

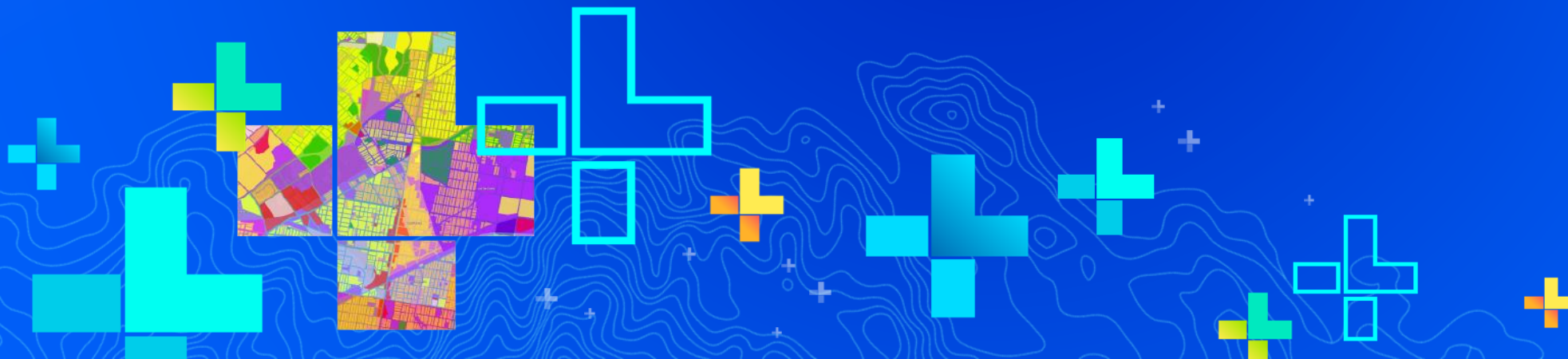


ArcGIS Online: Routing and Network Analysis using Web Services

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Max Zeng

SEE
WHAT
OTHERS
CAN'T



Introductions

- Who are we?
 - Members of the Network Analyst development team
- Who are you?
 - Network Analyst users?
 - ArcGIS Online users?
 - Trying to figure out what is ArcGIS Online?



Metadata

- Slides and code samples for this workshop on Routing and Network Analysis using web services are available at

<http://esriurl.com/uc19nawago>



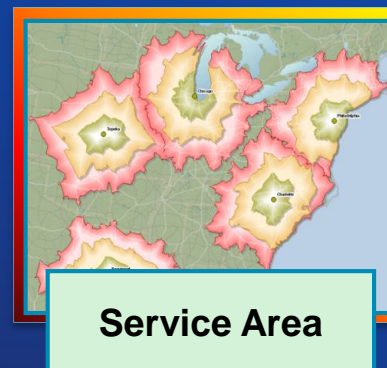
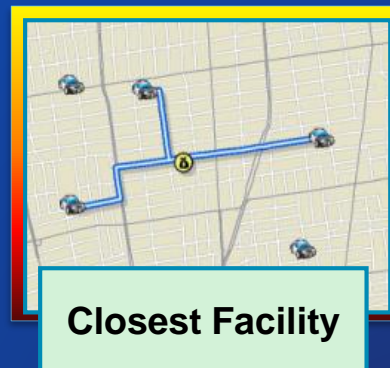
Topics

- **What are the ArcGIS Online network analysis services**
- **Accessing the services using out-of-the-box apps**
- **Service capabilities**
- **Managing credits**
- **Support and resources**
- **Questions**

ArcGIS Online services

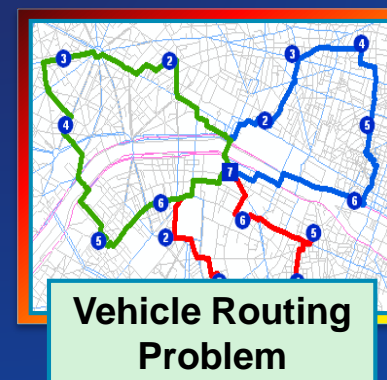
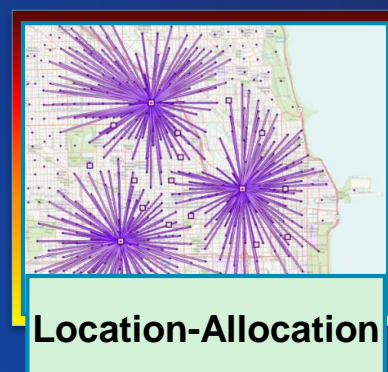
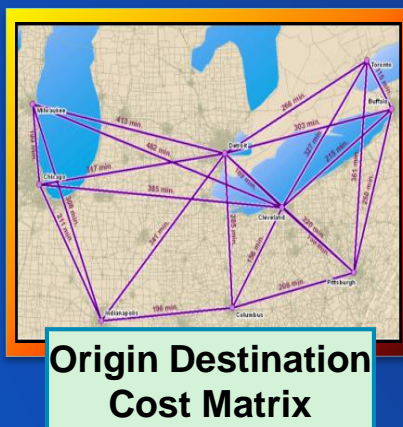
- Ready-to-use services hosted by Esri
- Provides mapping and spatial analysis capabilities





Network Analysis Services

Solve transportation problems



What you need to use online services

- ArcGIS Online subscription with service credits



- Your analysis inputs



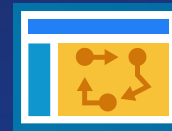
- Mapping apps



ArcMap



ArcGIS Pro



Map Viewer



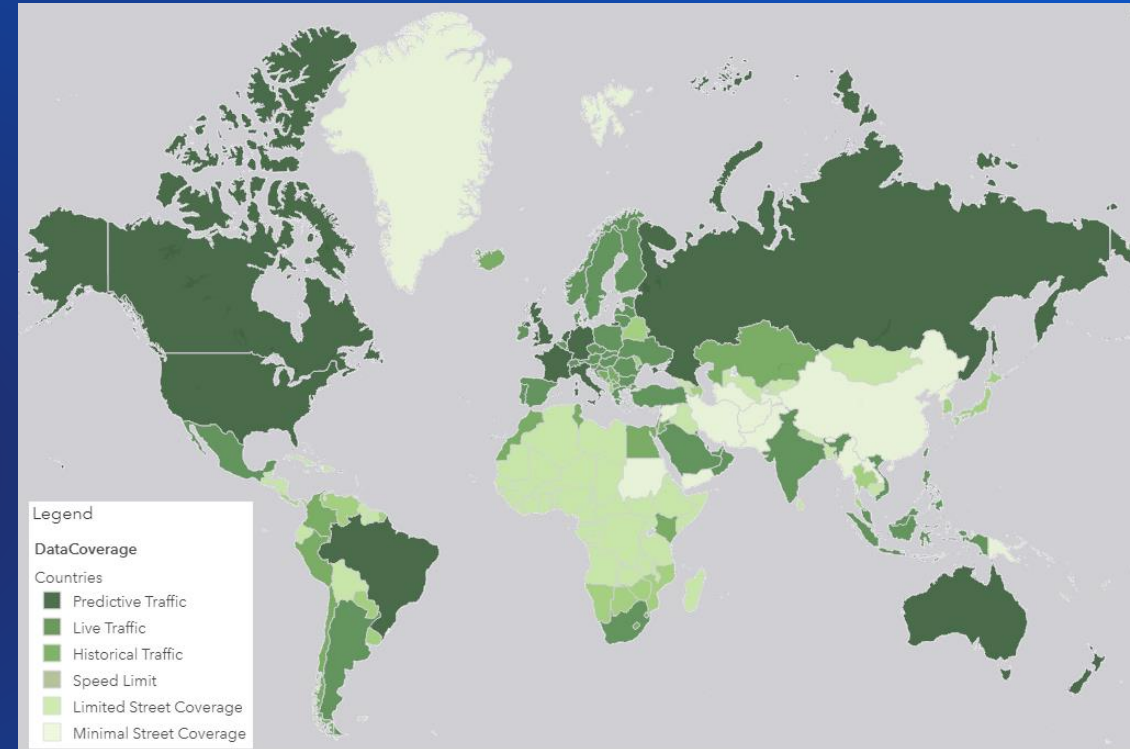
Business
Analyst Online

What you do **NOT** need for online services

- ArcGIS Network Analyst extension license
- Your own street data
- Your own ArcGIS Server software
- Hardware to host the server
- Staff to manage the IT infrastructure

