The Sidewalk Doesn't End:
Using Open Data Standards in Transportation

Topics

- What is Open Data Standards?

- Real Examples

- Smart Cities

- What Implementation would look like

- Takeaways

Open Data

Open Data

The idea that some data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control.

Open Charlotte
City of Charlotte Open Data Portal

Search for open data

Welcome to Open Charlotte

Providing accessible City services, operations and statistical data to promote community engagement, stimulate innovation and increase productivity.

311/Services	Arts & Education	Business & Budget
Community Safety	City Government	Neighborhoods & Housing
Transportation	Environment	Demographics
Planning & Zoning	Map Features	Historical Data

http://clt.charlotte.opendata.arcgis.com/

Wake County Open Data

Search for open data
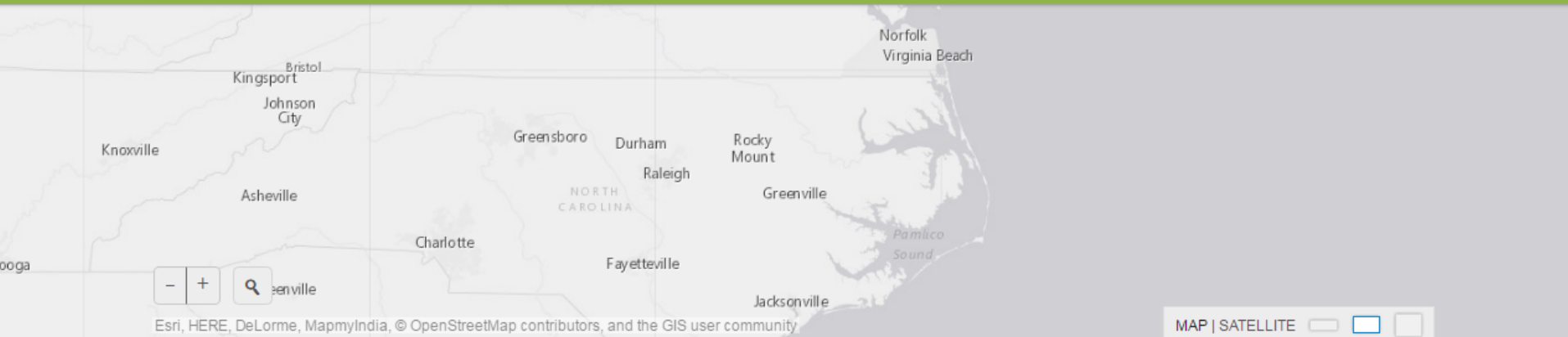
☐ SEARCH WITHIN MAP

My Activity

Welcome to our Open Data Portal

Our mission is to make high-quality information and source data accessible to all stakeholders to facilitate informed decision-making. This site offers the ability to Search, Filter, Download and use API Access to High Quality datasets.

Learn more about Open Data at Wake

Businesses, Government Agencies, Non Profits, Neighborhood Groups & Citizens can find data here in a variety of formats for use in Spreadsheets, Analytical Software and Apps.

We hope that you'll give us your feedback & tell us your Success Story!

Boundaries   Demographics   Electoral   Environment   Public Libraries

Public Safety   Parks   Property   Transportation   Zoning

http://data.wake.opendata.arcgis.com/

Search for open data 🔍 ☐ SEARCH WITHIN MAP

Morganton

Asheville

− + 🔍

MAP | SATELLITE

City of Asheville Open Data Portal

Connecting the citizens of Asheville with city data.

Find Data

Arts Culture and History

Boundaries

Buncombe County

Business

Environmental

Municipal

Planning/Zoning

Property and Addresses

Public Safety

Transportation

Buncombe County Addresses
Buncombe County Addresses

BY CMCNAMARA_AVL APRIL 12, 2016

Buncombe County Parcels
Buncombe County Parcels

BY CMCNAMARA_AVL APRIL 12, 2016

Traffic Signals
Traffic Counts and Traffic Signals

BY CMCNAMARA_AVL APRIL 08, 2016

NCDOT Traffic AADT
Traffic Counts and Traffic Signals

BY CMCNAMARA_AVL APRIL 08, 2016

Traffic Counts View
Traffic Counts and Traffic Signals

BY CMCNAMARA_AVL APRIL 08, 2016

http://data.ashevillenc.gov/

https://data.greensboro-nc.gov/

Steven Adler

Open Data, Data Governance, Social Data Scientist

"Often Open Data is hard to compare to other sources, even across administrative departments located in the same building. Open Data from more than one source has to be aggregated, normalized, cleansed, checked for quality, verified for authenticity, and validated for terms of use, at huge expense before it can be analyzed."

MORE CHOICES. BETTER ACCESS.

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MORE CHOICES. BETTER ACCESS.

