Sun Cloud Data Layers & Sustainability Plan

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Prepared by High Street Consulting Group with support from Kittelson and Associates under the oversight of Edward Brown and the Maricopa Association of Governments.

Inquiries to Mark Egge (egge@highstreetconsulting.com)

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# Overview

This document describes the data layers produced during the Sun Cloud AID Grant Phase II project and how to keep these data layers up to date over time.

These data layers are, generally speaking, collected and presented in the Sun Cloud Transportation Layers map: <https://azgeo.maps.arcgis.com/apps/mapviewer/index.html?webmap=27491fa8ca0b468cbcd57f0e77f65e4d>

The map above is the core data source for the Sun Cloud Explorer app: https://suncloud.azgeo.az.gov/

A few additional layers were produced but not ultimately included in the map or app linked above. These are noted at the end of this document.

Where possible, layers are based on the linework (and, in some cases, attributes) from Arizona DOT’s ATIS Event Layers. ADOT’s ATIS Event Layers are available here: <https://azgeo-open-data-agic.hub.arcgis.com/maps/azgeo::adot-highway-performance-monitoring-system-hpms-2020-data-/about>

These are the data layers:

Table Sun Cloud Data Layers (Phase II)

|  |  |
| --- | --- |
| Layer (with hyperlink) | Description |
| [Sun Cloud Performance Scores](https://azgeo.maps.arcgis.com/home/item.html?id=ffe3c0ac1483453c8ebfb991094007db) | Calculated needs scores for the Sun Cloud performance measures (based on data in other layers) |
| Safety [Junctions](https://azgeo.maps.arcgis.com/home/item.html?id=b7ab2303e3bd4e58a1e0a8964b07a951) and [Road Segments](https://azgeo.maps.arcgis.com/home/item.html?id=fdb09b5629514b6fadea59c86b764045) | Safety performance (observed and predicted crashes) |
| [Bridge Condition](https://azgeo.maps.arcgis.com/home/item.html?id=82c9157878ef40fca9cf8c07cbad1abb) | NBI Bridge Condition for Bridges and Culverts |
| [Pavement Roughness (NIRA Dynamics)](https://azgeo.maps.arcgis.com/home/item.html?id=fb7ae2ac7c5843db9485d17528c69af2) | IRI values for Sun Cloud routes from NIRA Dynamics connected vehicle data |
| [Pavement Condition (Regionally Compiled)](https://azgeo.maps.arcgis.com/home/item.html?id=e79f2d4b527b407cb24231917ff12888) | Compilation of regional pavement condition data in good, fair, poor condition. |
| [Transit Ridership](https://azgeo.maps.arcgis.com/home/item.html?id=befeb867ccaa443d849157ca9d13a433) | Ridership by transit route |
| [Travel Demand & Future Roadways](https://azgeo.maps.arcgis.com/home/item.html?id=b937984b5f0c4660aeca101ded306425) | Combined MAG, PAG, SVMPO and ADOT travel demand models. |
| [Travel Times](https://azgeo.maps.arcgis.com/home/item.html?id=f8447272002e490b8664263f5b3f9819) | INRIX travel time reliability and delay data |
| [Freight Flows](https://azgeo.maps.arcgis.com/home/item.html?id=13a9b6c6e13040d285a13d33354f3859) | Regional freight flows based on ATRI GPS data |
| [Freight Routes](https://azgeo.maps.arcgis.com/home/item.html?id=02bddff561894281981c566784898e40) | Designated critical freight routes |
| [Disadvantaged Facility Users](https://azgeo.maps.arcgis.com/home/item.html?id=4508e1a487524e8d8e5b192acaec72ac) | Replica-derived estimates of the portion of users on any given roadway segment from disadvantaged areas |
| [Broadband Coverage](https://azgeo.maps.arcgis.com/home/item.html?id=389a0988f77d4b8fa7f1e5840358e0ea) | Broadband availability and speeds by population and households from Ookla Speedtest data |
| [MS2 Traffic Counts](https://azgeo.maps.arcgis.com/home/item.html?id=a1c58439c0bd4a69a40df107c8231e3e) | Traffic count data from ADOT’s MS2 instance |
| [Environmental Indicators](https://azgeo.maps.arcgis.com/home/item.html?id=abe7dc97f8db4f56b0bce0727d10a382) | Sensitive environmental areas |
| [Justice40 Disadvantaged Areas](https://azgeo.maps.arcgis.com/home/item.html?id=08437379dc27460aad4c48aeb1f3c530) | CEJST Data |
| [Traffic Analysis Zones](https://azgeo.maps.arcgis.com/home/item.html?id=2fbfebdb7f074f2da7dadc3d37f6260f) | TAZs from combined TDMs. Current and future population and employment. |
| [LRTP Projects Points and Lines](https://azgeo.maps.arcgis.com/home/item.html?id=f3cca32ac1cd45409b8bf4852cd2ba4a) | Planned long-range projects |
| [Sun Cloud Routes](https://azgeo.maps.arcgis.com/home/item.html?id=436bcafe8fe24fae84c54e8d7984673e) | Baseline linework |
| Ecopia Asset Data |  |

In addition, there are several support data layers which are hosted on AZ Geo which are used to support the creation of the layers above. These include:

Table Sun Cloud (Phase II) Support Layers

|  |  |
| --- | --- |
| Layer (with hyperlink) | Description |
| [Segmented Sun Cloud Routes](https://azgeo.maps.arcgis.com/home/item.html?id=b82a0623026c42ea96bdc12dc42967ea) | This layer provides the segmented version of the Routes layer used as the segmentation of various layers above (disadvantaged facility users, safety segments, Wejo pavement condition, performance scores, etc.) |
| [Segmented Routes by Line Representation Type](https://azgeo.maps.arcgis.com/home/item.html?id=b82a0623026c42ea96bdc12dc42967ea) | Roadways in ATIS (and other networks) are sometimes represented with one line feature, and sometimes with two line-features (e.g. a divided highway). This layer includes an attribute for each segment of the Sun Cloud routes indicating its representation type. This is used for conflation efforts, e.g. if the source layer has one line and the destination network as two, attributes like AADT should be divided by two when assigned to the destination network. Used for the TDM conflation and Disadvantaged Facility Users layers, among others. |

## Scripts and Repository

The source version repository containing the source code for the Sun Cloud Explorer as well as the scripts used to produce or conflate the Sun Cloud data layers is available here:

<https://bitbucket.org/high-street/sun_cloud/>

The production app is hosted in a separate repository:

https://bitbucket.org/high-street/sun\_cloud\_explorer/

# Data Maintenance Plan

Many of the Sun Cloud data layers will require periodic updates to reflect changes in existing conditions, travel demand, and evolving changes in the regional network of arterial roads.

The table beginning on the following page summarizes the recommended timing and level of effort for updating the Sun Cloud data layers

## Table 1: Sun Cloud Data Updates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Layer (Link)** | **Description** | **Data Source (and cost, if applicable)** | **Recommended Update Interval and Method** | **Est. Effort to Update (Hours)** |
| [Sun Cloud Performance Scores](https://azgeo.maps.arcgis.com/home/item.html?id=ffe3c0ac1483453c8ebfb991094007db) | Calculated needs scores for the Sun Cloud performance measures | Calculated from values in other layers | Use scoring engine to rescore particular measures each time the underlying data is updated | 1 |
| Safety [Junctions](https://azgeo.maps.arcgis.com/home/item.html?id=b7ab2303e3bd4e58a1e0a8964b07a951) and [Road Segments](https://azgeo.maps.arcgis.com/home/item.html?id=fdb09b5629514b6fadea59c86b764045) | Safety performance (observed and predicted crashes) | ADOT crash data | Annual (run [safety scripts](https://bitbucket.org/high-street/sun_cloud/src/main/layers/Safety/)) | 60 |
| [Bridge Condition](https://azgeo.maps.arcgis.com/home/item.html?id=82c9157878ef40fca9cf8c07cbad1abb) | Condition information for Bridges and Culverts | National Bridge Inventory | Annual (run [bridge script](https://bitbucket.org/high-street/sun_cloud/src/main/layers/bridges/)) | 8 |
| [Pavement Condition (NIRA Dynamics)](https://azgeo.maps.arcgis.com/home/item.html?id=e79f2d4b527b407cb24231917ff12888) | IRI values for Sun Cloud routes from NIRA Dynamics connected vehicle data | NIRA Dynamics via Wejo, $45,000 for one time data extract | See layer details. | 40 |
| [Transit Ridership](https://azgeo.maps.arcgis.com/home/item.html?id=befeb867ccaa443d849157ca9d13a433) | Ridership by transit route | Regional transit agencies | Annual (gather data from agencies, process) | 40 |
| [Travel Demand, Future Roadways](https://azgeo.maps.arcgis.com/home/item.html?id=b937984b5f0c4660aeca101ded306425) | Combined regional travel demand models. | MAG, PAG, SVMPO and ADOT | Every three to five years. See layer details. | 160 |
| [Travel Times](https://azgeo.maps.arcgis.com/home/item.html?id=f8447272002e490b8664263f5b3f9819) | Travel time reliability and delay data | INRIX | Annual. Primarily just conflation. | 12 |
| [Freight Flows](https://azgeo.maps.arcgis.com/home/item.html?id=13a9b6c6e13040d285a13d33354f3859) | Regional freight flows | Based on ATRI GPS data (licensed, $35,000) | If requested and funded | 40 |
| [Freight Routes](https://azgeo.maps.arcgis.com/home/item.html?id=02bddff561894281981c566784898e40) | Designated critical freight routes | FHWA | Once per five years | 4 |
| [Disadvantaged Facility Users](https://azgeo.maps.arcgis.com/home/item.html?id=4508e1a487524e8d8e5b192acaec72ac) | Replica-derived estimates of the portion of users on any given roadway segment from disadvantaged areas | Replica (paid $12,000 for access through consultant team; agency access more expensive) | Annual if licensing agreement in place. Mostly scripted. | 32 |
| [Broadband Coverage](https://azgeo.maps.arcgis.com/home/item.html?id=389a0988f77d4b8fa7f1e5840358e0ea) | Broadband availability and speeds by population and households | Ookla Speedtest data ($80,780 for detailed data; Ookla’s free speed data may be used for future updates) | Annual. New scripts required if using free version of data. | 24 |
| [MS2 Traffic Counts](https://azgeo.maps.arcgis.com/home/item.html?id=a1c58439c0bd4a69a40df107c8231e3e) | Traffic count data from ADOT’s MS2 instance | ADOT | Annual. Mostly scripted. | 24 |
| [Environmental Indicators](https://azgeo.maps.arcgis.com/home/item.html?id=abe7dc97f8db4f56b0bce0727d10a382) | Sensitive environmental areas | Various | Once per five years; mostly manual process. | 40 |
| [Justice40 Disadvantaged Areas](https://azgeo.maps.arcgis.com/home/item.html?id=08437379dc27460aad4c48aeb1f3c530) | CEJST Data | Council on Environmental Quality  Climate and Economic Justice Screening Tool | Annual, or when updated by CEQ. Download and republish with light scripting for field names. | 4 |
| [Traffic Analysis Zones](https://azgeo.maps.arcgis.com/home/item.html?id=2fbfebdb7f074f2da7dadc3d37f6260f) | TAZs from combined TDMs. Current and future population and employment. | MAG, PAG, SVMPO and ADOT | Same interval as travel demand data | Included with TDM effort |
| [Medians and Sidewalks](https://azgeo.maps.arcgis.com/home/item.html?id=916d5488fdd24bb68638a3fd9a72a479) | Roadway medians and sidewalks, mapped by Ecopia based on 2022 aerial imagery. | Ecopia, $38k | No planned updates | 4 |
| [Bike Lanes and Sidewalks](https://azgeo.maps.arcgis.com/home/item.html?id=cb5cb66c5924402c81e8dd945f832196#visualize) | Bike lanes and sidewalks (in small urban areas), mapped by Ecopia using 2022 aerial imagery. | Ecopia, same $38k as above | No planned updates | 4 |
| [LRTP Projects Points and Lines](https://azgeo.maps.arcgis.com/home/item.html?id=f3cca32ac1cd45409b8bf4852cd2ba4a) | Planned long-range projects | Various | Every three to five years. Gather and compile. | 16 |
| [Sun Cloud Routes](https://azgeo.maps.arcgis.com/home/item.html?id=436bcafe8fe24fae84c54e8d7984673e) | Baseline linework | ADOT ATIS | Annual. Mostly scripted. | 16 |
| Ecopia Asset Data | Asset data extracted from aerial imagery | Ecopia AI | No planned updates | N/A |

# Data Layer Maintenance Scope of Work

Future data layer updates may be completed in one of several ways:

1. Ad hoc. Layers updated by individual agencies as needed. For example, PAG may choose to use the Sun Cloud bridge condition layer for its internal planning purposes, and update the Sun Cloud layer for the region. The most likely outcome under the ad hoc category is that MAG would desire and create updated data layers, produced for MAG’s internal use but published publicly.
2. MAG or ADOT stewardship. MAG could choose to assume responsibility for updating the layers and dedicate resources to doing so. This is essentially the same as #1, but with a more structure.
3. Consultant support, coordinated by MAG or ADOT. Maintenance of specific or all data layers could be completed by private contractors under a contract managed by MAG with contributions from member agencies. This would require managerial capacity to coordinate among member agencies, develop a scope, define contributions, etc.