Data coverage

- Global coverage*
- Uses high quality street data
 - Predictive and real time traffic where available
 - Support for vehicle weight, width and height restrictions
 - Can use preferred truck routes or avoid toll roads
- Driving, Walking, Trucking, or your own travel modes



[View web map](#)

Accessing the services



Organization subscription required

- All services are secured and require ArcGIS Online organization subscription with service credits
- Existing ArcGIS Desktop users get a free organization subscription
- Sign up for a 60 day free trial at www.arcgis.com
 - Comes with 200 service credits

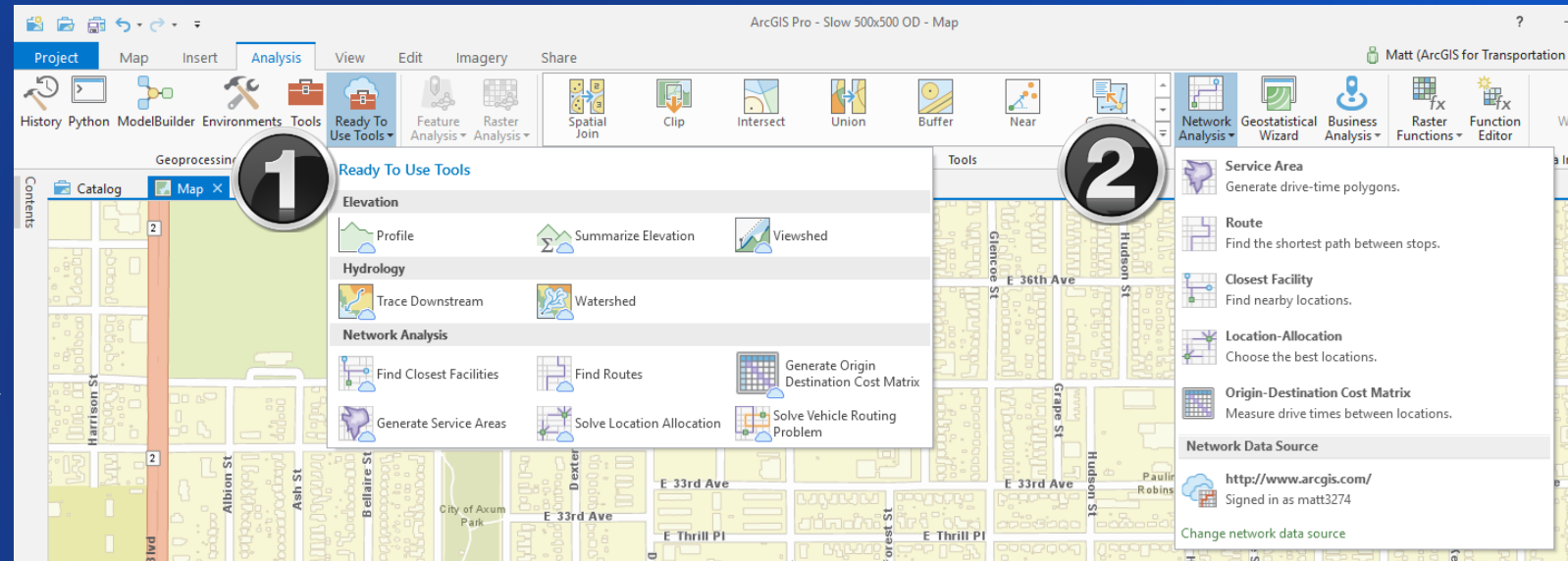


Ways to access the services

- **Out-of-the box apps**
 - ArcGIS Pro
 - ArcMap
 - Directions and Analysis tools in Map Viewer
- **Some services are supported in other ArcGIS apps**
 - Insights for ArcGIS
 - GeoPlanner for ArcGIS
 - Business Analyst Online
 - Collector for ArcGIS
- **ArcGIS web and runtime SDKs**
 - <https://developers.arcgis.com/features/directions/>

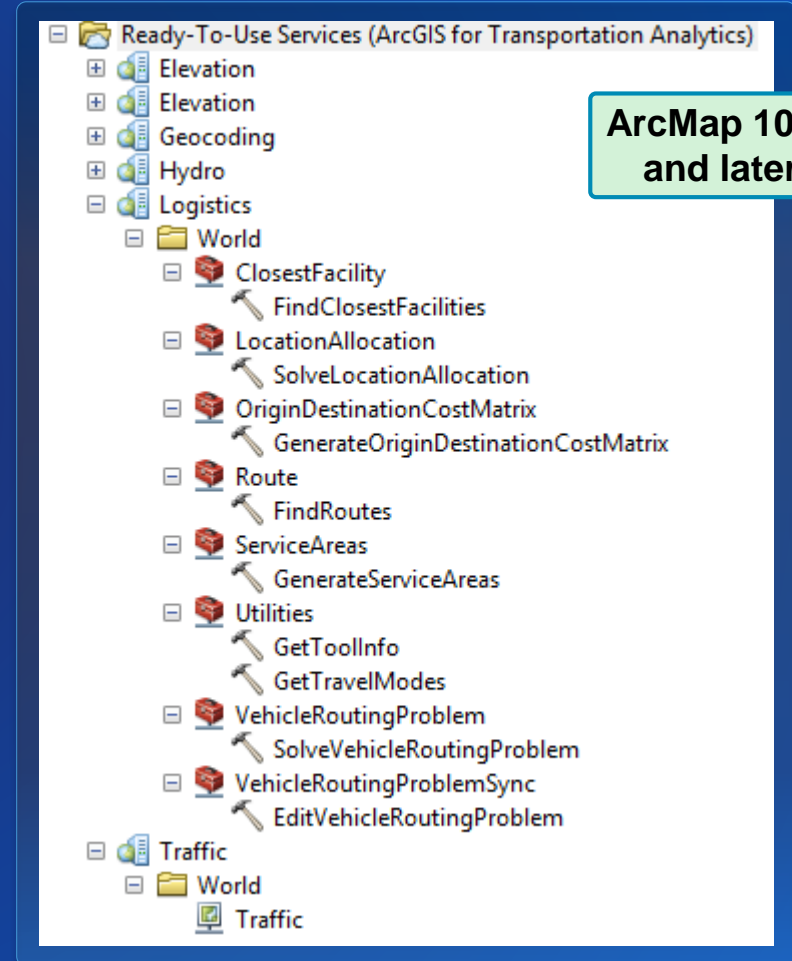
Using services with ArcGIS Desktop (ArcGIS Pro)