Open Data Standards

A set of standards in which Open Data is formatted in to Improve the quality, effectiveness and reliability of data that includes, but is not limited too: Data Licenses, Data Quality, Data Versioning, Metadata, Data Vocabularies, Data Formats, and Data Commonality.

Real Life

A Guide to the **General Transit Feed Specification**

TRANSIT SYSTEM
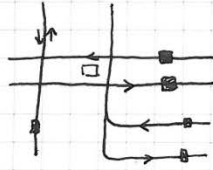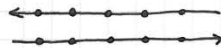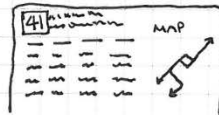
Table names of .txt files shown in red boxes.
Fields linking tables in red text.

FARES
fare.attributes
fare_id
fare_rules

agency

MAPS

ROUTES

agency.id
route.id

routes   shapes

route.id   shape.id

TRIPS   CALENDAR
MAP   JAN.

trips
service.id
calendar
calendar_dates

trip_id

STOPS   TRANSFERS

stop_times

stop_id
stop_id
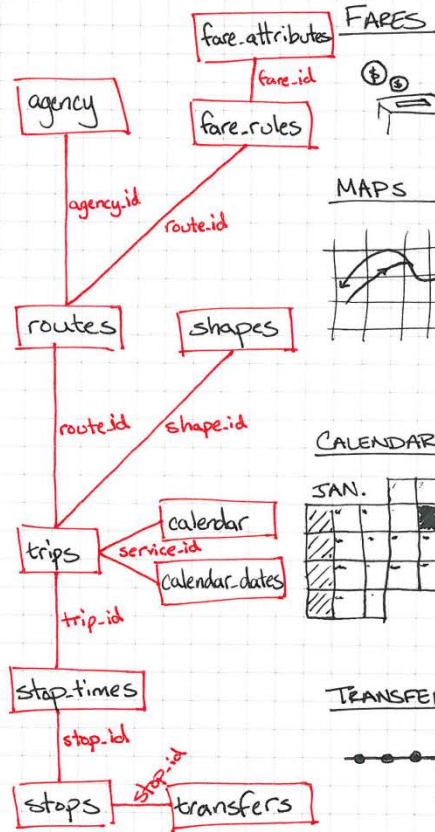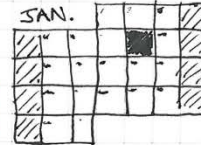
stops   transfers
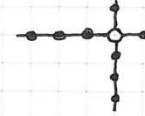
Not shown: feed.info.txt, frequencies.txt

James

About GTFS

- GTFS is a series of 11 files that translate in transit data into a machine readable format.

- *Machine-readable data is data (or metadata) which is in a **format** that can be understood by a computer. This is generally data file **formats** intended principally for processing by machines (RDF, XML, JSON).

Files

- Agency.txt
- Blocks.txt
- Calendar.txt
- Calendar_dates.txt
- Fares.txt
- Feed_info.txt
- Frequencies.txt

- Routes.txt
- Shapes.txt
- Stop_Times.txt
- Stops.txt
- Transfers.txt
- Trips.txt

PLEASE
Take A
Number

A84

https://developers.google.com/transit/gtfs/

GTFS-Realtime

GTFS-Realtime

- Small text file

- Hosted on Google Transit Partner site or organizations website

- More useful than just for Google
  - Anyone could use it in an application

- Computer readable format

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parttransportation@gmail.com
Change account | Sign out

Realtime Transit ✕   Search

Products ﹥ Transit ﹥ Realtime Transit

🚆 **Realtime Transit**

2011

GUIDES   REFERENCE   SAMPLES

Introduction
Feed Types
Trip Updates
Service Alerts
Vehicle Positions

What is GTFS-realtime?

☆ ☆ ☆ ☆ ☆

GTFS-realtime is a feed specification that allows public transportation agencies to provide realtime updates about their fleet to application developers. It is an extension to GTFS (General Transit Feed Specification), an open data format for public transportation schedules and associated geographic information. GTFS-realtime was designed around ease of implementation, good GTFS interoperability and a focus on passenger information.

The specification was designed through a partnership of the initial Live Transit Updates partner agencies, a number of transit developers and Google. The specification is published under the Apache 2.0 License.

How do I start?

1. Continue reading the overview below.
2. Decide which feed types you will be providing.
3. Take a look at example feeds.
4. Create your own feeds using the reference.
5. Publish your feed.

Overview of GTFS-realtime feed types

The specification currently supports the following types of information:

- **Trip updates** - delays, cancellations, changed routes
- **Service alerts** - stop moved, unforeseen events affecting a station, route or the entire network
- **Vehicle positions** - information about the vehicles including location and congestion level

Updates of each type are provided in a separate feed. Feeds are served via HTTP and updated frequently. The file itself is a regular binary file, so any type of webserver can host and serve the file (other transfer protocols might be used as well). Alternatively, web application servers could also be used which as a response to a valid HTTP GET request will return the feed. There are no constraints on how frequently nor on the exact method of how the feed should be updated or retrieved.