One final potential maintenance strategy would be for a statewide agency (likely ADOT, but possibly the state land board) to take ownership and expand the geographic coverage to be statewide.

## AZ Geo Publication QA/QC Checklist

|  |  |
| --- | --- |
| **Item** | **Complete?** |
| Fields list added to this document and complete | X |
| All field names lower\_case\_underscore\_format and aliases (and aliases include units, as needed) |  |
| Field values rounded or decoded as appropriate (Map Viewer) |  |
| Default symbology/renderer reviewed (Map Viewer) |  |
| Generalized data quality review – missing data elements? Erroneous data? |  |
| Metadata complete: Summary, Description, Tags, and Credits |  |
| Delete Protection Enabled |  |
| Export Data Enabled |  |
| Pop-up definition set, fields hidden, rounding specified (Map Viewer) |  |
| Draft Permissions – Sharing Level: Everyone; Group Sharing: Sun Cloud Developers, Sun Cloud Dev Editors |  |
| Final Permissions – Share with Arizona Sun Cloud Content 1, Hub Community Members |  |

After a layer has been published, any non-display fields should be hidden.

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Description automatically generated

## Adding Data Layers to the Sun Cloud Explorer

1. Publish the new data layer to AZ Geo; complete the publication checklist
2. Add to the Sun Cloud Transportation Layers map: <https://azgeo.maps.arcgis.com/apps/mapviewer/index.html?webmap=27491fa8ca0b468cbcd57f0e77f65e4d>
3. On your local machine with Experience Builder Developer Edition configured, open the Sun Cloud Explorer for editing.
4. Add new layer to exb\_widgets\_mag\_suncloud/widgets/layer-symbology/src/setting/setting.tsx near line 250
5. Add to exb\_widgets\_mag\_suncloud/widgets/layer-symbology/src/runtime/widget.tsx near line 200
6. If symbolizing multiple attributes, add the appropriate code to widget.tsx near line 150 and configure the appropriate renderers in the appropriate .js file in the [runtime folder](https://bitbucket.org/high-street/exb_widgets_mag_suncloud/src/main/widgets/layer-symbology/src/runtime/)
7. In ExB re-add all of the layers and set props for each
8. Add the layer to the filters list
9. Add the layer to the data table widget
10. Save and publish app
11. Export the source code and update the repo

# Data Layer Methodology

The pages below describe the methods used to the produce the Sun Cloud data layers. This information may be complemented by the metadata published with the data layers on AZ Geo.

## Projection

All layers are projected in EPSG:2223 NAD 1983 StatePlane Arizona Central FIPS 0202 (Feet)

Note: to publish layers in the correct projection, the *map* coordinate system must be set to AZ State Plane: Graphical user interface, text, application, email

Description automatically generated

# Sun Cloud Routes

|  |  |
| --- | --- |
| Summary | The Sun Cloud Routes layer is based on ADOT ATIS Functional Classification event layer. It includes arterial and higher functional class roadways across the region, and major collectors outside of the Phoenix and Tucson urbanized areas. This layer defines which roadways are included and excluded in the Sun Cloud datasets and serves as the baseline linework for all other layers. |
| Data Sources | ATIS Functional Classification: <https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::functional-classification-2020/about>  USA Urbanized Areas: <https://hub.arcgis.com/maps/esri::usa-urban-areas/about>  ATIS Facility Type: <https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::adot-highway-performance-monitoring-system-hpms-2020-data-/explore?layer=17&location=34.157762%2C-111.874019%2C7.86> |
| Processing Script | Layers/routes/sun\_cloud\_routes.ipynb |
| Published URL | <https://azgeo.maps.arcgis.com/home/item.html?id=436bcafe8fe24fae84c54e8d7984673e> |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field Name | Alias (Required) | Hide | Filter? | Symbology? |
| OBJECTID | Object ID | X |  |  |
| route\_id | Route ID |  |  |  |
| functional\_class | Functional Class |  | X | (default) |
| Shape\_Length | Length (Feet) |  |  |  |

### Method

Table

Description automatically generatedThe Sun Cloud Routes layer is based on the ATIS FunctionalClass event layer. It includes all regional Interstates, arterial roadways, and major collectors in urban areas outside of the Phoenix and Tucson metropolitan areas. It also includes current and future regionally significant routes.

The Sun Cloud Routes layer avoids intersection with the ATIS Routes (AllRoadsNetwork) event layer to avoid bringing in overlapping features for the non-inventory direction. The ATIS FacilityType event layer is used to remove ramps and planned/unbuilt roads from the Sun Cloud Routes layer (but this is accomplished by selecting the features to be removed in the FacilityType layer and using select by location to remove from the Sun Cloud Routes layer—again, intersect is not used).

Processing Steps:

1. Download the latest ATIS Functional Class event layer and ATIS Facility Type event layer
2. Run the sun\_cloud\_routes.ipynb Jupyter notebook from within the ArcGIS Pro project

## Sun Cloud Segments

|  |  |
| --- | --- |
| Summary | Sun Cloud Routes, segmented for scoring. Segments are from intersection to intersection for urban arterials and collectors. Freeways and expressways are broken into five-mile segments. |
| Data Sources | Sun Cloud Routes: <https://azgeo.maps.arcgis.com/home/item.html?id=436bcafe8fe24fae84c54e8d7984673e#overview>  USA Urban Areas: <https://www.arcgis.com/home/item.html?id=432bb9246fdd467c88136e6ffeac2762> |
| Repository Folder | sun\_cloud/layers/routes\_segmented |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=9a948ae2bcb84925bfdc64e90128f715> |

This is a **private** data layer. These segments are used for the Sun Cloud scorer. This layer is not published publicly in this form.

### Method

1. Save the Sun Cloud routes data locally.
2. Split the routes layer at major intersection. Major intersection is created per Esri’s technical article “How To: Create points on line intersections in ArcGIS Pro” <https://support.esri.com/en/technical-article/000025044>.
3. If a segment is longer than 5 miles and not within the urban area, split it at every 5 mile point.
4. Delete short segments that are shorter than 250ft.

## Sun Cloud Junctions

|  |  |
| --- | --- |
| Title | Sun Cloud Junctions |
| Summary | The Sun Cloud Junctions layer is based on the ADOT HPMS Junctions and Sun Cloud Segments layers. This layer defines major junctions that are to be included in the Sun Cloud datasets as well as related safety studies. |
| ATIS Source Data | <https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::adot-highway-performance-monitoring-system-hpms-2020-data-/explore?layer=0> |
| Processing Script | BitBucket: High Street/ MAG/sun\_cloud/Task2 Data Layer Development/Junctions/Junctions.ipynb |
| Published URL | https://azgeo.maps.arcgis.com/home/item.html?id=484538787f0648abbd4b428eb8583e60 |
|  |  |

This is a **private** data layer. These segments are used for the Sun Cloud scorer. This layer is not published publicly in this form. This layer is part of producing the Sun Cloud

Processing Steps

1. **Clip** the ADOT HPMS Junctions layer to the Sun Cloud boundary, creating a *Junctions\_SunCloud\_Clip* layer.
2. From the *Junctions\_SunCloud\_Clip* layer, pull out the desired junction types by using the **Select Layer By Attribute** geoprocessing tool.

Graphical user interface, text, application, email

Description automatically generated

The SQL above will select junctions that are a roundabout or those with:

|  |  |  |
| --- | --- | --- |
| Junction Geometry:   * T-Intersection * Y-Intersection * Cross-Intersection (Four Legs) * Five or more legs and not otherwise categorized   AND  Junction Sym: Junction at grade | | |
| AND | | |
| Traffic Control   * Signal (3 color) * Roundabout | OR | Traffic Control   * Ramp Entering * Ramp Leaving   Signalization < 5 |

1. **Export** the selected features from the previous step to a new feature class, creating *Junctions\_SunCloud\_Select.*
2. **Intersect** *Junctions\_SunCloud\_Select* with *Routes* to create *Sun\_Cloud\_Junctions.*
3. **Delete Identical Features** by shape.
4. Use the **Select by Location** geoprocessing tool to select the junctions that intersect with major intersections (with a search distance of 50 feet).

Graphical user interface, text, application, email

Description automatically generated

1. **Export** selection to a new feature class to create *Sun\_Cloud\_Major\_Junctions.*
2. To polish up the final attributes of *Sun\_Cloud\_Major\_Junctions,* delete extraneous fields and rename those remaining in accordance with High Street naming conventions.

Text, letter

Description automatically generated

# Sun Cloud Jurisdictional Boundaries

|  |  |
| --- | --- |
| Summary | Sun Cloud region jurisdictional boundaries for cities, Municipal Planning Area boundaries, Metropolitan Planning Organizations, Councils of Government, and counties. |
| Data Sources | Various |
| Processing Script | Manual download and compilation |
| Publish URL | https://azgeo.maps.arcgis.com/home/item.html?id=46dced1c928f4ebca6d05fa539c07f63 |
| Publish Type | Public |

# Climate and Economic Justice Screening Tool Disadvantaged Areas

|  |  |
| --- | --- |
| Title | Sun Cloud CEJST Disadvantaged Census Tracts 2022 |
| Summary | Disadvantaged areas identified by the Climate and Economic Justice Screening Tool (Version 1.0). |
| Description | This layer highlights disadvantaged census tracts within Maricopa, Pinal, Cochise, Pima and Santa Cruz counties. Communities are considered disadvantaged if they are in census tracts that meet the thresholds for at least one of the tool’s categories of burden (Definition N), or if they are on land within the boundaries of Federally Recognized Tribes. The data is from the Climate and Economic Justice Screening Tool published by the White House Council on Environmental Quality as part of the Justice40 initiative. |
| Tags (3+) | suncloud, justice40, equity |
| Credits (Data Sources) | Council on Environmental Quality (CEQ) Version 1.0 published 11/22/2022. Retrieved from <https://screeningtool.geoplatform.gov/en/> on 12/12/2022 |
| Processing Script | No processing. Fields renamed with the “bulk assign pro” tool. https://bitbucket.org/high-street/sun\_cloud/src/main/layers/justice\_40/ |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=08437379dc27460aad4c48aeb1f3c530> |
| Publish Type | Public, Unlisted |

## Fields List

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Alias (Required)** | **Hide / Filter / Symbolize** |
| OBJECTID | Object ID | Hide |
| Shape\_Length | Length (Feet) | Hide |
| CC | Total categories exceeded | (default symbol) + Filter |
| ... (too many to list here) |  |  |

Based on Version 1.0. Census tracts identified as disadvantaged if:

|  |  |
| --- | --- |
| Definition N community, including adjacency index tracts | Identified as disadvantaged |
| Identified as disadvantaged due to tribal overlap | Identified as disadvantaged due to tribal overlap |

(SQL: "SF" = 'Arizona' and ("SN\_C" = 1 or "SN\_T" = 1))

For more details, refer to: <https://screeningtool.geoplatform.gov/en/>

Or, for the methodology: <https://screeningtool.geoplatform.gov/en/methodology>

# Disadvantaged Facility Users

|  |  |
| --- | --- |
| Title | Disadvantaged Facility Users 2021 |
| Summary | Segment-level estimates of the portion of facility users with a home location in a Justice40-designated disadvantaged area. Source: Replica Places, Fall 2021 |
| Description | Count of daily trips taken per segment. Counts trips for all users, trips for user with a home location in a [disadvantaged area](https://azgeo.maps.arcgis.com/home/item.html?id=08437379dc27460aad4c48aeb1f3c530), and the portion of trips taken by users from disadvantaged areas. Indicates the portions of trips taken on each roadway segment by users from disadvantaged areas. User assignments based on Replica data. Replica models activity in the built environment based on a synthetic population. Data was queried from Replica using BigQuery using one OSM segment per Sun Cloud segment. [Replica methodology documentation](https://help.replicahq.com/en/articles/5632479-replica-methodology-summary). |
| Tags (3+) | justice40, replica, equity, suncloud |
| Credits (Data Sources) | Source: Replica Places, Fall 2021 |
| Processing Script | https://bitbucket.org/high-street/sun\_cloud/src/main/layers/justice\_40\_users/ |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=4508e1a487524e8d8e5b192acaec72ac> |

## Fields List

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Alias (Required)** | **Hide / Filter (F) / Symbolize (S)** |
| OBJECTID | Object ID | Hide |
| Shape\_\_Length | Length (Feet) | Hide |
| route\_id | Route ID |  |
| trips | 'Total Person Trips (Replica Estimate) | Filter (symbolized default – size) |
| j40\_trips | Trips by Disadvantaged Users' | Filter |
| percent\_j40 | Percent Disadvantaged Users | Filter (symbolized default – color) |

Query Replica using BigQuery based on the OSM IDs of matching segments.

