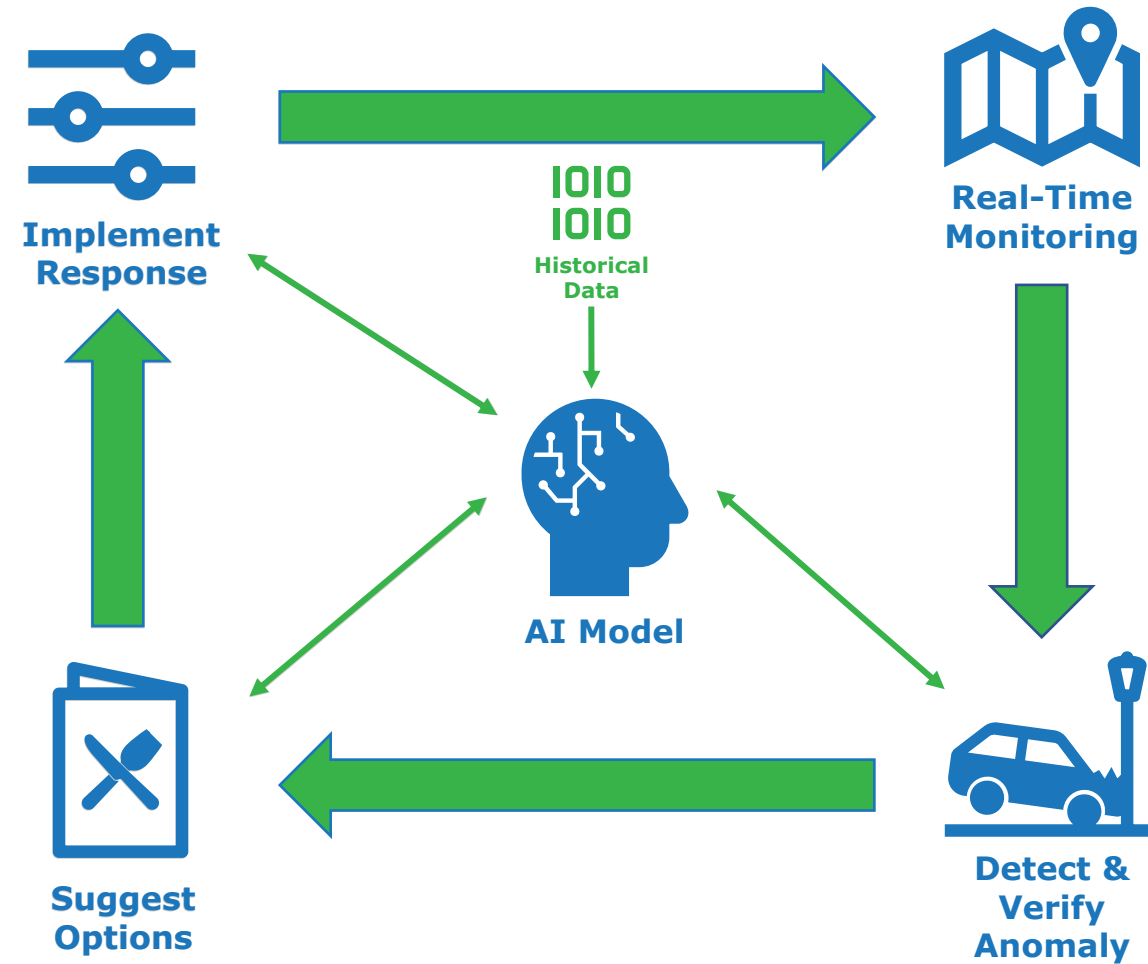
Implement Response

Historical Data

Real-Time Monitoring

AI Model

Suggest Options

Detect & Verify Anomaly

Thank You for Your Participation

For any questions, please contact us at:
rm3p@vdot.virginia.gov

Regional Multi-Modal Mobility Program