Contents
How do I start?
Overview of GTFS-realtime feed types
Data format
Data structure
Getting Help
Google Maps and Live Transit Updates

https://developers.google.com/transit/gtfs-realtime/

3 Types of Feeds

Service Alerts

- Inform user of higher level problems and are atypical

- Alerts are given in a textual description

- Examples of service alerts
  - Detours
  - Moved stops
  - Special events causing delays

- "Station Y is closed due to construction"

Trip Updates

- Works with GPS devices to give up to date information

- Uses GTFS data and calculates how long it will take to get to the stop

- "Bus X is delayed by 5 minutes"

https://developers.google.com/transit/gtfs-realtime/trip-updates

Vehicle Positions

- Works with GPS devices to give up to date vehicle positions

- Sends Over Information:
  - X and Y Coordinates
  - Odometer
  - Bearing
  - Speed

What about Roads?

Sewer Line Work on Walker Avenue Extended Through March 4

Posted Date: 2/19/2016 9:00 AM

Due to recent inclement weather, sewer line rehabilitation and road work on the 2400 block of Walker Avenue has been extended through Friday, March 4. Work will continue between 9 am and 4 pm each day. Road closure signs are in place and motorists are encouraged to use alternate routes to avoid the area. Delays should be expected through the work zone.

#

Current System (RSS)

- Communicates to everyone who subscribes

- Hosts data on website

- May not be geographically tagged

- Information generally stored in text (not computer readable)

- Is not standardized

https://developers.google.com/transit/gtfs-realtime/trip-updates

Finally! An open format for publishing your road event data

ABOUT THE STANDARD

The open data movement has demonstrated its value to society on many occasions, particularly with recent efforts to improve information about transit systems. Following the example of other formats like GTFS, Open511 proposes a specification for road incident, construction and much more that matches open data criteria. With Open511, public bodies and citizens can get the most out of your jurisdiction's data by turning your road events into powerful and innovative software and analysis.

WHY OPEN ROAD EVENTS?

Welcome to Open511

Open511 is the open standard for sharing road and construction data. Read more at open511.org.

To try out our editing interface, log in (see the link in the upper right) with username **demo**, password **demo**.