# Broadband Coverage

|  |  |
| --- | --- |
| Title | Sun Cloud Broadband Coverage and Quality 2022 |
| Summary | Fixed and mobile internet connection speeds from Ookla Speedtest Intelligence. |
| Description | Hexagonally binned speed test data reporting the 80th percentile upload and download speeds for fixed and mobile internet connections. Binned in 1km, 2.5km, and 5km bins.  Based on Maricopa Association of Governments analysis of Ookla® Speedtest Intelligence® data for July 2021 through August 2022. Ookla trademarks used under license and reprinted with permission. Based on U.S. Census Bureau 2020 Decennial Census (population) and American Community Survey 2020 5-Year Estimates.  Broadband categories. Limited: less than 25 down / 3 up; Basic: less than 100 down / 10 up; Good: less than 250 down / 20 up; Best: greater than 250 down / 20 up |
| Data Sources | Ookla Speedtest Intelligence Data  U.S. Census Bureau Decennial Census (2020), American Community Survey 5-Year Estimates (2020) |
| Processing Script | broadband/data\_prep.R |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=389a0988f77d4b8fa7f1e5840358e0ea> |

Note: need to determine if I’m going to publish a standalone version of this layer…

## Fields List

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Alias (Required)** | **Hide / Filter / Symbolize** |
| OBJECTID | OBJECTID | Hide |
| id | ID | Hide |
| population | Population |  |
| households | Households |  |
| count\_fixed | Fixed Connection Test Count |  |
| count\_mobile | Mobile Test Count |  |
| download\_fixed | Fixed Connection Download Mbps |  |
| download\_mobile | Mobile Download Mbps |  |
| upload\_fixed | Fixed Connection Upload Mbps |  |
| upload\_mobile | Mobile Upload Mbps |  |
| category\_fixed | Fixed Connection Broadband Category | (default symbol) + Filter |
| category\_mobile | Mobile Broadband Category | Symbolize + Filter |
| hh\_no\_broadband | Households Without Broadband | symbolize |
| pop\_no\_broadband | Population Without Broadband | symbolize |
| hh\_no\_mobile\_broadband | Households Without Mobile Broadband |  |
| Shape\_\_Area | Shape\_\_Area | Hide |
| Shape\_\_Length | Shape\_\_Length | Hide |

For future updates, a similar dataset (though with less granularity and detail) is published and made freely available by Ookla. With the loss of some granularity, it would be possible to swap in a new data layer based on the freely available data in lieu of the existing layer with licensed data.

### Method

Processing Steps:

1. Download and extract twelve months of data from Speedtest Intelligence dashboard
2. If necessary, generate 1 km and 5 km hexbin shapefiles using QGIS
3. Run the R script to tabulate CSV outputs to hexbins

# Safety – Segments

|  |  |
| --- | --- |
| AGOL Title | Sun Cloud Safety Segments 2021 |
| Summary | Segments within Sun Corridor boundary with Safety related calculations. Crash frequency, crash rates, and crash predictions. |
| Description | See published layer. |
| Data Sources | AADT: https://services6.arcgis.com/clPWQMwZfdWn4MQZ/arcgis/rest/services/AADT\_2020\_gdb/FeatureServer/0  Urban Areas:  https://services.arcgis.com/P3ePLMYs2RVChkJx/ArcGIS/rest/services/USA\_Urban\_Areas/FeatureServer/3  Road Medians:  https://services1.arcgis.com/XAiBIVuto7zeZj1B/arcgis/rest/services/ATIS\_prod\_gdb/FeatureServer/33  ATIS:  https://services6.arcgis.com/clPWQMwZfdWn4MQZ/arcgis/rest/services/AZ\_All\_Roads\_Network\_2021/FeatureServer/0  Crash Data:  2017-2021 Crashes from AZDOT Public Records |
| Processing Script | https://bitbucket.org/high-street/sun\_cloud/src/main/layers/Safety/create\_safety\_layer.ipynb |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=fdb09b5629514b6fadea59c86b764045> |

## Fields List

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Name** | **Alias (Required)** | **Description (Optional)** | **Hide / Filter / Symbolize** |
| OBJECTID | Object ID |  | Hide |
| Shape\_Length | Length (Feet) |  | Hide |
| crashes | Total number of all crashes | Total number of all crashes per year (five-year rolling average) | Filter + Symbol |
| impaired\_driving\_crashes | Number of Impaired Driving Crashes |  |  |
| injury\_crashes | Number of Serious Injuries |  | Filter + Symbol |
| injury\_rate | Rate of Serious Injuries per million VMT | Rate of serious injuries per million vehicle miles traveled | Filter + Symbol |
| fatal\_injury\_crashes | Number of Fatalities |  | Filter + Symbol |
| fatal\_injury\_rate | Rate of Fatalities per million VMT | Rate of Fatalities and serious injuries per million Vehicle Miles Traveled | Filter + Symbol |
| non\_motorized\_fatal\_injury | Number of Non-motorized Fatalities and Non-motorized Serious Injuries |  | Filter + Symbol |
| spf\_id | Safety Performance Function ID | ID related to SPF used in predicted crashes |  |
| predicted\_kabc\_crashes | SPF-based Predicted Crashes | Predicted crashes based on facility Safety Performance Function |  |
| expected\_kabc\_crashes | Expected Number of All Crashes | Historical with EB method |  |
| excess\_expected\_kabc\_crashes | Excess Expected Number of All Crashes | Comparison of predicted and expected crashes | Default, Filter |
| level\_of\_safety\_service\_kabc | Level of Safety Service | Performance measure that indicates low/high potential of crash reduction | Filter + Symbol |

### Method

Detailed safety methodology can be found on AZGEO [here](https://azgeo.maps.arcgis.com/home/item.html?id=fdb09b5629514b6fadea59c86b764045#overview).

Uses a unique segmentation scheme:

## Sun Cloud Safety Segments

|  |  |
| --- | --- |
| Summary | Sun Cloud Routes, segmented for safety analysis. Segmented at number of lane changes, mile posts and major intersections. Segments over 1 mi are split at one mile points. |
| Feature Service URL | <https://azgeo.maps.arcgis.com/home/item.html?id=0b2997c4e340431b9f6e0282ecfdee25> |
| Data Sources | 1. Sun Cloud Routes: <https://azgeo.maps.arcgis.com/home/item.html?id=436bcafe8fe24fae84c54e8d7984673e#overview> 2. Through Lane: <https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::adot-highway-performance-monitoring-system-hpms-2020-data-/about?layer=41> 3. Mile Post: <https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::adot-highway-performance-monitoring-system-hpms-2020-data-/about?layer=1> |
| Repository Folder | sun\_cloud/layers/routes\_segmented |

This is a **private** data layer. These segments are used for the Sun Cloud scorer. This layer is not published publicly in this form. This layer is part of producing the Sun Cloud

### Method

1. Process the Through Lane layer.
   1. Round up the half (.5) lanes in the NumberOfLanse field.
   2. Remove features where number of lane value is null or zero.
2. Split the Sun Cloud routes layer where number of lane value changes.
3. Split the result from #2 where it intersects with the Mile Post points.
4. Split the result from #3 at major intersection (functional class is 1-17 or 11-17)
5. If a segment is longer than one mile, split it at one-mile interval.

# Safety – Junctions

|  |  |
| --- | --- |
| AGOL Title | Sun Cloud Safety Junctions 2021 |
| Summary | Junctions within Sun Corridor boundary with safety related calculations. Crash frequency, crash rates, and crash predictions. |
| Description | See published layer. |
| Data Sources | AADT: https://services6.arcgis.com/clPWQMwZfdWn4MQZ/arcgis/rest/services/AADT\_2020\_gdb/FeatureServer/0  Urban Areas:  https://services.arcgis.com/P3ePLMYs2RVChkJx/ArcGIS/rest/services/USA\_Urban\_Areas/FeatureServer/3  Road Medians:  https://services1.arcgis.com/XAiBIVuto7zeZj1B/arcgis/rest/services/ATIS\_prod\_gdb/FeatureServer/33  ATIS:  https://services6.arcgis.com/clPWQMwZfdWn4MQZ/arcgis/rest/services/AZ\_All\_Roads\_Network\_2021/FeatureServer/0  Crash Data:  2017-2021 Crashes from AZDOT Public Records |
| Processing Script | https://bitbucket.org/high-street/sun\_cloud/src/main/layers/Safety/create\_safety\_layer.ipynb |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=b7ab2303e3bd4e58a1e0a8964b07a951> |

## Fields List

(See Safety Segments fields list – identical.)

### Method

Detailed safety methodology can be found on AZGEO [here](https://azgeo.maps.arcgis.com/home/item.html?id=b7ab2303e3bd4e58a1e0a8964b07a951).