- 1 • Ready-To-Use tools**
 - GP Services
 - ArcGIS Pro 1.3 or later
- 2 • Network Analysis gallery**
 - Network Analysis Layers
 - ArcGIS Pro 1.2 or later



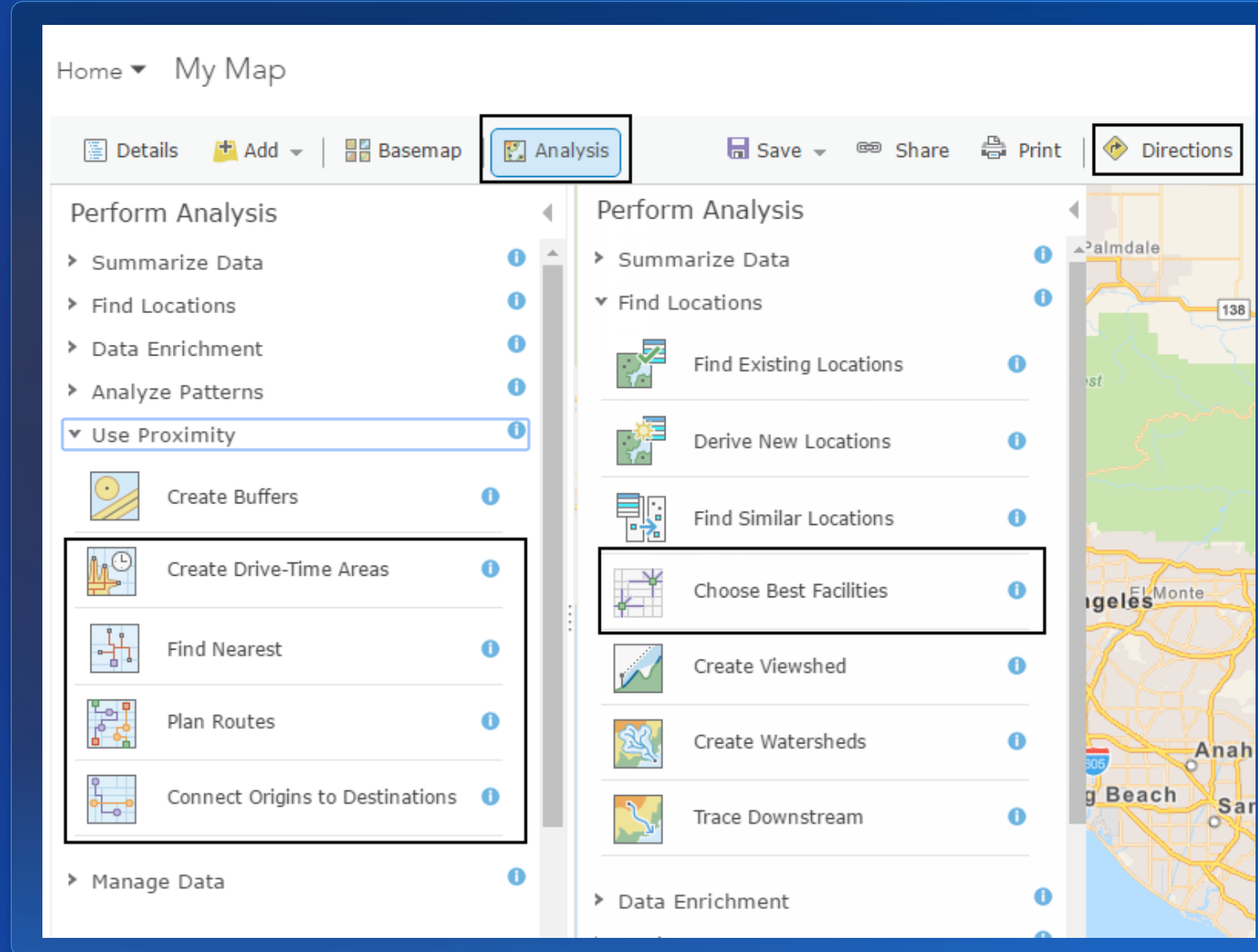
Using services with ArcGIS Desktop (ArcMap)

- Ready-To-Use Services node in ArcMap 10.2 and later



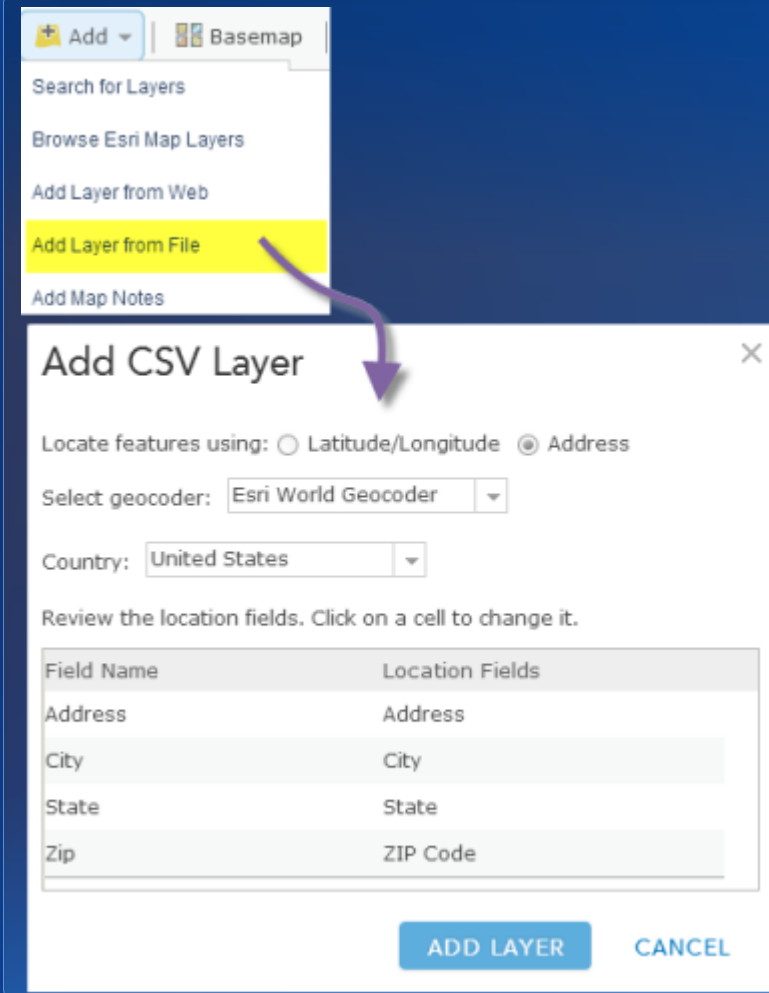
Using services in Map Viewer

- Directions button
- Analysis tools
 - Use Proximity
 - Most tools
 - Find Locations
 - Choose Best Facilities tool
 - Enrichment
 - Enrich Layer tool
- Summarize Data
 - Summarize Nearby tool



Using services with Map Viewer

- Need to add your inputs to ArcGIS Online
- Layers and data you can analyze
 - Feature service
 - Map service
 - Comma-separated values (CSV) file (.csv)
 - Route layers
 - GPS exchange format file (.gpx)
 - Shapefile (.zip)
 - File Geodatabase (.zip)
 - Map notes
- Cannot use network dataset created from your own street data