http://demo.open511.org/map/

Open-511

- Small text file

- Hosted on organization's or City's website

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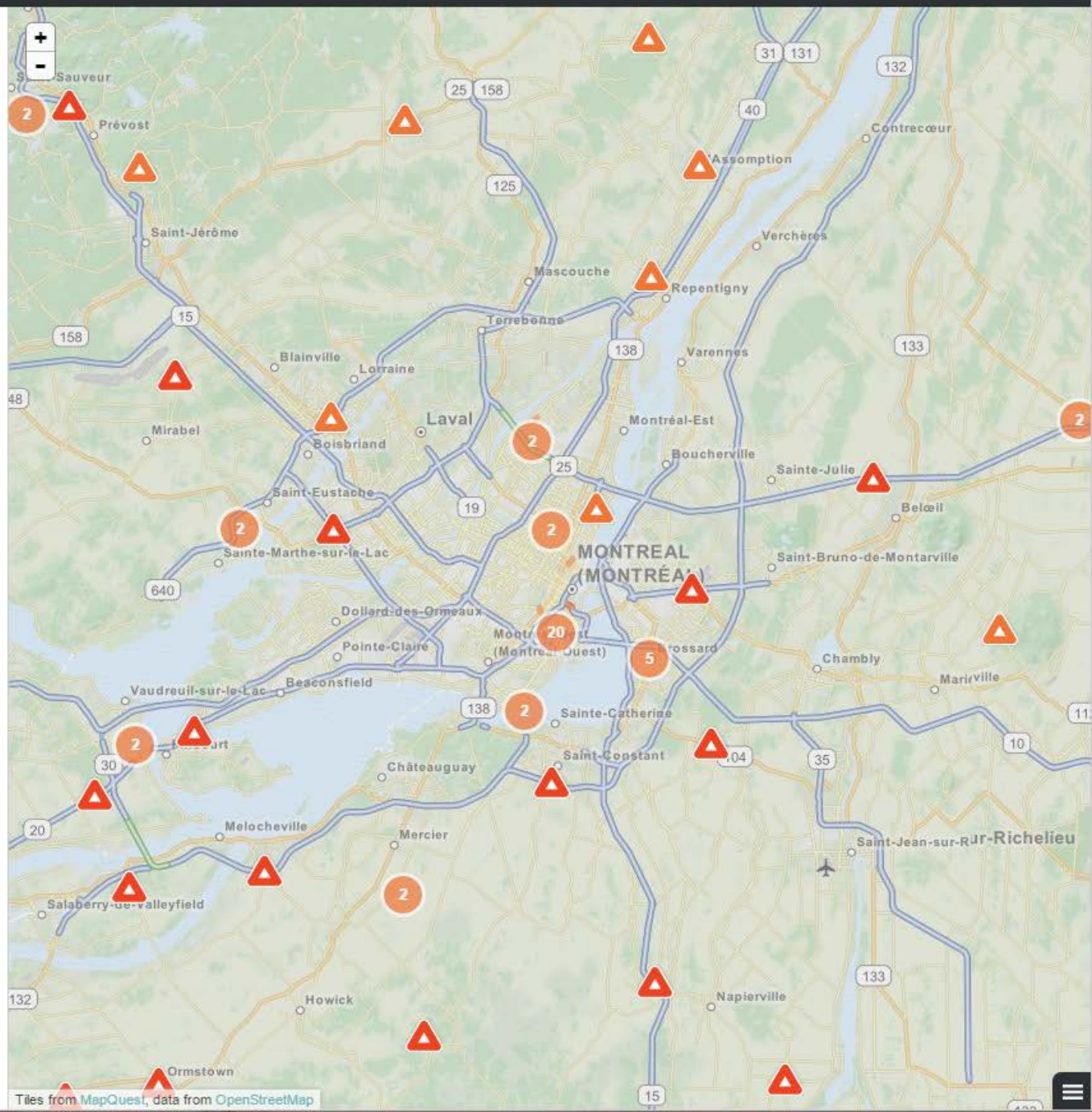
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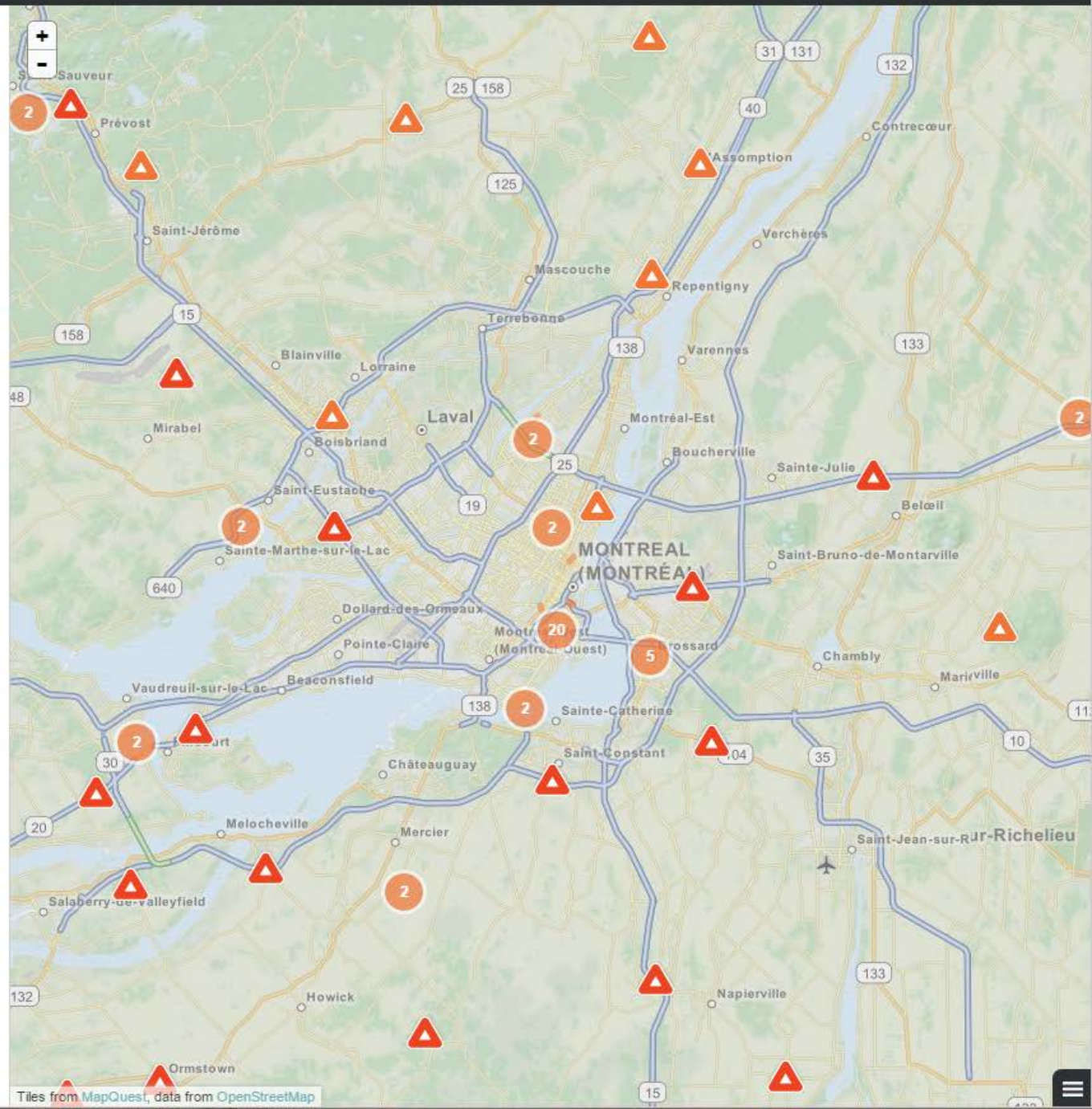http://demo.open511.org/map/