# Travel Demand

|  |  |
| --- | --- |
| Title (feature service) | Sun Cloud Regional Travel Demand Models – Existing Roadways |
| Summary | Segment level estimates of traffic volumes for base year 2019 and future year 2050 derived from regional models in the Sun Cloud region. |
| Description | Travel demand model networks from MAG, PAG, ADOT, and SVMPO were stitched together to create a Sun Cloud region wide network. In instances where model network links overlapped, the following priority order was utilized: 1) MAG, 2) PAG, 3) SVMPO 4) ADOT. Since the base year varied for each model, base year traffic volume data for each link from each model was prorated as needed to create a 2019 base year data set. Similarly, the future year (longest horizon year) for each model varied. Future year traffic volume data for each link from each model was prorated as needed to create a 2050 future horizon data set. Number of through travel lanes and link capacity attributes were carried forward for each network link for 2019 and 2050. Combined network was then conflated to the Sun Cloud centerline network. |
| Tags (3+) | Existing and future travel demand model volumes, roadway capacities, number of lanes, Sun Cloud |
| Credits (Data Sources) | MAG Regional Travel Demand Model, PAG Regional Travel Demand Model, SVMPO Regional Travel Demand Model, ADOT Statewide Travel Demand Model version 2 |

|  |  |
| --- | --- |
| Title (layer) | Sun Cloud Regional Travel Demand Models - Planned Future Roadways |
| Summary | This network is a representation of planned future roadways in the Sun Cloud region and includes segment level estimates of traffic volume projections for year 2050. |
| Description | Planned future roadway links from each model (MAG, PAG, SVMPO, and ADOT) were extracted to create this network. It includes projected number of travel lanes, link capacities, and daily traffic volumes. |
| Tags (3+) | Future travel demand model volumes, roadway capacities, number of lanes, Sun Cloud |
| Credits (Data Sources) | MAG Regional Travel Demand Model, PAG Regional Travel Demand Model, SVMPO Regional Travel Demand Model, ADOT Statewide Travel Demand Model version 2 |

## Field List – Existing Roadways (2019)

|  |  |  |
| --- | --- | --- |
| **Field** | **Alias** | **Hide / Filter / Symbolize** |
| OBJECTID | Object ID | Hide |
| route\_id | Route ID | Title |
| functional\_class | Functional Classification |  |
| sun\_cloud\_id | Segment ID |  |
| volume\_2019 | Daily Volume 2019 | Filter / Symbolize |
| volume\_2050 | Daily Volume 2050 | Filter / Symbolize |
| lanes\_2019 | Lanes 2019 |  |
| lanes\_2050 | Lanes 2050 |  |
| capacity\_2019 | Capacity 2019 |  |
| capacity\_2050 | Capacity 2050 |  |
| vc\_2019 | Volume/Capacity Ratio 2019 | Filter / Symbolize |
| vc\_2050 | Volume/Capacity Ratio 2050 | Filter / Symbolize |

## Fields List – Unbuilt Future Roadways (2050)

|  |  |  |
| --- | --- | --- |
| new\_name | new alias |  |
| OBJECTID | OBJECTID |  |
| sun\_cloud\_id | Segment ID |  |
| source | Source |  |
| route\_id | Route ID | (title) |
| volume\_2050 | Daily Volume 2050 | Symbolize (default) |
| capacity\_2050 | Capacity 2050 | Symbolize |
| Shape\_\_Length | Shape Length (US Feet) |  |

Existing Travel Demand Models:

* MAG
* PAG
* ADOT (details: https://storymaps.arcgis.com/stories/2dbf6aa617984e6fbbbb1a0cb95ac4d2)
* SVMPO (includes parts of Cochise County)

## Conflation Scenarios (TDM to ATIS)

A picture containing chart

Description automatically generated

|  |  |
| --- | --- |
| **One-to-One**  A single-carriageway roadway represented by a single feature in both the source and destination layers.  Diagram  Description automatically generated  All attributes are copied from source to destination. | **One-to-Two**  A dual-carriageway roadway represented by a single feature in the source (TDM) layer and two features in the destination (ATIS) layer.  Diagram  Description automatically generated  The attributes in the source are divided between the destination features. |
| **Two-to-One**  A single-carriageway road represented by two features in the source (TDM) layer and one feature in the destination (ATIS) layer.  Diagram  Description automatically generated  Attributes from the source features are combined in the destination feature | **Two-to-Two**  A dual-carriageway road represented by two features in both the source and destination layers.  A picture containing radar chart  Description automatically generated  Attributes from the source features are copied to the destination features. |

### One-to-One

A single-carriageway roadway represented by a single feature in both the source and destination layers.

**Rule**: All attributes are copied from source to destination.

Example: MAG\_28444 (N Pima Rd)

A picture containing diagram

Description automatically generated

|  |  |  |
| --- | --- | --- |
|  | Source (1) | Destination (2) |
| ABDAYVOL2019 | 11351 | 11351 |
| ABDAYVOL2019 | 11757 | 11757 |
| TOTDAYVOL2019 | 23108 | 23108 |

### One-to-Two (Single-Carriageway to Dual-Carriageway)

A dual-carriageway roadway represented by a single feature in the source (TDM) layer and two features in the destination (ATIS) layer.

**Rule**: The attributes in the source are **divided** between the destination features

Example: MAG\_27567 (92nd St / E Thompson Peak Pkwy)

A picture containing background pattern

Description automatically generated

|  |  |  |  |
| --- | --- | --- | --- |
|  | Source (1) | Destination (2) | Destination (3) |
| ABDAYVOL2019 | 2539 | 2539 | NULL |
| ABDAYVOL2019 | 2533 | NULL | 2533 |
| TOTDAYVOL2019 | 5072 | 2539 | 2533 |

### Two-to-One

A single-carriageway roadway represented by two features in the source (TDM) layer and one feature in the destination (ATIS) layer. (Most often seen as overpasses over access controlled facilities.)

**Rule**: The attributes in the source features are **added** in the destination feature.

Example: MAG\_28314 and MAG\_28313 (N Pima Rd / Princess Dr.)

Diagram

Description automatically generated with low confidence

|  |  |  |  |
| --- | --- | --- | --- |
|  | Source (1) | Source (2) | Destination (3) |
| ABDAYVOL2019 | 29440 | 14995 | 29440 |
| ABDAYVOL2019 | 0 | 0 | 14995 |
| TOTDAYVOL2019 | 29440 | 14995 | 44435 |

### Two-to-Two

A dual-carriageway roadway represented by two features in the source (TDM) layer and two features in the destination (ATIS) layer. (Most often access controlled facilities.)

**Rule**: The attributes in the source features are **transferred** to the destination features.

Example: MAG\_28223 and MAG\_28224 (Loop 101)

A picture containing diagram

Description automatically generated

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Source A (1) | Dest. A (2) | Source B (3) | Dest. B (4) |
| ABDAYVOL2019 | 48671 | 48671 | 48852 | 48852 |
| ABDAYVOL2019 | 0 | NULL | 0 | NULL |
| TOTDAYVOL2019 | 48671 | 48671 | 48852 | 48852 |

# Bridges

The Sun Cloud Bridge Condition 2022 layer is created from the national bridge inventory.

|  |  |
| --- | --- |
| Title | Sun Cloud Bridge Condition 2022 |
| Summary | The national bridge inventory (NBI) data for 2022 is converted to a feature class. This data layer includes statewide bridges and culverts. |
| Description | The data layer is created from the 2022 NBI data for Arizona. The statewide bridges and culverts data is converted to a feature class then snapped to the Sun Cloud routes layer with 25-meter search distance. A new field was added to denote the structure type and the owner/maintenance code was decoded using the NBI data dictionary (https://nationalbridges.com/nbiDesc.html#ITEM\_6A). |
| Data Source | National Bridge Inventory: <https://www.fhwa.dot.gov/bridge/nbi/ascii.cfm> |
| Repository Folder | sun\_cloud/layers/bridges |
| Published URL | <https://azgeo.maps.arcgis.com/home/item.html?id=82c9157878ef40fca9cf8c07cbad1abb> |

## Fields List

|  |  |  |
| --- | --- | --- |
| field | alias | hide / filter / symbol |
| OBJECTID | OID | Hide |
| structure\_number\_008 | Structure Number | Title |
| maintenance\_021 | Maintenance Responsibility |  |
| owner\_022 | Owner |  |
| structure\_len\_mt\_049 | Structure Length |  |
| deck\_width\_mt\_052 | Deck Width |  |
| deck\_cond\_058 | Deck Condition Rating |  |
| superstructure\_cond\_059 | Superstructure Condition Rating |  |
| substructure\_cond\_060 | Substructure Condition Rating |  |
| culvert\_cond\_062 | Culvert Condition Rating |  |
| structural\_eval\_067 | Structural Evaluation Rating |  |
| deck\_geometry\_eval\_068 | Deck Geometry Evaluation Rating | Filter + Symbol |
| ~~deck\_structure\_type\_107~~ | ~~Deck Structure Type~~ |  |
| bridge\_condition | Bridge Condition | Filter + (Default symbol) |
| lowest\_rating | Lowest Rating | Filter + Symbol |
| type | Structure Type | Filter + symbol |

**Field Description**

National Bridge Inventory field description: <https://www.fhwa.dot.gov/bridge/mtguide.pdf>

* structure\_number\_008: Structure number.
* maintenance\_021: Agency responsible for the maintenance.
* owner\_022: Owner’s name.
* structure\_len\_mt\_049: Length of the structure in meters.
* deck\_width\_mt\_052: Out-to-out width of the structure in meters.
* deck\_cond\_058: The overall integer rating for the condition of the bridge deck.
* superstructure\_cond\_059: The integer rating of the physical condition of all structural members.
* substructure\_cond\_060: The integer rating of the physical condition of piers, abutments, piles, fenders, footings, or other components.
* culvert\_cond\_062: The integer rating of the alignment, settlement, joints, structural condition, scour, and other items associated with culverts.
* structural\_eval\_067: Appraisal code for structural evaluation.
* deck\_geometry\_eval\_068: An integer rating assigned to the bridge based on ADT, Functional Class, lane number, and Facility Type.
* deck\_structure\_type\_107: Code for the type of deck system.
* Lowest\_rating: The lowest integer value of deck\_cond\_058, superstructure\_cond\_059, substructure\_cond\_060, and culvert\_cond\_062

### Method

1. Download the current year’s NBI data and save it as xlsx file. Provide the url for the current year's NBI data, delimited version.
2. Convert the Excel sheet to a feature class.
   1. Convert the Excel sheet into a file geodatabase table. It will output **AZ22\_tb** to the default geodatabase.
   2. Convert the coordinates into Degrees Minutes Seconds (DMS) format and save it to LAT and LON fields.
   3. Using the LAT and LON fields, convert the table into a feature class, **AZ22\_fc**.
   4. Clean up all the text fields by removing quotation marks and leading and trailing white spaces.
3. Bridge conflation
   1. Clip the bridge feature class to Sun Cloud boundary polygon **Sun\_Cloud\_Boundary**. Output is **AZ22\_clip**.
   2. Snap bridge points to the Sun Cloud Routes network, using 15-meter search radius. Add new fields to save the fuzzy string match result.
   3. Run fuzzy string match to validate the snapping result. Review the flagged bridges.
4. If the Lowest Rating doesn’t exist, calculate the minimum structure rating (field name: val\_bser).
5. Delete unnecessary fields, change field name and alias following the naming convention.

# Pavement Roughness (NIRA Dynamics)

|  |  |
| --- | --- |
| Title | Sun Cloud Pavement Roughness |
| Summary | Pavement roughness data by NIRA Dynamics (Wejo) as of June 2023, conflated to Sun Cloud routes. |
| Description | The NIRA Dynamics pavement conditions data (long-term International Roughness Index score) has been merged with the Sun Cloud routes layer. By applying a 75ft buffer and considering the functional classification, each Sun Cloud routes segment has been matched to multiple pavement condition segments. Finally, the Long\_term\_Roughness\_Uncertainty and the Long\_term\_Roughness are aggregated by weighted average.  Pavement roughness data is produced from sensors embedded in connected vehicles detecting rough pavement. More details about the methodology and validation steps is available in this paper. |
| Tags (3+) | Pavement, asset.condition |
| Credits (Data Sources) | NIRA Dynamics via Wejo |
| Processing Script | <https://bitbucket.org/high-street/sun_cloud/src/main/layers/pavement_wejo/> |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=fb7ae2ac7c5843db9485d17528c69af2> |

## Fields List

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Alias (Required)** | **Hide / Filter / Symbolize** |
| OBJECTID | Object ID | Hide |
| Shape\_Length | Length (Feet) |  |
| functional\_classification\_code | Functional Classification Code | Hide |
| functional\_classification | Functional Classification |  |
| average\_iri | Average Roughness (IRI) |  |
| Average\_iri\_uncertainty | Roughness Uncertainty | Hide |
| Source\_seg\_sum\_mi | Source Segment Length (mi) | Hide |

Sources:

Obtained from Wejo who is a reseller for NIRA Dynamics.