The screenshot shows the 'Add' menu in the ArcGIS Online interface. The 'Add Layer from File' option is highlighted in yellow. A purple arrow points from this option to the 'Add CSV Layer' dialog box. The dialog box has a close button (X) in the top right corner. It contains the following elements:

- Search for Layers** (input field)
- Browse Esri Map Layers** (button)
- Add Layer from Web** (button)
- Add Layer from File** (button, highlighted in yellow)
- Add Map Notes** (button)

Add CSV Layer dialog box details:

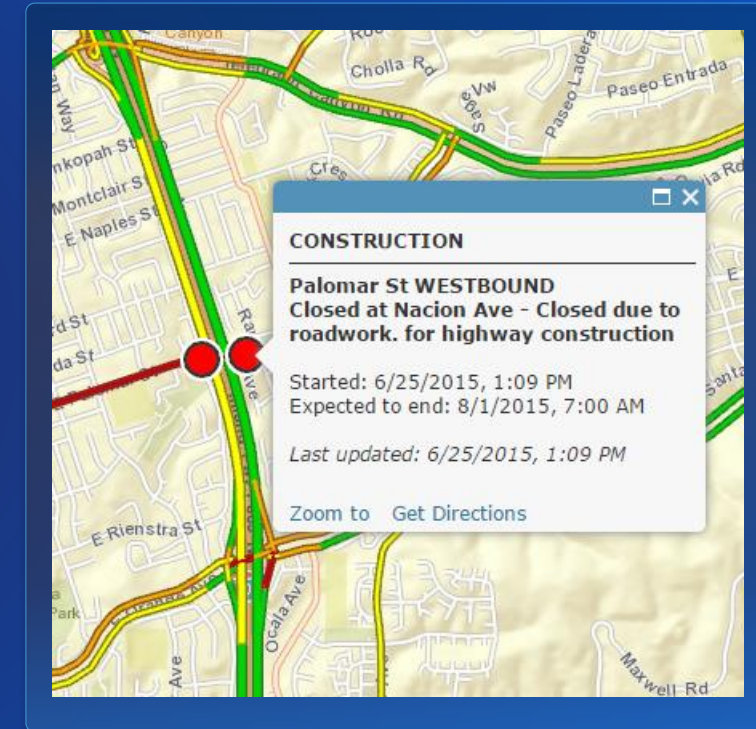
- Locate features using:** ☐ Latitude/Longitude ☒ Address
- Select geocoder:**
- Country:**
- Review the location fields. Click on a cell to change it.**
- | Field Name | Location Fields |
|------------|-----------------|
| Address | Address |
| City | City |
| State | State |
| Zip | ZIP Code |
- ADD LAYER** (button)
- CANCEL** (button)

Service capabilities



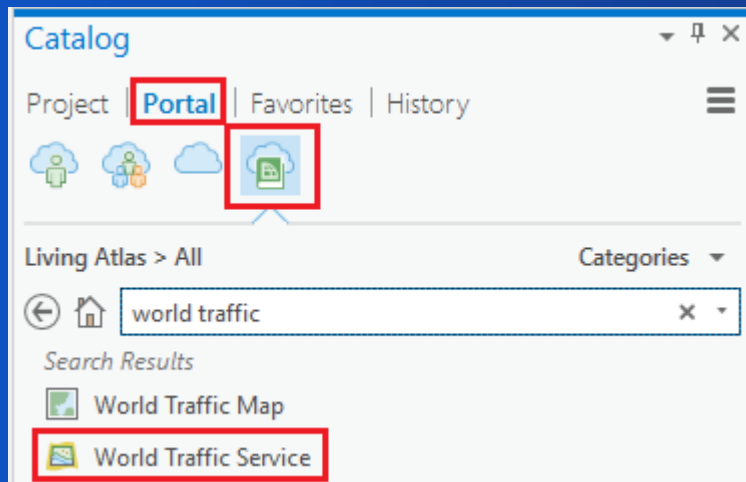
Traffic service

- Visualize traffic speeds
 - Support for live, historical and predictive traffic conditions
- Traffic Incidents
- Background layer to display results from network analysis services
- Data updated every five minutes

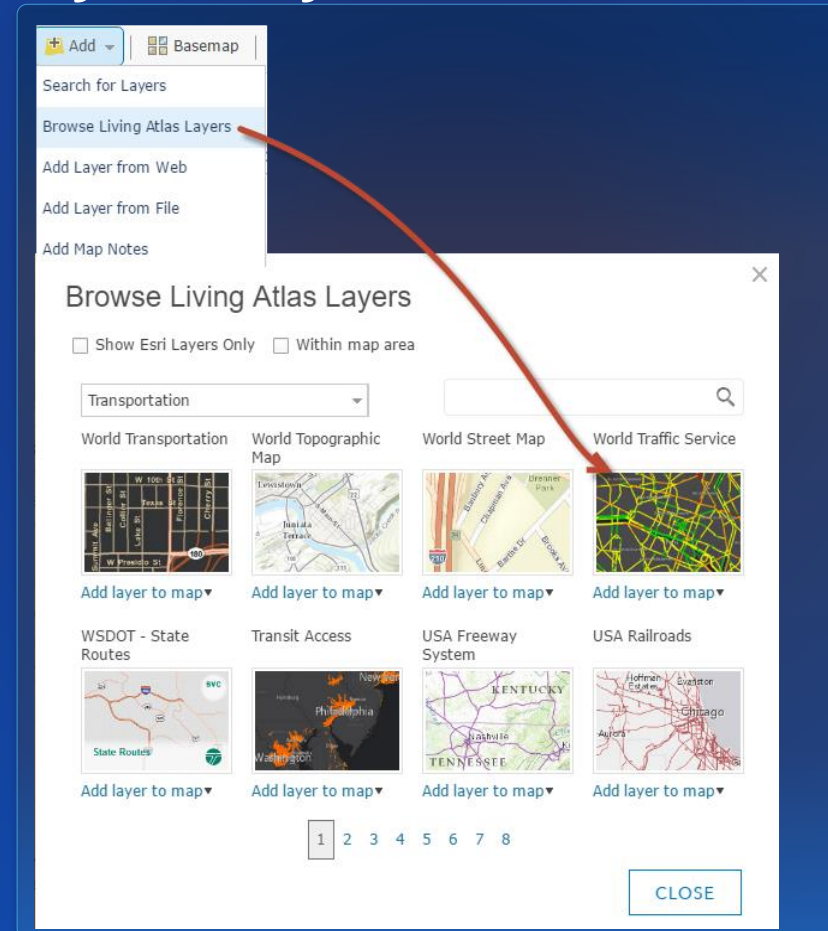


Using Traffic service

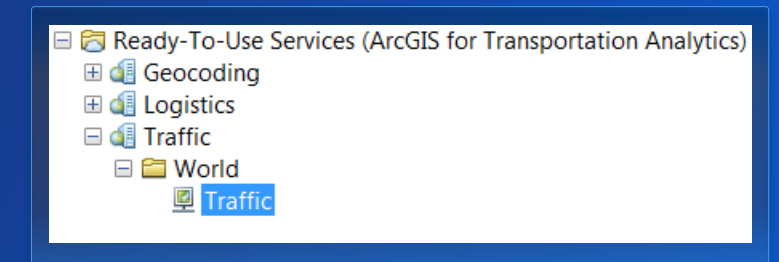
Add from the Living Atlas on the Project pane in ArcGIS Pro



Use the World Traffic web map or add Traffic layer from Living Atlas Layers to your own web map