Tiles from MapQuest, data from OpenStreetMap

```json
{
  "events": {
    {
      "url": "/events/data.greensboro-nc.gov/32956/",
      "id": "data.greensboro-nc.gov/32956/",
      "jurisdiction_url": "http://data.greensboro-nc/open511/jurisdiction/greensboro-nc.gov/",
      "headline": "Sewer Line Work on Walker Avenue Extended Through March 4",
      "description": "Due to recent inclement weather, sewer line rehabilitation and road work on the 2400 block
          Walker Avenue has been extended through Friday, March 4. Work will continue between 9 am and 4 pm each
          closure signs are in place and motorists are encouraged to use alternate routes to avoid the area. Dela
          be expected through the work zone.",
      "status": "ACTIVE",
      "event_type": "CONSTRUCTION",
      "event_subtypes": "EMERGENCY_MAINTENANCE",
      "updated": "2016-04-04T09:00:00Z",
      "created": "2016-19-02T09:00:00Z",
      "severity": "MODERATE",
      "detour": "N/A",
      "grouped_events": [
        "/events/data.greensboro-nc.gov/254584/",
        "/events/data.greensboro-nc.gov/254584/"
      ],
      "attachements": [
        {
          "url": "http://data.greensboro-nc.gov/traffic/advisory/39473/com.pdf",
          "length": "200345",
          "type": "application/pdf",
```

PART
pindmont authority for regional transportation

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△ OPEN511

EVENTS

Overview

purpose	The event resource provides information about road events (accidents, constructions, special events). The `events` resource is a list of `event` elements matching the filtering parameters if any are provided.
method	GET

Parameters

In addition to the filters described below, some URL parameters are common to all resources: format, version, accept-language, and limit.

Parameter	Required/optional	Description
status	optional	By default the API should only send events where the `status` field is ACTIVE. Supported filter values: • `ACTIVE` Default value, returns only active events.

Resources
Root (Discovery)
Jurisdiction
Jurisdiction geography
Events
Areas

Common
Introduction
Tech Requirements
Context

Getting Started
For data consumers
For data providers

Tools
Validator
Event viewer
Implementation demo

Versions
1.0 (current)
0.9
History

Contribute
Submit an issue or a comment
Join the mailing list
Contact

Drafts

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```json
{
  "events": {
    {
      "url": "/events/data.greensboro-nc.gov/32956/",
      "id": "data.greensboro-nc.gov/32956/",
      "jurisdiction_url": "http://data.greensboro-nc/open511/jurisdiction/greensboro-nc.gov/",
      "headline": "Sewer Line Work on Walker Avenue Extended Through March 4",
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      "detour": "N/A",
      "grouped_events": [
        "/events/data.greensboro-nc.gov/254584/",
        "/events/data.greensboro-nc.gov/254584/"
      ],
      "attachments": [
        {
          "url": "http://data.greensboro-nc.gov/traffic/advisory/39473/com.pdf",
          "length": "200345",
          "type": "application/pdf",
```

Description

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{
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    {
      "url": "/events/data.greensboro-nc.gov/32956/",
      "id": "data.greensboro-nc.gov/32956/",
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        "/events/data.greensboro-nc.gov/254584/",
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      ],
      "attachments": [
        {
          "url": "http://data.greensboro-nc.gov/traffic/advisory/39473/com.pdf",
          "length": "200345",
          "type": "application/pdf",
```

Description Categories

```
21          "/events/data.greensboro-nc.gov/254584/"
22        ],
23       "attachements": [
24          {
25            "url": "http://data.greensboro-nc.gov/traffic/advisory/39473/com.pdf",
26            "length": "200345",
27            "type": "application/pdf",
28            "title": "Detour map",
29            "hreflang": "en"
30          }
31        ],
32       "geography": {
33          "type": "LineString",
34          "coordinates": [
35              [
36                   -79.831941600743349,
37                   36.06885556271353
38              ],
39              [
40                   -79.832458554150975,
41                   36.068874774602101
42              ],
43              [
44                   -79.833124057388247,
45                   36.068889183515417
46              ],
47              [
```