# Pavement Condition (Regionally Compiled)

Note: this pavement condition was produced by combining multiple regional sources. This layer has been superseded and replaced by the NIRA Dynamics Pavement Roughness data layer described below.

|  |  |
| --- | --- |
| Title | Sun Cloud Pavement Condition |
| Summary | Pavement condition data from ADOT (2021), Pima County (2022), Tucson (2022), MAG (2019), SCMPO (2019), and SEAGO (2022) |
| Description | A regional pavement condition layer combined from multiple regional agencies. Pavement condition indices have been cross-walked to a standardized Good / Fair / Poor rating methodology. |
| Tags (3+) | pavement |
| Credits (Data Sources) | ADOT (2021), Pima County (2022), Tucson (2022), MAG (2019), SCMPO (2019), and SEAGO (2022) |
| Processing Script | https://bitbucket.org/high-street/sun\_cloud/src/main/layers/pavement/standardize\_and\_merge.ipynb |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=e79f2d4b527b407cb24231917ff12888> |

## Fields List

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Alias (Required)** | **Hide / Filter / Symbolize** |
| OBJECTID | Object ID | Hide |
| Shape\_Length | Length (Feet) |  |
| sun\_cloud\_condition | Pavement Condition | Filter + (default symbol) |
| source | Pavement Condition Data Source |  |

Sources:

ADOT: https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::hpms-bins-2020-pavement-data/about

Pima County: https://pimamaps.pima.gov/arcgis/rest/services/Transportation/Streets2/MapServer/15/ (access by getting token from https://pimamaps.pima.gov/HtmlPubViewer/index.html?configBase=https://pimamaps.pima.gov/Geocortex/Essentials/PublicPM/REST/sites/transportationsite/viewers/transportationmap/virtualdirectory/Resources/Config/Default&layertheme=2)

Tucson: <https://maps2.tucsonaz.gov/arcgis/rest/services/Geocortex/geoctxPavement/MapServer/20/> (via https://maps2.tucsonaz.gov/Html5Viewer/?viewer=maptucson)

Sun Corridor (Casa Grande): Provided by Irene Higgs based on their 2020 RTP update. SCMPO is currently completing a 2023 pavement condition update that likely will not be available until later in 2023. Provided as spreadsheets and manually transferred to the Sun Cloud Routes linework.

MAG (not public): ABNA 2019

SEAGO: Exported from Vaisala RoadAI. Vaisala uses a computer-vision based method to evaluate pavement condition. It assigns rating scores of 0.00 to 1.00 and class values from 1 to 5. Vaisala does not provide written documentation of what these scores correspond to. The rating scores do not necessarily correspond to class values. For Sun Cloud purposes:

|  |  |
| --- | --- |
| Vaisala RoadAI Pavement Condition | Sun Cloud Rating |
| < 0.5 | Poor |
| 0.5 – 0.6 | Fair |
| >= 0.6 | Good |

Graphical user interface, application

Description automatically generated

#### Distress Measures to Good / Fair / Poor (ADOT)

Table

Description automatically generated

Diagram

Description automatically generated

To compare PCI, PASER, and Pavement Condition Rating (PCR), the team referred to Ram et al.’s *Developing a Correlation between the Pavement Condition Ratings used by Five Federal Lands Management Agencies*, written for FHWA and published in 2016. This article utilized data for around 300,000 miles of federal public roads that utilized various performance rating scales and compared them.

Chart, waterfall chart

Description automatically generated

# Transit Ridership

|  |  |
| --- | --- |
| Title | Sun Cloud Transit Ridership 2021 |
| Summary | Average daily transit ridership by route for all Sun Cloud area transit services. Includes transit routes. |
| Description | This data layer summarized transit ridership for all Sun Corridor transit services. The data is gathered from the various respective agencies and processed to an annualized average daily ridership per route. In most cases, the data presented is based on 2021 ridership. Data represents ridership in both directions. |
| Tags (3+) | transit, suncloud, 2021 |
| Credits (Data Sources) | Valley Metro, Sun Tran, SEAGO, SVMPO |
| Processing Script | (Lots of manual schlepping of data.) |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=befeb867ccaa443d849157ca9d13a433> |

## Fields List

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Alias (Required)** | **Hide / Filter / Symbolize** |
| OBJECTID | Object ID | Hide |
| Shape\_Length | Length (Feet) | Hide |
| route | Route |  |
| operator | Operator | Symbolize |
| avg\_daily\_rides | Average Daily Ridership | (default symbol) + Filter |
| type | Service Type | (default symbol) + Filter |

## AZ Geo Publication Checklist

|  |  |
| --- | --- |
| **Item** | **Complete?** |
| Fields list added to this document and complete | X |
| All field names lower\_case\_underscore\_format and alias | X |
| Fields list reviewed by Mark | X |
| Renderers Generated | X |
| Metadata complete: Summary, Description, Tags, and Credits |  |
| Fields Hidden | X |
| Delete Protection Enabled |  |
| Export Data Enabled | X |
| Draft Permissions – Sharing Level: Everyone; Group Sharing: Sun Cloud Developers, Sun Cloud Dev Editors |  |
| Final Permissions – Share with Arizona Sun Cloud Content 1, Hub Community Members |  |

General process:

1. Get transit routes from the 4x feature services behind: <https://arizona-sun-cloud-agic.hub.arcgis.com/apps/a1d3403256144a85aa0c21ff5ddcaad2>

* Valley Metro / MAG Routes:
  + https://services2.arcgis.com/2t1927381mhTgWNC/arcgis/rest/services/ValleyMetroBusRoutes/FeatureServer/0/
  + https://services2.arcgis.com/2t1927381mhTgWNC/arcgis/rest/services/ValleyMetroRail/FeatureServer/0/
* Tucson Streetcar:
  + https://publicgis.tucsonaz.gov/open/rest/services/OpenData/OpenData\_Transportation/MapServer/10/
* Tucson / Pima TOT Bus Routes:
  + https://publicgis.tucsonaz.gov/open/rest/services/OpenData/OpenData\_Transportation/MapServer/23/
* Pinal County Bus Routes:
  + https://services1.arcgis.com/MdyCMZnX1raZ7TS3/arcgis/rest/services/Pinal\_Transit\_gdb/FeatureServer/1/
* Cochise County
  + https://services1.arcgis.com/MdyCMZnX1raZ7TS3/arcgis/rest/services/Cochise\_Transit\_gdb/FeatureServer/1/

1. Get transit ridership data:
   1. Valley Metro (https://www.valleymetro.org/about/agency/transit-performance/ridership-reports)
   2. Sun Tran (Tucson) (https://www.suntran.com/about/)
   3. Sierra Vista - SVMPO
   4. Douglas + Cochise Connection: Humberto Rivera (humberto.rivera@douglasaz.gov)
   5. Bisbee, Benson – SEAGO
   6. City of Maricopa (SCMPO)
   7. City of Coolidge (Cotton Express, CART): Eric Heet (eheet@coolidgeaz.com)
2. Calculate annual average daily riders per route and join ridership data back to a feature layer. Ridership should be based on average annualized daily ridership (average September ridership is a good proxy for annualized average ridership is annualized data not available)
3. Merge everything together into a single file, rename fields, etc.

# LRTP Projects

|  |  |
| --- | --- |
| Title | Sun Cloud LRTP Projects |
| Summary | Combined point and line feature classes of LRTP Projects from agencies within the Sun Cloud region. |
| Description |  |
| Data Source | MAG – Shapefiles received from MAG  PAG – Shapefiles received from PAG. Tables from 2045 Regional Mobility and Accessibility Plan  SVMPO – Shapefiles received from SVMPO. Tables from Sierra Vista Metropolitan Planning Organization 2050 Long Range Plan  SCMPO – Map and tables from Sun Corrior Regional Transportation Plan 2040 |
| Repository Folder |  |
| Published URL | <https://azgeo.maps.arcgis.com/home/item.html?id=f3cca32ac1cd45409b8bf4852cd2ba4a> |

**This is a reference layer only**. Field names may not correspond to project standards.

## AZ Geo Publication Checklist

|  |  |
| --- | --- |
| **Item** | **Complete?** |
| Metadata complete: Summary, Description, Tags, and Credits |  |
| Fields Hidden |  |
| Delete Protection Enabled |  |
| Export Data Enabled |  |
| Draft Permissions – Sharing Level: Everyone; Group Sharing: Sun Cloud Developers, Sun Cloud Dev Editors |  |
| Final Permissions – Share with Arizona Sun Cloud Content 1, Hub Community Members |  |

**Field Description**

|  |  |
| --- | --- |
| **LRTPProjects\_Points** | |
| **Field Name** | **Description** |
| SunCloud\_ProjID | Name of Agency + OriginalID |
| OriginalID | Original Project Identification number from agency's LRTP |
| Agency | MAG/PAG/SVMPO/SCMPO |
| ProjectJurisdiction | Responsibility or jurisdiction of the project |
| Location | Location of the project (Cross streets or specific location) |
| Description | Project description from the LRTP |
| Type | Type of Project (Taken from the LRTP data or derived from the project description) |
| Cost | Cost of the project as listed in the LRTP |
| Comments | General comments if needed |

|  |  |
| --- | --- |
| **LRTPProjects\_Lines** | |
| **Field Name** | **Description** |
| SunCloud\_ProjID | Name of Agency + OriginalID |
| OriginalID | Original Project Identification number from agency's LRTP |
| Agency | MAG/PAG/SVMPO/SCMPO |
| ProjectJurisdiction | Responsibility or jurisdiction of the project |
| OnRoad | Road project is located on |
| From | Start of project |
| To | End of project |
| Description | Project description from the LRTP |
| Type | Type of Project (Taken from the LRTP data or derived from the project description) |
| Cost | Cost of the project as listed in the LRTP |
| Miles | Length of project in miles |
| Comments | General comments if needed |

**Data Fields Key**

*Fields From each original file used to populate the combined file*

*Note: SCMPO was digitized from a map and data populated from report table*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Field Name** | **MAG** | **PAG** | **SVMPO** | **SCMPO** |
| **SunCloud\_ProjID** | "Source + Original ID" | "Source + Original ID" | "Source + Original ID" | "Source + Original ID" |
| **OriginalID** | "Identification\_Code" | "RTPID" | "Proj\_ID" | Manually added ID |
| **Source** | *MAG* | *PAG* | *SVMPO* | *SCMPO* |
| **ProjectJurisdiction** | Derived from "Identification\_Code" | "lead" | "Sponser"\* | "Sponser"\* |
| **OnRoad (lines)** | Derived from "ProjectName" | "st\_name" | "OnRoad" | Derived from "Location"\* |
| **Location(points)** | Derived from "ProjectName" | st\_name | "OnRoad" + "AtRoad" | "Location"\* |
| **From (lines only)** | Derived from "ProjectName" | st\_name | "From" | Derived from "Location"\* |
| **To (lines only)** | Derived from "ProjectName" | "termini" | "To" | Derived from "Location"\* |
| **Description\*\*** | "ProjectDescription" | "project" | "Desc" | From LRTP report |
| **Type** | Derived from "ProjectDescription" | "subsystem" | Derived from "ProjID" | "Type"\* |
| **Cost** | n/a | - | Cost (2021$)\* | Listed on report map |
| **Status** | n/a | rtpstatus |  |  |
| **Miles (Lines only)** | Calculated in GIS | "length" | "Miles" | "Length (Miles)"\* |
| **Comments** | - | - | - | - |

*\* From LRTP Report tables. Not provided in GIS data*

*\*\* Project descriptions were then consolidated into a more simplified list*

### Method

• Took existing shapefiles and combined them into two new feature classes. One for linear projects and one for point projects

• Created a SunCloudProjectID field in both feature classes based off the projects original ID from the LRTP and the agency name (e.g. PAG - 23)

• Reviewed available data fields to come up with a common set of field names in GIS

• Created a reference table of common fields (See tab: LRTP Projects - Data Fields Key)

• Created excel document with new data fields and populated them with the available data from each GIS file

• Joined the combined data excel sheets back to the new feature classes using the ProjectID field as the common field.