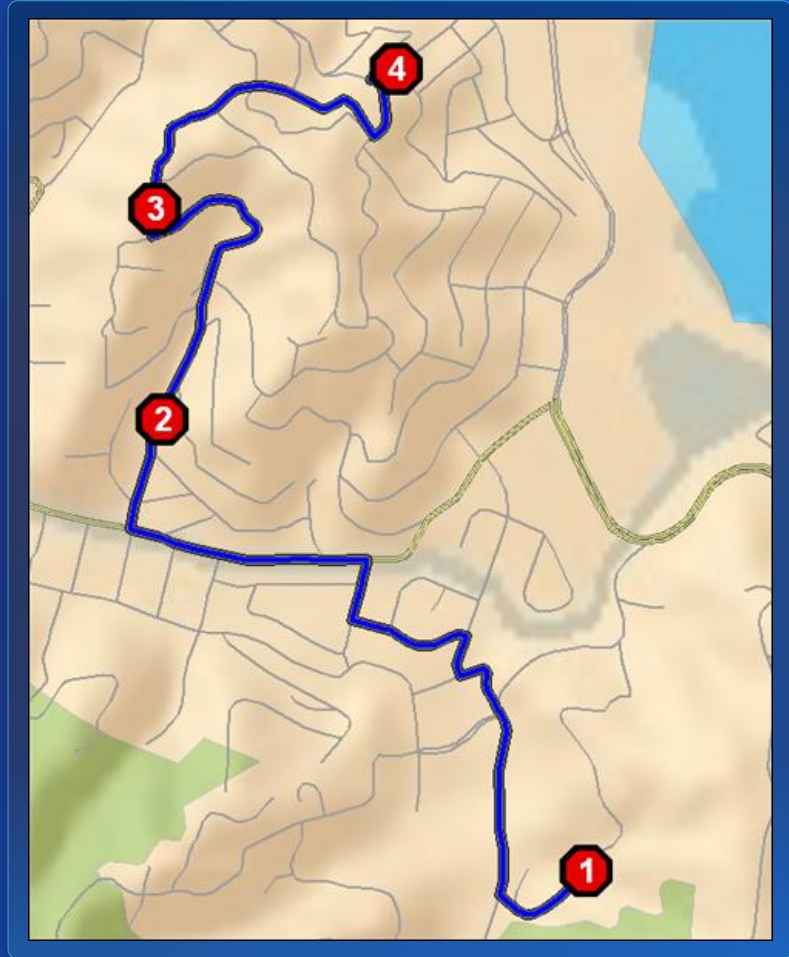


Use Traffic map service from Ready-to-Use Services in ArcMap



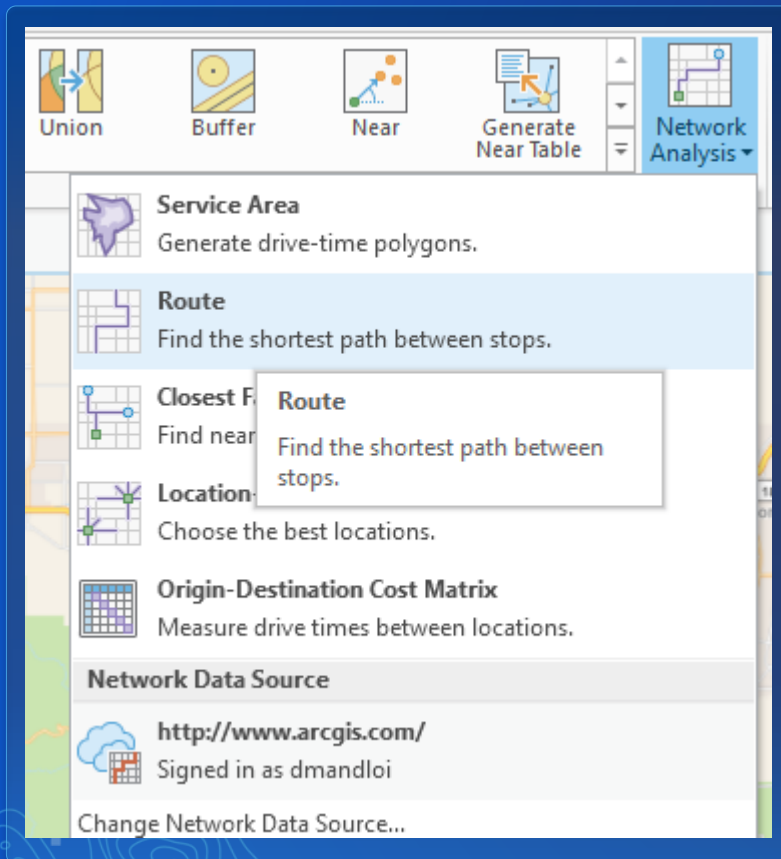
Route Service

- Simple Route – Point-to-point routing between stops in the given sequence
- Optimized Route – Find the best route and sequence for visiting a series of stops
- Use live traffic conditions
- Driving directions in many languages

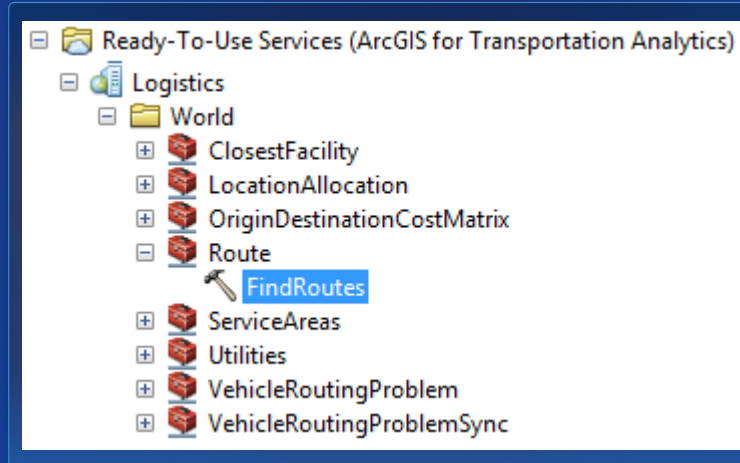


Using the Route service from Desktop

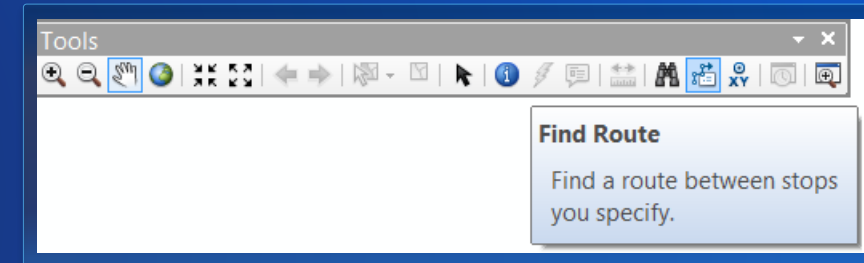
Use Route analysis layer in ArcGIS Pro



Use FindRoutes geoprocessing tool from Ready-to-Use Services in ArcMap



Use Find Route button on the Tools toolbar in ArcMap



Using the Route service from Map Viewer

Directions

ALL

A

15354 Castana Ave, Paramount, California

B

4036 Agate St, Jurupa Valley, California

C

8409 Lime Ave, Fontana, California

D

2255 Lorain Rd, San Marino, California

ADD DESTINATION

Driving Time

HIDE OPTIONS

Optimize order

Return to start

Use traffic

GET DIRECTIONS

CLEAR

122.22 miles • 2 hours 36 minutes

ZOOM TO FULL ROUTE

A

1. Start at 15354 Castana Ave, Paramount, California

↑

2. Go north on Castana Ave toward Paseo St

0.11 mi • 1 minute

↱

3. Turn right on Paseo St

0.14 mi • 1 minute

↰

4. Turn left on Lakewood Blvd (CA-19 N)

1.26 mi • 2 minutes

Use Directions in Map Viewer

Use Connect Origins to Destinations analysis tool in Map Viewer

Connect Origins to Destinations

1 Choose point layer representing the origin locations:

Home Locations (Points)

2 Route to destinations in

Work Locations (Points)

3 Measure

Driving Time

Traffic based on typical conditions for

Live traffic

Now

+3

+6

+9

+12 hr

Traffic based on typical conditions for

Monday

8:00 AM

See availability.