Attachments

Geography

```json
      "/events/data.greensboro-nc.gov/254584/"
    ],
    "attachements": [
      {
        "url": "http://data.greensboro-nc.gov/traffic/advisory/39473/com.pdf",
        "length": "200345",
        "type": "application/pdf",
        "title": "Detour map",
        "hreflang": "en"
      }
    ],
    "geography": {
      "type": "LineString",
      "coordinates": [
          [
              -79.831941600743349,
              36.06885556271353
          ],
          [
              -79.832458554150975,
              36.068874774602101
          ],
          [
              -79.833124057388247,
              36.068889183515417
          ],
          [
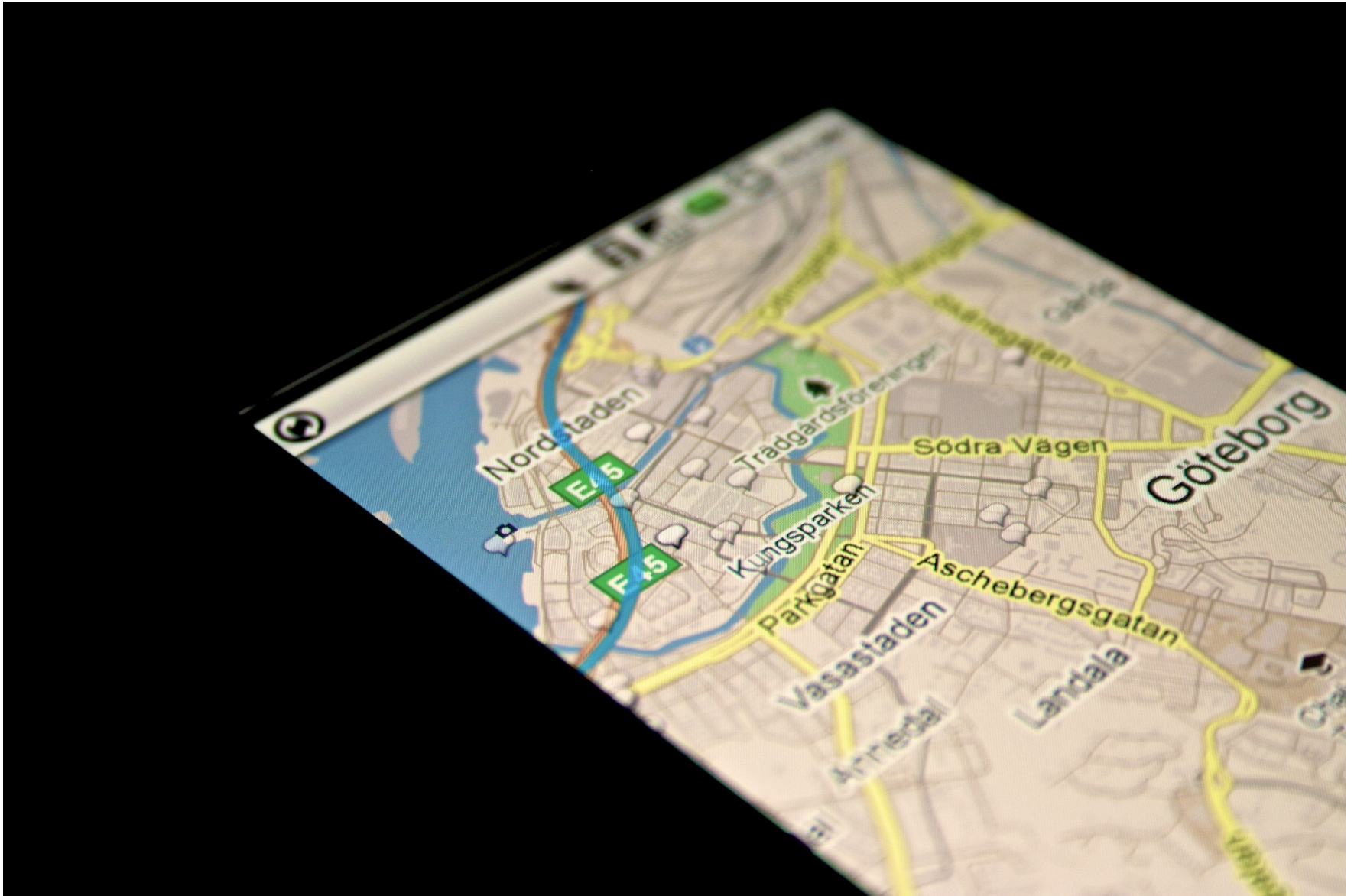```

```
43          [
44                  -79.833124057388247,
45                  36.068889183515417
46          ],
47          [
48                  -79.833641010795844,
49                  36.068908395395709
50          ]
51      ]
52  },
```

Time Constraints