• Digitized SCMPO projects based off a map in the LRTP since there was no GIS data available

• Used tables in each agency's LRTP to fill in missing data as available

# Traffic Analysis Zones

|  |  |
| --- | --- |
| Title | Sun Cloud Population and Employment Current and Future |
| Summary | Traffic Analysis Zone-level estimates and forecasts of base year (2019) and future year (2050) population, households, and employment. Created from the combined TAZ files associated with the combined regional travel demand models. |
| Description |  |
| Data Source | MAG – shapefiles from MAG  PAG – shapefiles from PAG  SVMPO – shapefiles from SVMPO  ADOT – shapefiles from ADOT |
| Repository Folder | sun\_cloud/layers/taz/ |
| Published URL | <https://azgeo.maps.arcgis.com/home/item.html?id=2fbfebdb7f074f2da7dadc3d37f6260f> |

**[Note, this list will be pared down considerably in the future. See** [**this task**](https://tasks.office.com/highstreetconsulting.com/Home/Task/94HG7RHDhE6UNrl0IfXRKWQAHOg7?Type=TaskLink&Channel=Link&CreatedTime=638139397638120000)**.]**

## Fields List

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Description** | **Hide / Filter / Symbol** |
| SunCloud\_TAZID | Source of TAZ + Original TAZ ID |  |
| Model | Source of TAZ | Filter |
| TOTHH\_2019 | Total households for year 2019 | Symbol |
| TOTPOP\_2019 | Total population for year 2019 | Symbol |
| TOTEMP\_2019 | Total employment for year 2019 | Symbol |
| SCHOOL\_ENR\_2019 | School enrollment for year 2019 | Hide |
| UNIVER\_ENR\_2019 | University enrollment for year 2019 | Hide |
| OFFICE\_EMP\_2019 | Office employment for year 2019 | Hide |
| PUBLIC\_EMP\_2019 | Public sector employment for year 2019 | Hide |
| RETAIL\_EMP\_2019 | Retail employment for year 2019 | Hide |
| IND\_EMP\_2019 | Industrial employment for year 2019 | Hide |
| OTHER\_EMP\_2019 | Other employment for year 2019 | Hide |
| NSB\_EMP\_2019 | Non-site based employment for year 2019 | Hide |
| CON\_EMP\_2019 | Construction employment for year 2019 | Hide |
| WHLSL\_EMP\_2019 | Wholesale employment for year 2019 | Hide |
| FIRE\_EMP\_2019 | Finance, insurance, real-estate employment for year 2019 | Hide |
| SERV\_EMP\_2019 | Service sector employment for year 2019 | Hide |
| HWYRET\_2019 | Highway retail employment for year 2019 | Hide |
| WORKHOME\_2019 | Work at home for year 2019 | Hide |
| AG\_EMP\_2019 | Agricultural employment for year 2019 | Hide |
| HEALTH\_EMP\_2019 | Healthcare employment for year 2019 | Hide |
| LEISURE\_EMP\_2019 | Leisure employment for year 2019 | Hide |
| MINING\_EMP\_2019 | Mining employment for year 2019 | Hide |
| PARKVISIT\_2019 | Park visits for year 2019 | Hide |
| EMPRES\_2019 | Employed residents in households for year 2019 | Hide |
| TOTHH\_2021 | Total households for year 2021 | Hide |
| TOTPOP\_2021 | Total population for year 2021 | Hide |
| TOTEMP\_2021 | Total employment for year 2021 | Hide |
| SCHOOL\_ENR\_2021 | School enrollment for year 2021 | Hide |
| UNIVER\_ENR\_2021 | University enrollment for year 2021 | Hide |
| OFFICE\_EMP\_2021 | Office employment for year 2021 | Hide |
| PUBLIC\_EMP\_2021 | Public sector employment for year 2021 | Hide |
| RETAIL\_EMP\_2021 | Retail employment for year 2021 | Hide |
| IND\_EMP\_2021 | Industrial employment for year 2021 | Hide |
| OTHER\_EMP\_2021 | Other employment for year 2021 | Hide |
| NSB\_EMP\_2021 | Non-site based employment for year 2021 | Hide |
| CON\_EMP\_2021 | Construction employment for year 2021 | Hide |
| WHLSL\_EMP\_2021 | Wholesale employment for year 2021 | Hide |
| FIRE\_EMP\_2021 | Finance, insurance, real-estate employment for year 2021 | Hide |
| SERV\_EMP\_2021 | Service sector employment for year 2021 | Hide |
| HWYRET\_2021 | Highway retail employment for year 2021 | Hide |
| WORKHOME\_2021 | Work at home for year 2021 | Hide |
| AG\_EMP\_2021 | Agricultural employment for year 2021 | Hide |
| HEALTH\_EMP\_2021 | Healthcare employment for year 2021 | Hide |
| LEISURE\_EMP\_2021 | Leisure employment for year 2021 | Hide |
| MINING\_EMP\_2021 | Mining employment for year 2021 | Hide |
| PARKVISIT\_2021 | Park visits for year 2021 | Hide |
| EMPRES\_2021 | Employed residents in households for year 2021 | Hide |
| TOTHH\_2050 | Total households for future year | Symbol |
| TOTPOP\_2050 | Total population for future year | Symbol |
| TOTEMP\_2050 | Total employment for future year | Symbol |
| SCHOOL\_ENR\_2050 | School enrollment for future year | hide |
| UNIVER\_ENR\_2050 | University enrollment for future year | hide |
| OFFICE\_EMP\_2050 | Office employment for future year | hide |
| PUBLIC\_EMP\_2050 | Public sector employment for future year | hide |
| RETAIL\_EMP\_2050 | Retail employment for future year | hide |
| IND\_EMP\_2050 | Industrial employment for future year | hide |
| OTHER\_EMP\_2050 | Other employment for future year | hide |
| NSB\_EMP\_2050 | Non-site based employment for future year | hide |
| CON\_EMP\_2050 | Construction employment for future year | hide |
| WHLSL\_EMP\_2050 | Wholesale employment for future year | hide |
| FIRE\_EMP\_2050 | Finance, insurance, real-estate employment for future year | hide |
| SERV\_EMP\_2050 | Service sector employment for future year | hide |
| HWYRET\_2050 | Highway retail employment for future year | hide |
| WORKHOME\_2050 | Work at home for future year | hide |
| AG\_EMP\_2050 | Agricultural employment for future year | hide |
| HEALTH\_EMP\_2050 | Healthcare employment for future year | hide |
| LEISURE\_EMP\_2050 | Leisure employment for future year | hide |
| MINING\_EMP\_2050 | Mining employment for future year | hide |
| PARKVISIT\_2050 | Park visits for future year | hide |
| EMPRES\_2050 | Employed residents in households for future year | hide |

**Method**

• Started with shapefiles of TAZs from MAG, PAG, SVMPO, and ADOT

• Used the MAG TAZ file as the base

• Added the PAG and SVMPO TAZ files to the MAG file

• There was some overlap between the MAG and PAG files in southeast Pinal County. The MAG TAZ's were kept and 6 TAZs from PAG were removed

• After combining MAG, PAG, and SVMPO files The gaps in the Sun Cloud area were filled in with ADOT TAZs. This included western Pima County, Santa Cruz County, and areas of Cochise County not in the SVMPO area

• Some of the TAZ edges didn’t perfectly align between ADOT and the other files. Only minor fixes were needed to fill small gaps/overlaps. The size of TAZ's were not significantly altered

• In newly combined TAZ file - created SunCloud\_TAZID which is the source of the data + the original TAZ ID (e.g. MAG 2101)

• Created combined attribute list using MAG TAZ data fields as a base. Added additional fields from the other TAZ files that were not included in the MAG file. See tab "TAZ - Data Fields Key" for a list of those fields.

• Created excel sheet with all fields and populated it with all the data from the different TAZ files

• As shown in the table to the right, the base and future years for each data set was different. Because of this, the data needed to be prorated to the chosen base years of 2019 and 2021 and the future year of 2050

• The prorated data was then joined that data back to GIS based on the "SunCloud\_TAZID" field

• Conducted a review of the data to make sure prorated numbers made sense for both base and future years

**Data Fields Key**

*Fields From each original file used to populate the combined file*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Field Name\*** | **MAG** | **PAG** | **SVMPO** | **ADOT** |
| SunCloud\_TAZID | Model name + "ID" | Model name + "ID" | Model name + "ID" | Model name + "ID" |
| Model | MAG | PAG | SVMPO | ADOT |
| TOTHH | "TOTHH" | "HH" | "Total\_HH" | "HH" |
| TOTPOP | "TOT\_POP" | "POP" | "Total\_POP" | "HHPOP" |
| TOTEMP | "TOT\_EMP" | "TOTAL\_EMP" | "TOTAL\_EMP" | "TOT\_EMP" |
| SCHOOL\_ENR | "KTO8ENROLL" + "HSENROLL" |  | "SCHOOL\_ENROLLMENT" |  |
| UNIVE\_ENR | "ASUENROLL" |  |  | "UNIVENROLL" |
| OFFICE\_EMP | "EMP1" |  | "OFFICE" |  |
| PUBLIC\_EMP | "EMP2" | "PUBSRV\_EMP" |  |  |
| RETAIL\_EMP | "EMP3" | "RETL\_EMP" | "RETAIL" | "RETAIL" |
| IND\_EMP | "EMP4" | "IND\_EMP" | "IND" | "MANUF" |
| OTHER\_EMP | "EMP5" |  |  |  |
| NSB\_EMP | "NSBEMP" |  |  |  |
| CON\_EMP | "CONSTEMP" |  |  | "CONSTR" |
| WHLSL\_EMP |  | "WHLSL\_EMP" |  | "WHOLESALE" |
| FIRE\_EMP |  | "FIRE\_EMP" |  |  |
| SERV\_EMP |  | "SERV\_EMP" | "SERVICE" | "SERVICE" |
| HWYRET |  |  | "HWYRET" |  |
| WORKHOME | "WAHEMP" |  |  |  |
| AG\_EMP |  |  |  | "AG" |
| HEALTH\_EMP |  |  |  | "HEALTH" |
| LEISURE\_EMP |  |  |  | "LEISURE" |
| MINING\_EMP |  |  |  | "MINING" |
| PARKVISIT |  |  |  | "PARKVISIT" |
| EMPRES |  |  |  | "EMPRES" |

\*Field names are the same for base and future years. This table removes the year from the field name

|  |  |  |
| --- | --- | --- |
| **Years of Original Data** | | |
|  | **Base Year** | **Future Year** |
| MAG | 2023 | 2050 |
| PAG | 2019 | 2045 |
| SVMPO | 2020 | 2050 |
| ADOT | 2016 | 2050 |

# MS2 Traffic Count

MS2 Traffic Count Database System (TCDS) data from 2010 toobtained from ADOT and processed to compute the average annual volume count and weighted annual volume count.

|  |  |
| --- | --- |
| Title | Sun Cloud MS2 Traffic Count |
| Summary | Sun Cloud MS traffic volume count was obtained from ADOT. Average annual volume count and weighted annual volume count was computed. |
| Description | MS2 traffic count data was obtained from ADOT. For each station within the Sun Cloud region, average annual volume count and weighted average were computed and attributed. |
| Credits / Data Source | MS2 data extracted by Lucas Murray at ADOT. <https://adot.public.ms2soft.com/tcds/tsearch.asp?loc=Adot&mod=TCDS> |
| Repository Folder | sun\_cloud/layers/ms2 |
| Published URL | <https://azgeo.maps.arcgis.com/home/item.html?id=a1c58439c0bd4a69a40df107c8231e3e> |

## Fields List

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Alias | Description | **Hide** |
| OBJECTID |  |  |  |
| SHAPE\_LENGTH |  |  |  |
| local\_id | Local ID | Station ID |  |
| route\_id | Route ID | Route ID |  |
| on\_road | On Road | On road |  |
| from\_road | From Road |  |  |
| to\_road | To Road |  |  |
| dir | Dir |  |  |
| agency | Agency |  |  |
| y\_[year value] | [year value] Avg Volume Count | Average volume count is computed where data was available. |  |
| weighted\_avg\_annual\_cnt | Weighted Avg Volume Count | Weighted average volume is computed using the data year as weight. |  |
| latest\_count | Latest AADT Count | Latest annual average daily traffic count. |  |
| latest\_count\_date | Latest AADT Count Year | Year value of the latest annual average daily traffic count. |  |

### Method

**See repository.**

# Travel Time Reliability

|  |  |
| --- | --- |
| Title | Sun Cloud Travel Time Reliability |
| Year |  |
| Summary | Level of Travel Time Reliability for Sun Cloud Routes |
| Description | INRIX travel time data conflated to Sun Cloud routes layer |
| Tags (3+) |  |
| Credits (Data Sources) | INRIX data |
| Processing Script | sun\_cloud/layers/travel\_time\_reliability/ |
| Publish URL | https://azgeo.maps.arcgis.com/home/item.html?id=f8447272002e490b8664263f5b3f9819 |

### Fields List

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Alias | Description | Hide / Filter / Symbolize? |
| route\_id | Route ID | Route ID | Hide |
| functional\_class | Functional Classification | Functional classification |  |
| xd\_segment\_id | XD Segment ID | INRIX’s segmentation ID |  |
| road\_name | Road Name | Road name from the INRIX layer |  |
| miles | Miles |  |  |
| free\_flow\_speed | Free Flow Speed |  |  |
| average\_speed | Average Speed |  |  |
| peak\_lottr | Peak Period LOTTR |  | (default symbol) + filter |
| daily\_delay | Daily Delay (Minutes) | sum (FF\_DelayAM, FF\_DelayMid, FF\_DelayPM) | Filter + Symbol |
| peak\_tti | Peak Period TTI | max(TTI\_AM, TTI\_MID, TTI\_PM) |  |
| peak\_pti | Peak Period PTI | max(PTI\_AM, PTI\_MID, PTI\_PM) |  |

## Conflation Steps

See repository.