4 Result layer name

Routes from Home Locations to Work Locations

Save result in

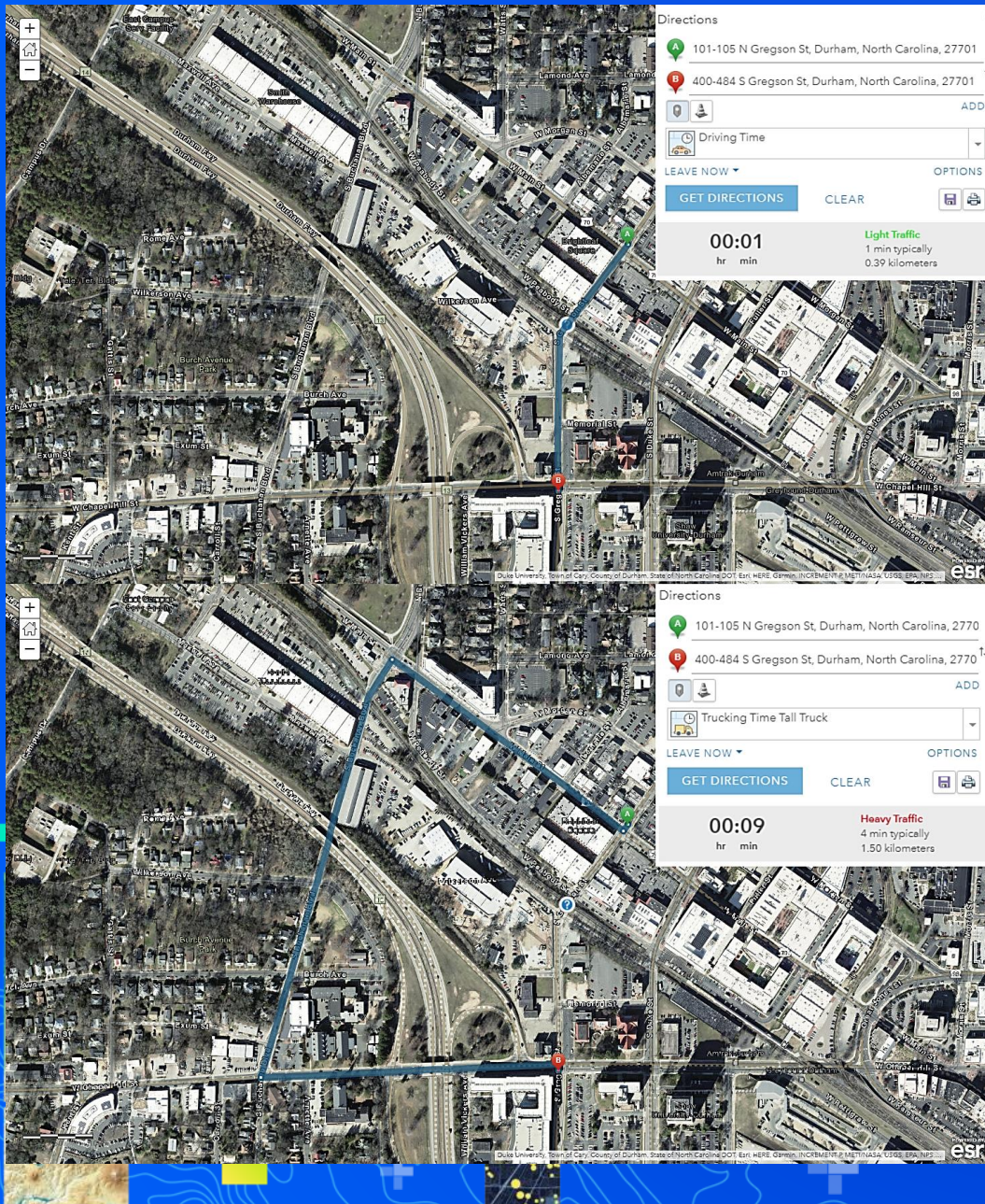
outputs

Use current map extent

Show credits

RUN ANALYSIS

Network Analysis with ArcGIS Online

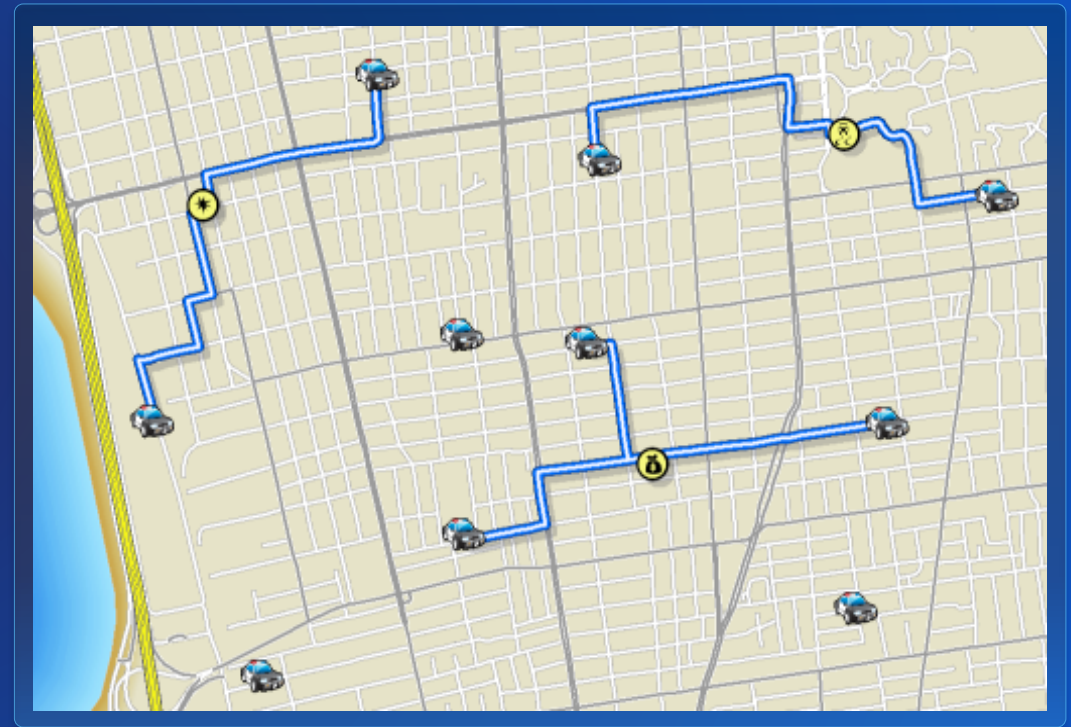


Demo: Directions with custom travel modes

Find best route for a truck that requires 4 meter clearance

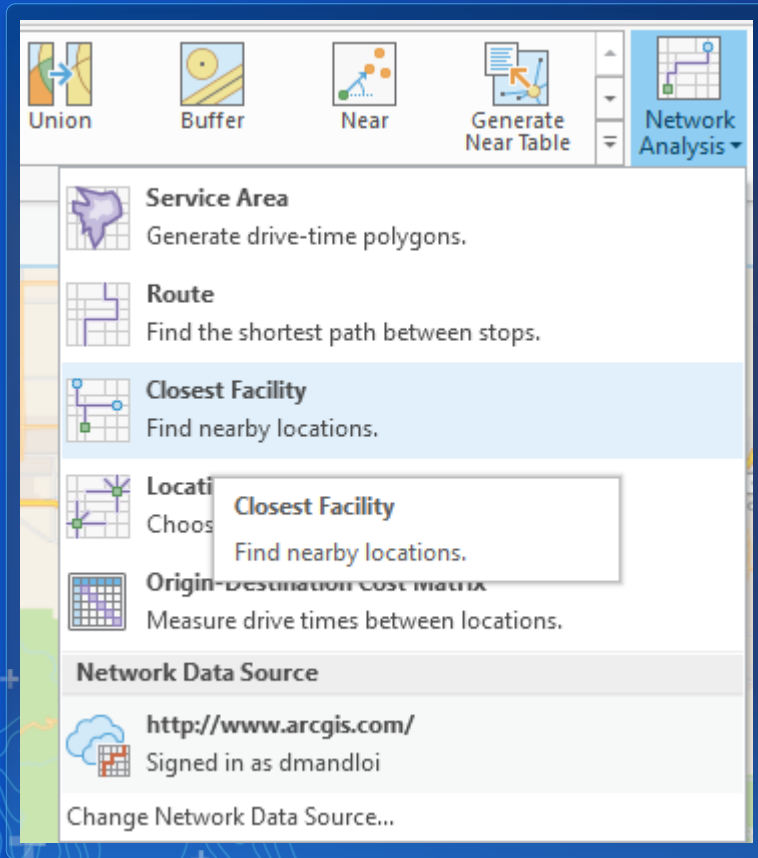
Closest Facility service

- Find the closest facilities from each incident
- Generate routes and driving directions
- You can also...
 - Use live traffic conditions
 - Limit the search distance
 - Limit the number of facilities to find
 - Travel from the facility to the incident



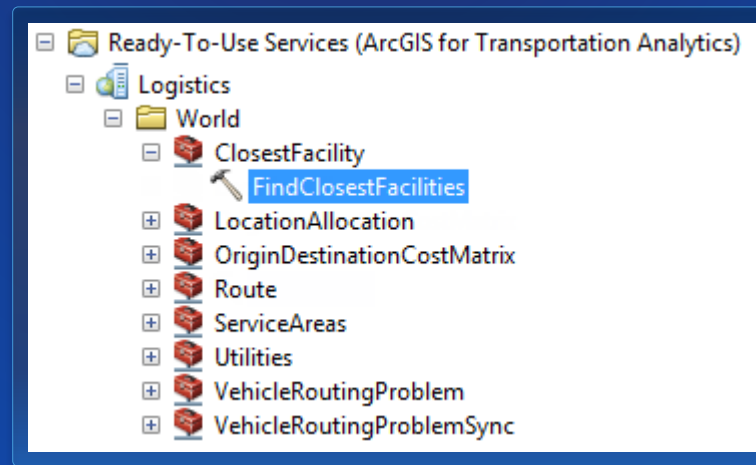
Using the Closest Facility service