```
53      "schedule": {
54        "recurring_schedules": [
55          "start_date": "2016-02-19",
56          "end_date": "2016-03-04",
57          "daily_start_time": "09:00",
58          "daily_end_time": "16:00"
59        ]
60      }
61
62
63    }
64
65  }
66
67
68 }
69
```

PART

pledmont authority for regional transportation

MORE CHOICES. BETTER ACCESS.

Why?

GTFS + Open511

Geography

```
21        "/events/data.greensboro-nc.gov/254584/"
22      ],
23      "attachements": [
24        {
25          "url": "http://data.greensboro-nc.gov/traffic/advisory/39473/com.pdf",
26          "length": "200345",
27          "type": "application/pdf",
28          "title": "Detour map",
29          "hreflang": "en"
30        }
31      ],
32      "geography": {
33        "type": "LineString",
34        "coordinates": [
35          [
36              -79.831941600743349,
37              36.06885556271353
38          ],
39          [
40              -79.832458554150975,
41              36.068874774602101
42          ],
43          [
44              -79.833124057388247,
45              36.068889183515417
46          ],
47          [
```

PART

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shapes.csv

```
1   shape_id,shape_pt_lat,shape_pt_lon,shape_pt_sequence
2   6B_16:07,36.05759811,-80.30339813,0
3   6B_16:07,36.05759811,-80.30349731,1
4   6B_16:07,36.05720139,-80.30400085,2
5   6B_16:07,36.05749893,-80.30439758,3
6   6B_16:07,36.05799866,-80.30500031,4
7   6B_16:07,36.05820084,-80.30539703,5
8   6B_16:07,36.05860138,-80.30599976,6
9   6B_16:07,36.05860138,-80.30609894,7
10  6B_16:07,36.05879974,-80.3065033,8
11  6B_16:07,36.05889893,-80.30680084,9
12  6B_16:07,36.05899811,-80.30699921,10
13  6B_16:07,36.05899811,-80.30709839,11
14  6B_16:07,36.0591011,-80.30719757,12
15  6B_16:07,36.05939865,-80.30699921,13
16  6B_16:07,36.05950165,-80.30680084,14
17  6B_16:07,36.05970001,-80.30660248,15
18  6B_16:07,36.05979919,-80.3062973,16
19  6B_16:07,36.05979919,-80.30590057,17
20  6B_16:07,36.05989838,-80.30560303,18
21  6B_16:07,36.06000137,-80.30539703,19
22  6B_16:07,36.06010056,-80.30519867,20
23  6B_16:07,36.06019974,-80.30509949,21
24  6B_16:07,36.06029892,-80.30500031,22
25  6B_16:07,36.0603981,-80.30490112,23
26  6B_16:07,36.0605011,-80.30480194,24
27  6B_16:07,36.06069946,-80.30470276,25
28  6B_16:07,36.06100082,-80.30470276,26
29  6B_16:07,36.06110001,-80.30470276,27
30  6B_16:07,36.06150055,-80.30480194,28
```

Route > Agency