### Method

1. Save the Sun Cloud routes layer locally.
2. Clean up the INRIX data.
   1. Project to WKID=2223.
   2. Remove rows with no geometry or road name, as they do not coincide with the Sun Cloud routes.
3. Split the routes layer at end points of the source layer.
4. Transfer over key fields in multiple phases.
   1. String match: Use this method for the segments if route ID and road names exist.
      1. Create a 5-meter route buffer and join it to the largest overlap source layer.
      2. Compare route id and road name values using the custom string match function.
      3. Attribute the key fields if the string matches.
      4. Repeat this process with 10-meter and 20-meter buffer.
   2. Spatial match with overlap length comparison: Use it where source segment does not have road name value.
      1. Intersect the route buffer with the source.
      2. Transfer the key attributes if overlapping length (Shape\_Length) is greater than 50. It assures inclusion of incorrect join at intersection.
   3. Short segments: Use this method for short segments where buffer cannot be created.
      1. If Shape\_Length <50, transfer attributes from the segment that touches the boundary and has the same route ID.
5. Finally, unsplit the line if route ID, functional class and all the key attributes’ values are the same.

# Freight Routes

|  |  |
| --- | --- |
| Title | Sun Cloud Freight Routes 2023 |
| Summary | National Highway Freight Network routes in the Sun Cloud region |
| Description | Primary Highway Freight System (PHFS), Other Interstate portions not on the PHFS, Critical Rural Freight Corridors (CRFCs) and Critical Urban Freight Corridors (CUFCs) in the Sun Cloud region. Based on data layers published by FHWA at https://ops.fhwa.dot.gov/Freight/infrastructure/nfn/index.htm |
| Tags (3+) | freight, fhwa, nhfn |
| Credits | FHWA (https://ops.fhwa.dot.gov/Freight/infrastructure/nfn/index.htm) |
| Processing Script | 1. Download Routes 2. Intersect with Sun Cloud counties 3. Merge into a single layer 4. Dissolve based on Route ID/Name and Source |
| Publish URL | https://azgeo.maps.arcgis.com/home/item.html?id=02bddff561894281981c566784898e40 |

## Fields List

See hosted feature layer.

# ATRI Freight Flows

|  |  |
| --- | --- |
| Title | Sun Cloud Freight Flows 2022 (ATRI) |
| Summary | Freight count data by ATRI is conflated to Sun Cloud TDM network. |
| Description |  |
| Tags (3+) |  |
| Credits (Data Sources) |  |
| Processing Script | Processed by Shuyao Hong at MAG |
| Publish URL | https://azgeo.maps.arcgis.com/home/item.html?id=13a9b6c6e13040d285a13d33354f3859 |

## Fields List – Unbuilt Future Roadways (2050)

|  |  |  |
| --- | --- | --- |
| name | alias |  |
| OBJECTID | OBJECTID |  |
| Shape\_\_Length | Shape Length (US Feet) |  |
| Freight\_trips | Freight Trips (ATRI) |  |

**Method: Contact Shuyao Hong at MAG**

# Environmental Indicators (NEPA Layer)

|  |  |
| --- | --- |
| Title | Sun Cloud Environmental Indicators (NEPA) |
| Summary | This layer contains polygons that reflect the following resources and areas that may need to be considered when determining which level of NEPA review is necessary:  • Air Quality: Nonattainment areas (SO2 2010, Lead 2008, Ozone 8hr 2015, Ozone 1 hour 1979, PM 10 1979, NO 1971, CO 1971)  • Critical Habitats: Critical habitats, potential linkage zones, grazing allotments, important bird areas, wilderness areas, conservation priority areas, grasslands, national forest system  • Cultural Resources: Buildings, Districts, Sites, and Structures  • Tribal Lands: AIANNH land  • Water Resources: lakes, recharge areas, sole source aquifers, central Arizona project |
| Description | This layer contains information about the particular resources or environmental indicators in a given area. It was developed by merging all of the individual indicator layers to group category layers, and then merging those grouped category layers into one final layer. Then, it was clipped to the Sun Cloud boundary to eliminate polygon extents outside of the Sun Cloud region. |
| Tags (3+) | NEPA, environmental indicator, air quality, water resources, cultural resources, tribal lands, critical habitats |
| Credits (Data Sources) | Air Quality  <https://www.epa.gov/green-book/green-book-gis-download>  Critical Habitats  <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>  <https://library-audubon.hub.arcgis.com/datasets/9217fd74cf8b4e47bd2d77720a757873/explore?layer=0&location=32.752441%2C65.812499%2C3.58>  <https://gis.blm.gov/azarcgis/rest/services/nlcs/BLM_AZ_WLD/FeatureServer/0>  <https://azdot.gov/business/environmental-planning/programs/wildlife-linkages>  <https://azconservation.org/project/natural_infrastructure_data_sources/>  <https://hspartner.maps.arcgis.com/home/item.html?id=b81b0e4909934f2da26a1ee452d5c64a&sublayer=0>  <https://data.fs.usda.gov/geodata/edw/datasets.php?dsetCategory=boundaries>  Cultural Resources  <https://irma.nps.gov/DataStore/Reference/Profile/2210280/>  Tribal Lands  <https://catalog.data.gov/dataset/tiger-line-shapefile-2018-nation-u-s-current-american-indian-alaska-native-native-hawaiian-area>  Water Resources  <https://uair.library.arizona.edu/item/292543/browse-data/Water>  <https://catalog.data.gov/dataset/epa-sole-source-aquifers> |
| Processing Script | Not intended to be updated. |
| Publish URL | <https://azgeo.maps.arcgis.com/home/item.html?id=abe7dc97f8db4f56b0bce0727d10a382> |

## Fields List

|  |  |  |  |
| --- | --- | --- | --- |
| **NEPA Features Layer**  **Rivers, Stems, Tributaries and Streams Layer** | | | |
| **Field** | **Alias** | **Description (Optional)** | **H/F/S** |
| OBJECTID | Object\_ID |  | Hide |
| category | Category | Air Quality, Water Resources, Tribal Lands, Critical Habitats, or Cultural Resources  Follows the following naming convention:  ‘Environmental Indicator Category (Subcategory)’ | Filter |
| item | Item | Name of the environmental indicator |  |
| details | Details | Additional categorization or information about the environmental indicator. Varies by environmental indicator. |  |
| Source | Source | Original data source |  |
| Shape | Shape | Polygon | Hide |
| Shape\_Length | Shape\_Length | Length of polygon | Hide |
| Shape\_Area | Shape\_Area | Area of polygon | Hide |

## AZ Geo Publication Checklist

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| --- | --- |
| **Item** | **Complete?** |
| Fields list added to this document and complete | X |
| All field names lower\_case\_underscore\_format | X |
| All fields have friendly aliases set | X |
| Fields list reviewed by Mark | X |
| Default symbology reviewed by Mark | X |
| Metadata complete: Summary, Description, Tags, and Credits |  |
| Fields Hidden |  |
| Delete Protection Enabled |  |
| Export Data Enabled |  |
| Draft Permissions – Sharing Level: Everyone; Group Sharing: Sun Cloud Developers, Sun Cloud Dev Editors |  |
| Final Permissions – Share with Arizona Sun Cloud Content 1, Hub Community Members |  |

## Method

1. Import data from files and URLs
2. Take the counties layer and dissolve it so that we have the shape of the sun cloud boundary – use the clip tool to clip all of the layers that are only displaying the features that are within the boundary
3. Field formatting
   1. Hide fields that we don’t need from each layer
   2. Calculate a “Category” field for each layer that indicates the environmental indicator category and subcategory
      1. Naming Convention: ‘Environmental Indicator Category (Subcategory)’
   3. Rename fields
      1. Field that shows the name of the environmental indicator 🡪 “Item”
      2. Field that shows any additional information about the environmental indicator that may be of interest to a sun cloud user 🡪 concatenate (if necessary) 🡪 “Details”
4. Merge Layers
   1. Merge each layer within each environmental indicator category
      1. Clip to Sun Cloud Region to eliminate all polygons that lie outside of the counties
   2. Merge each environmental indicator category layer in to one EI layer
5. Count Overlap
6. Run Count Overlapping features to create a layer that provides the count of features within each polygon’s geography – it will show where there are multiple overlapping indicators
7. Save all 3 layers into the Environmental Indicators final geodatabase
   1. EI Feature Count Layer
   2. EI Features layer