Use Closest Facility analysis layer in ArcGIS Pro



Use Find Nearest analysis tool in Map Viewer

Use FindClosestFacilities geoprocessing tool from Ready-to-Use Services in ArcMap

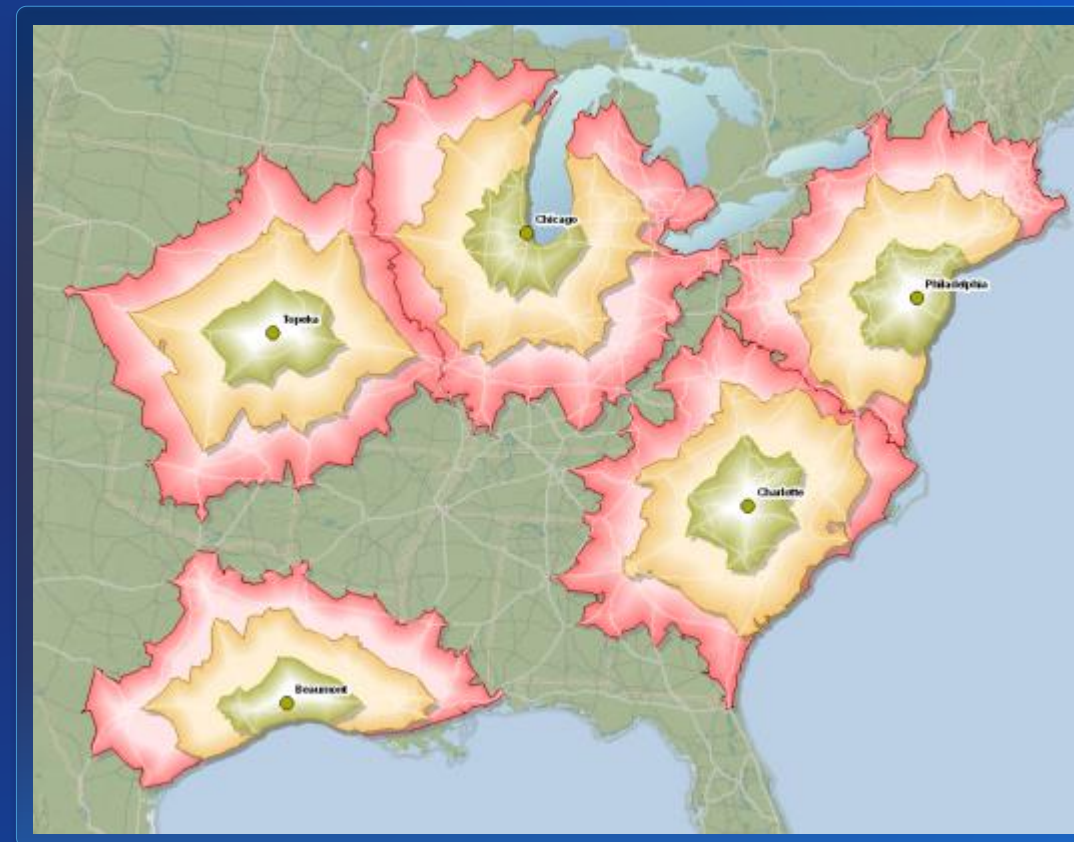


The screenshot shows the 'Find Nearest' tool interface in Map Viewer. The tool is configured with the following settings:

- 1 Choose point layer from which the nearest locations are found:** customers
- 2 Find the nearest locations in:** Stores_Points
- 3 Measure:** Walking Time
- 4 For each location in the input layer:**
 - ☒ Limit the number of nearest locations to: 2
 - ☒ Limit the search range to: 10 Minutes
- 5 Result layer name:** Nearest Stores to Customers
- Save result in: dmandloi
- ☒ Use current map extent
- RUN ANALYSIS**