```
agency.txt                    ✕

1   agency_id,agency_name,agency_url,agency_timezone,agency_lang,agency_phone,agency_fare_url,agency_email
2   1,Piedmont Authority for Regional
•   Transportation,http://www.partnc.org/index.htm,America/New_York,en,1-800-588-7787,http://www.partnc.org/part-express-fares/,contactus@partnc.org
3
```

MORE CHOICES. BETTER ACCESS.

Why not do this for roads?

Overview   FAQ   Other content tools

Base Map Data   Cities in 3D   Imagery   Street View   Transit

Base Map Partner Program

Improve and enrich the map of your community

One of the exciting things about maps and geography is that the world is a constantly changing place and keeping on top of these changes is a never-ending endeavor. We recognize that in order to provide our users with the best, most up-to-date map possible, we must partner with the most comprehensive and authoritative data sources.

If your organization has authoritative vector data that would substantially improve the base map in Google Maps and Google Earth, we would like to hear from you. Check out our data format specifications and tell us about your data.

There are many benefits of adding your vector data to Google's base map:

- Improve navigation through your community with new roads and housing developments, bike paths and parcel data.
- Update major landmarks, natural features, and places of interest in your area.
- Ensure accurate representation of critical infrastructure like hospitals, police stations and airports.

Examples of how we've improved our U.S. base map with authoritative data sources

National parks, forests, and other public lands in the Pacific Northwest, based on data from the USDA Forest

Have Data? Get Started

"An important part of the mission of the USDA Forest Service is informing the public about the forests and grasslands we manage. In order to achieve this, we want information about our lands to be accessible to as large an audience as possible. We are very pleased that Google has used our geospatial datasets to improve the base map in Google Maps and Google Earth so that everyone can easily discover, navigate and enjoy these public lands."

- David George, Geospatial Service and Technology Center, USDA Forest Service

Have suggested edits?

Do you have a number of edits to the map to suggest (but no large datasets to provide)? Try our tool for easily suggesting edits to the map or use Google Map Maker.

https://maps.google.com/help/maps/mapcontent/basemap/

Map Content Partners Help

In what data formats does Google accept base map data?

Learn about the data formats we accept in Google's Complete Map Content Specifications.

We do accept all formats of base map (vector) data; however, when data is submitted in the formats described below, it makes it easier and quicker for Google to ingest it.

Supported data formats are:

- ESRI Shapefile
- MapInfo TAB
- KML/KMZ with the data represented as SchemaData and SimpleFields (preferred) or ExtendedData.
- DBF or CSV - If CSV, make sure it is comma-delimited, with each column surrounded by quotes to prevent issues with commas in names, etc. Also ensure that there is a header row.
- ESRI GeoDatabase (prefer data exported into individual shapefiles)

Google is aware that some users may use AutoCad. However, the above formats are strongly preferred.

Additionally:

- Please use UTF-8 character encoding for vector attributes. UTF-16 and UTF-32 are also accepted.
- Please, no special character encodings!
- We prefer files to be < 1GB.
- For lookup tables, DBF or CSV is acceptable. If CSV, make sure it is comma-delimited, with each column surrounded by quotes to prevent issues with commas in names, etc. Also ensure that there is a header row.
- FGDC formatted Metadata recommended.
- We do not have standards on field types, field widths, domains, etc.
- Please refer to the the Help Section about WMS and WFS. (FIXME: Insert link)

Base Map (Vector) Data

- What categories of base map data is Google currently accepting?
- **In what data formats does Google accept base map data?**
- How should I format addresses?
- How should vector geometry be represented?
- How should names be represented in the attribute table?
- What are the requirements for parks and protected areas?
- What are the requirements for points of interest (POI) ?
- What are the requirements for building footprints?
- What are the requirements for parcels?
- What are the requirements for address points?
- What are the requirements for road networks?

https://support.google.com/mapcontentpartners/answer/160408?hl=en&ref_topic=24789

Map Content Partners Help

In what data formats does Google accept base map data?

Learn about the data formats we accept in Google's Complete Map Content Specifications.

We do accept all formats of base map (vector) data; however, when data is submitted in the formats described below, it makes it easier and quicker for Google to ingest it.

Supported data formats are:

- ESRI Shapefile
- MapInfo TAB
- KML/KMZ with the data represented as SchemaData and SimpleFields (preferred) or ExtendedData.
- DBF or CSV - If CSV, make sure it is comma-delimited, with each column surrounded by quotes to prevent issues with commas in names, etc. Also ensure that there is a header row.
- ESRI GeoDatabase (prefer data exported into individual shapefiles)

Google is aware that some users may use AutoCad. However, the above formats are strongly preferred.

Additionally:

- Please use UTF-8 character encoding for vector attributes. UTF-16 and UTF-32 are also accepted.
- Please, no special character encodings!
- We prefer files to be < 1GB.
- For lookup tables, DBF or CSV is acceptable. If CSV, make sure it is comma-delimited, with each column surrounded by quotes to prevent issues with commas in names, etc. Also ensure that there is a header row.
- FGDC formatted Metadata recommended.
- We do not have standards on field types, field widths, domains, etc.
- Please refer to the the Help Section about WMS and WFS. (FIXME: Insert link)

Base Map (Vector) Data

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What are the requirements for road networks?

Learn about the data formats we accept in Google's Complete Map Content Specifications.

Google is presently accepted two specific types of network data: new roads, and bicycle and pedestrian paths.

- Use a segment-based representation: a segment is part of a road between two intersections. We can not accept roads that have multiple intersections hanging off of them.
- The street format is similar in many ways to the address format, with the exception of the different street number format.
- All address ranges should be specified relative to the the geometry (that is, the right side is to the right of the path from the start of the segment to the end of the segment).

The following fields are useful for roads and bike and pedestrian paths. Fields marked as "optional for BP" are not necessary for bike and pedestrian paths:

Field	Description	Example values
ID	A unique and stable identifier for the road segment	Any alphanumeric string (e.g. "14232514")
AR_RT_FR (optional for BP)	Starting address on right hand side, relative to geometry	42
AR_RT_TO (optional for BP)	Ending address on right hand side, relative to geometry	58
AR_LT_FR (optional for BP)	Starting address on left hand side, relative to geometry	41
AR_LT_TO (optional for BP)	Ending address on left hand side, relative to geometry	57

Base Map (Vector) Data

What categories of base map data is Google currently accepting?

In what data formats does Google accept base map data?

How should I format addresses?

How should vector geometry be represented?

How should names be represented in the attribute table?

What are the requirements for parks and protected areas?

What are the requirements for points of interest (POI) ?

What are the requirements for building footprints?

What are the requirements for parcels?

What are the requirements for address points?

What are the requirements for road networks?

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This is how cities get smarter

Data

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