## Source Layers

|  |  |  |  |
| --- | --- | --- | --- |
| **Category** | **Layer** | **Description** | **Source** |
| **Water Resources** | Lakes and Reservoirs | This polygon cover consists of all the lakes in Arizona. | [University of Arizona Institutional Repository](https://uair.library.arizona.edu/item/292543/browse-data/Water) |
| Recharge Areas | Depicts geographic boundaries of recharge areas. |
| Central Arizona Project | Depicts the Central Arizona Project aqueduct. |
| Sole Source Aquifers (SSA) | SSAs supply at least 50% of the drinking water consumed in the area overlying the aquifer. These areas may have no alternative drinking water source(s) that could physically, legally and economically supply all those who depend on the aquifer for drinking water. | [EPA](https://catalog.data.gov/dataset/epa-sole-source-aquifers) |
| **Air Quality (Nonattainment areas)** | Lead | Lead particulate matter level in air in micrograms per cubic meter (µg/m3). | [EPA EJ Screen Indexes](https://www.epa.gov/green-book/green-book-gis-download) |
| PM 10 | Particulate matter (PM 10) levels in air, micrograms per cubic meter (µg/m3) annual average. |
| Ozone 8 hour | Ozone summer seasonal avg. of daily maximum 8-hour concentration in air in parts per billion. |
| Ozone 1 hour | Ozone summer seasonal avg. of daily maximum 1-hour concentration in air in parts per billion. |
| Carbon Monoxide | 1971 Standard |
| Sulfur Dioxide | 2010 Standard |
| **Archaeological and Natural Heritage Resources** | National Historic Landmarks and Historic Places | Districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture. | [National Register of Historic Places](https://irma.nps.gov/DataStore/Reference/Profile/2210280/) |
| **Critical Habitats** | Critical habitats | Critical habitats designated by the U.S. Fish and Wildlife Service for all threatened species and endangered species under the Endangered Species Act, with certain specified exceptions. | [US Fish and Wildlife Service](https://ecos.fws.gov/ecp/report/table/critical-habitat.html) |
| Important Bird Areas | Any publications or reports that reference data provided in this release will cite the data using the following format: National Audubon Society. [Date]. Important Bird Areas Database, Boundary Digital Data Set. Any display of point locations of IBAs online should be accompanied by attribution to the National Audubon Society. Data for other conservation priorities should be cited similarly. | [Audubon Society](https://library-audubon.hub.arcgis.com/datasets/9217fd74cf8b4e47bd2d77720a757873/explore?layer=0&location=39.391901%2C65.812499%2C3.58) |
| Wilderness Area | Boundary line features depicting the Arizona BLM NLCS Wilderness Area Boundaries | [Bureau of Land Management](https://gis.blm.gov/azarcgis/rest/services/nlcs/BLM_AZ_WLD/FeatureServer/0) |
| Priority Linkage Zones | Biologists, engineers, planners and land managers from nine public agencies have worked together since 2004 to identify large blocks of protected habitat, the potential wildlife movement corridors through and between them, the factors that could possibly disrupt these linkage zones and opportunities for conservation. The assessment document (below) and map are the initial efforts to identify potential linkage zones that are important to Arizona’s wildlife and natural ecosystems. This is only the first step in a continuing process of defining critical habitat connectivity areas. This nonbinding document and map serve as an informational resource to planners and engineers, providing suggestions for the incorporation of these linkage zones into their management planning to address wildlife connectivity at an early stage of the process. If considerations for wildlife connectivity can be integrated into regional planning and projects early in the process, the linkage areas (or some portion of them) have the potential to be maintained or conserved during this time of growth and development. Recognizing that habitat connectivity is a landscape issue involving multiple land jurisdictions, this workgroup has engaged in unprecedented cooperation and facilitated discussions and partnerships to help ensure a unified approach to wildlife linkage conservation and management. This reinforces the commitment to and efficiency of wildlife connectivity measures undertaken by all stakeholders, using research and adaptive management in ongoing evaluations of those measures. | [AZ DOT](https://azdot.gov/business/environmental-planning/programs/wildlife-linkages) |
| Priority Linkage Zones across Habitat |
| Conservation Priority Areas | This contains geographic information pertaining to priority conservation areas in western North America. The region encompasses a sequence of mountain ranges, including the Rocky Mountains, that form the backbone or spine of the western North America, along with the surrounding deserts and semi-arid lands. Priority conservation areas (conservation areas) are geographic areas that have been selected because of the sensitive biological species, habitats, and features (targets) that are known to occur in these areas. Conservation, protection, and management actions within these areas should be prioritized in order to ensure persistence and survival of these sensitive biological features. | [AZ Conservation Areas](https://azconservation.org/project/natural_infrastructure_data_sources/) |
| Grasslands | The grassland assessment identifies high-quality native grasslands in Arizona, New Mexico, and northern Mexico. This assessment was conducted by TNC, the Bureau of Land Management, the Natural Resources Conservation Service, the U.S. Forest Service, the University of Arizona, and the Arizona State Land Department. For the natural infrastructure composite layer, we excluded priority grasslands from the Apache Highlands ecoregion, which are accounted for in the ecoregional assessment core habitat layer. |
| National Forest System | An area encompassing all the National Forest System lands administered by an administrative unit. The area encompasses private lands, other governmental agency lands, and may contain National Forest System lands within the proclaimed boundaries of another administrative unit. All National Forest System lands fall within one and only one Administrative Forest Area. | [National Forest Service](https://data.fs.usda.gov/geodata/edw/datasets.php?dsetCategory=boundaries) |
| Grazing Allotments | This polygon feature class is part of a multi-purpose dataset. It will aid in the administration of these grazing allotments under the Bureau of Land Management's (BLM's) grazing program, and also in scientific, integrated land use planning or other activities that would affect, or be affected by, livestock grazing. | [Bureau of Land Management](https://hspartner.maps.arcgis.com/home/item.html?id=b81b0e4909934f2da26a1ee452d5c64a&sublayer=0) |
| **Tribal Lands** | American Indian and Alaska Native Land Area Representation (AIAN-LAR) | The American Indian/Alaska Native/Native Hawaiian (AIANNH) Areas Shapefile includes the following legal entities: federally recognized American Indian reservations and off-reservation trust land areas, state-recognized American Indian reservations, and Hawaiian home lands (HHLs). The statistical entities included are Alaska Native village statistical areas (ANVSAs), Oklahoma tribal statistical areas (OTSAs), tribal designated statistical areas (TDSAs), and state designated tribal statistical areas (SDTSAs). Joint use areas are also included in this shapefile refer to areas that are administered jointly and/or claimed by two or more American Indian tribes. The Census Bureau designates both legal and statistical joint use areas as unique geographic entities for the purpose of presenting statistical data. Note that tribal subdivisions and Alaska Native Regional Corporations (ANRCs) are additional types of American Indian/Alaska Native areas stored by the Census Bureau, but are displayed in separate shapefiles because of how they fall within the Census Bureau's geographic hierarchy. The State of Hawaii's Office of Hawaiian Home Lands provides the legal boundaries for the HHLs. The boundaries for ANVSAs, OTSAs, and TDSAs were delineated for the 2010 Census through the Tribal Statistical Areas Program (TSAP) by participants from the federally recognized tribal governments. The Bureau of Indian Affairs (BIA) within the U.S. Department of the Interior (DOI) provides the list of federally recognized tribes and only provides legal boundary information when the tribes need supporting records, if a boundary is based on treaty or another document that is historical or open to legal interpretation, or when another tribal, state, or local government challenges the depiction of a reservation or off-reservation trust land. | [U.S. Census Bureau, Department of Commerce](https://catalog.data.gov/dataset/tiger-line-shapefile-2018-nation-u-s-current-american-indian-alaska-native-native-hawaiian-area) |

Non-Polygon Water Resources

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| --- | --- | --- | --- |
| **Category** | **Layer** | **Description** | **Source** |
| **Rivers, Stems, Tributaries, Streams, Springs** | Major Rivers, Main Stems, Primary and Secondary Tributaries | Data layer depicts all rivers and streams. | [University of Arizona Institutional Repository](https://uair.library.arizona.edu/item/292543/browse-data/Water) |
| Springs | This coverage consists of spring locations in Arizona. |
| Streams | This coverage consists of stream locations in Arizona. |

**Environmental Indicator Resources**

* [NEPA Assist](https://www.epa.gov/nepa/nepassist)
* [EPA Green Book](https://www.epa.gov/green-book/green-book-gis-download)
* [US Forest and Wildlife Service - Critical Habitats](https://ecos.fws.gov/ecp/report/table/critical-habitat.html)
* [Audubon Society – Important Bird Areas](https://library-audubon.hub.arcgis.com/datasets/9217fd74cf8b4e47bd2d77720a757873/explore?layer=0&location=32.752441%2C65.812499%2C3.58)
* [Bureau of Land Management – Wildlife Areas](https://gis.blm.gov/azarcgis/rest/services/nlcs/BLM_AZ_WLD/FeatureServer/0)
* [AZ DOT – Wildlife Linkages](https://azdot.gov/business/environmental-planning/programs/wildlife-linkages)
* [The Nature Conservancy](https://azconservation.org/project/natural_infrastructure_data_sources/)
* [National Register of Historic Places](https://irma.nps.gov/DataStore/Reference/Profile/2210280/)
* [AIANNH Land](https://catalog.data.gov/dataset/tiger-line-shapefile-2018-nation-u-s-current-american-indian-alaska-native-native-hawaiian-area)
* [University of Arizona Institutional Repository](https://uair.library.arizona.edu/item/292543/browse-data/Water)
* [EPA Sole Source Aquifers](•%09https:/catalog.data.gov/dataset/epa-sole-source-aquifers)

**Jurisdiction-Specific Environmental Indicator Resources**

* [Arizona’s State Wildlife Action Plan, HabiMap, and Online Environmental Review Tool](https://habimap.azgfd.com/)
* [Scottsdale Environmentally Sensitive Lands](https://www.scottsdaleaz.gov/codes/eslo)
* [Pima County’s Conservation Lands System (CLS)](https://gisopendata.pima.gov/datasets/conservation-lands-system-categories/explore?location=31.976714%2C-111.875000%2C9.57)
* [Town of Oro Valley Environmentally Sensitive Lands Ordinance (ESLO)](https://www.orovalleyaz.gov/Government/Departments/Town-Clerk/Services/Submit-a-Public-Records-Request)
* [City of Tucson Environmental Resource Zones](https://gisdata.tucsonaz.gov/datasets/cotgis::environmental-resource-zone/explore?location=32.145881%2C-110.881755%2C11.04)

# Needs Scoring Layer

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| --- | --- |
| Title | Sun Cloud Needs Scores |
| Summary | Contains the scores and normalized scores for performance measures applied to Sun Cloud routes and intersections assessing system performance and investment needs. |
| Description | The data in this layer is produced by the Sun Cloud Scoring Engine and is consumed and displayed by the Sun Cloud Explorer. [Add scoring methodology summary] |
| Tags (3+) | performance, needs, suncloud |
| Publish URL | Temporary: <https://azgeo.maps.arcgis.com/home/item.html?id=6d1d71c0b1aa463aa4b5dfe511b5abfd>  (two layers: segments and junctions) |

## Fields List

For each layer, provide a fields list. Be sure to indicate which fields should be hidden, used as filters, and which fields should be available as symbology options.

|  |  |  |
| --- | --- | --- |
| Field name | Alias | Hide /Filter/ Symbolize |
| OBJECTID |  | Hide |
| Shape\_Length |  |  |
| pavement\_pct\_good | Percent of Pavement in Good Condition |  |
| pavement\_pct\_poor | Percent of Pavement in Poor Condition |  |
| bridge\_structural\_rating | Bridge Structural Evaluation Rating |  |
| bridge\_deck\_geometry | Bridge Deck Geometry Rating (Sufficient Width) | |
| lottr | Level of Travel Time Reliability |  |
| los | Vehicle Level of Service |  |
| avg\_delay | Average Daily Minutes of Delay |  |
| vmt\_change | Forecasted Change in Vehicle Miles Traveled |  |
| transit\_overlap | Carries Transit Service |  |
| transit\_ridership | Daily Transit Ridership |  |
| employment\_change | Forecasted Change in Nearby Employment |  |
| critical\_freight | Carries Critical Freight Route |  |
| households\_no\_broadband | Adjacent Households Without Broadband Access | |
| fatality\_rate | Fatalities per 100 Million VMT |  |
| serious\_injury\_rate | Incapacitating injuries per 100 Million VMT |  |
| non\_motorized\_injuries | Non-motorized Fatal & Incapacitating Injuries | |
| excess\_expected\_crashes | Excess Expected Fatal & Incapacitating Crashes | |
| percent\_disadvantaged | Percent of Users from Disadvantaged Areas | |
| pavement\_pct\_good\_normalized | Normalized Percent of Pavement in Good Condition Score | |
| pavement\_pct\_poor\_normalized | Normalized Percent of Pavement in Poor Condition Score | |
| bridge\_structural\_rating\_normalized | Normalized Bridge Structural Evaluation Rating Score | |
| bridge\_deck\_geometry\_normalized | Normalized Bridge Deck Geometry Rating (Sufficient Width) Score | |
| lottr\_normalized | Normalized Level of Travel Time Reliability Score | |
| los\_normalized | Normalized Vehicle Level of Service Score |  |
| avg\_delay\_normalized | Normalized Average Daily Minutes of Delay Score | |
| vehicle\_miles\_traveled\_normalized | Normalized Forecasted Change in Vehicle Miles Traveled Score | |
| transit\_overlap\_normalized | Normalized Carries Transit Service Score |  |
| transit\_ridership\_normalized | Normalized Daily Transit Ridership Score |  |
| employment\_change\_normalized | Normalized Forecasted Change in Nearby Employment Score | |
| critical\_freight\_normalized | Normalized Carries Critical Freight Route Score | |
| households\_no\_broadband | Normalized Adjacent Households Without Broadband Access Score | |
| fatality\_rate\_normalized | Normalized Fatalities per 100 Million VMT Score | |
| serious\_injury\_rate\_normalized | Normalized Incapacitating injuries per 100 Million VMT Score | |
| non\_motorized\_injuries\_normalized | Normalized Non-motorized Fatal & Incapacitating Injuries Score | |
| excess\_expected\_crashes\_normalized | Normalized Excess Expected Fatal & Incapacitating Crashes Score | |
| composite\_score\_assets | Asset Condition Needs Score | Symbolize\* |
| composite\_score\_mobility | Mobility Needs Score | Symbolize\* |
| composite\_score\_economy | Economic Development Needs Score | Symbolize\* |
| composite\_score\_safety | Safety Needs Score | Symbolize\* |
| composite\_score | Combined Needs Score | Symbolize\* |
| composite\_score\_equity\_weighted | Combined Needs Score with Disadvantaged Users Multiplier | Symbolize\* |

\* can use same renderer for all