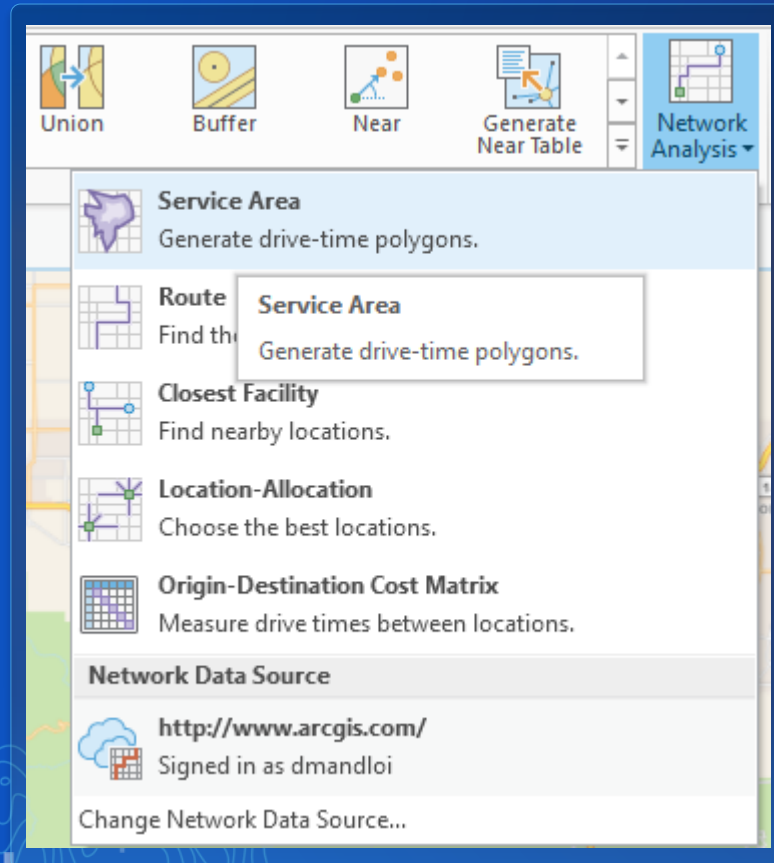
Service Areas (Drive Times) service

- Find the area you can reach from a location in a given time period
- You can also...
 - Solve for many locations
 - Use multiple drive time values
 - Analyze for different times of the day
 - Specify the direction of travel

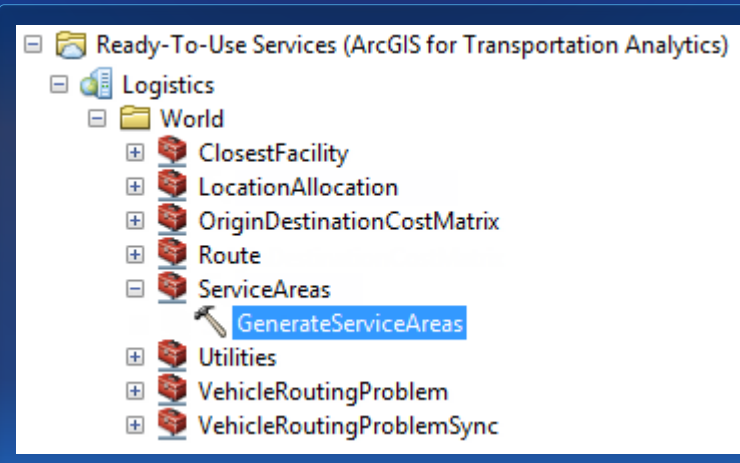


Using the Service Areas service

Use Service Area analysis layer in ArcGIS Pro



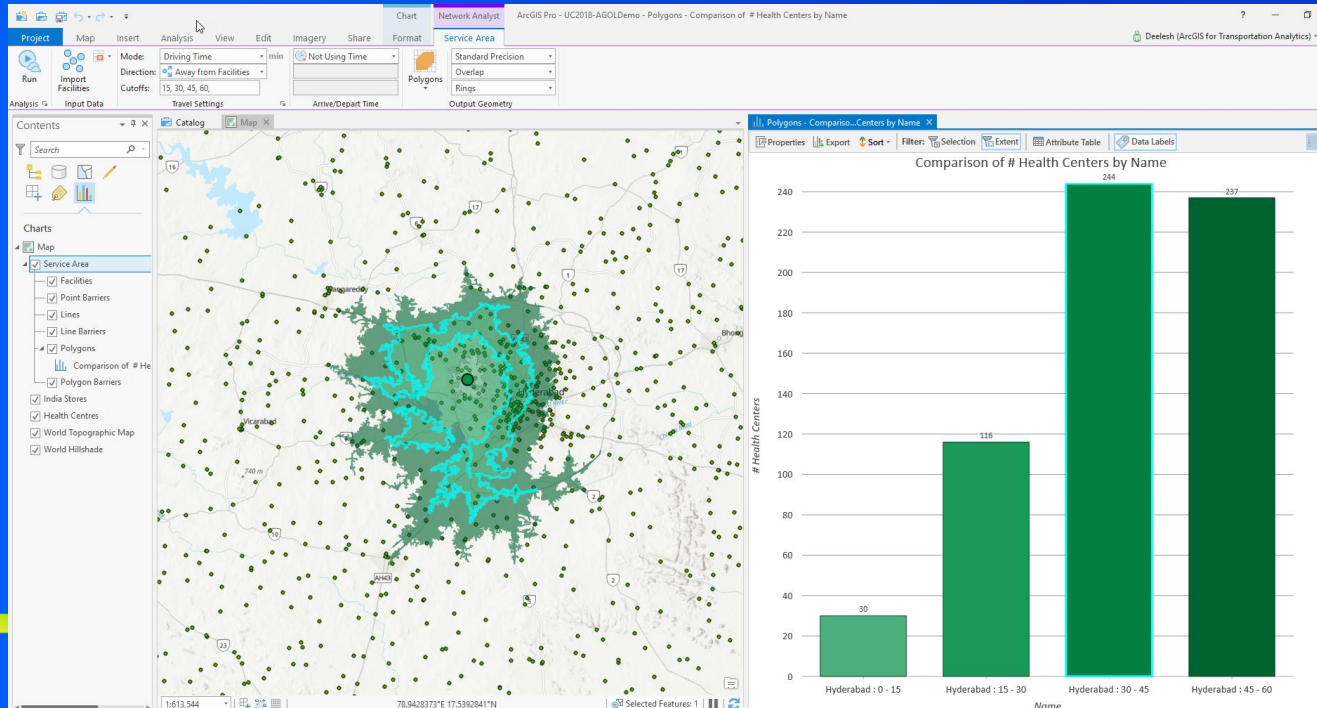
Use GenerateServiceAreas geoprocessing tool from Ready-to-Use Services in ArcMap



Use Create Drive Time Areas, Summarize Nearby or Enrich Layer analysis tools in Map Viewer

The screenshot shows the 'Create Drive-Time Areas' tool interface in Map Viewer. The tool is configured with the following settings:

- 1 Choose point layer to calculate drive-time areas around:** San Francisco Stores
- 2 Measure:** Walking Time, 5 10 Minutes
- 3 Areas from different points:** Overlap, Dissolve, Split
- 4 Result layer name:** Travel from San Francisco Stores (5 10 Minutes)
- Save result in:** dmandloi
- ☒ Use current map extent
- [Show credits](#)
- RUN ANALYSIS**

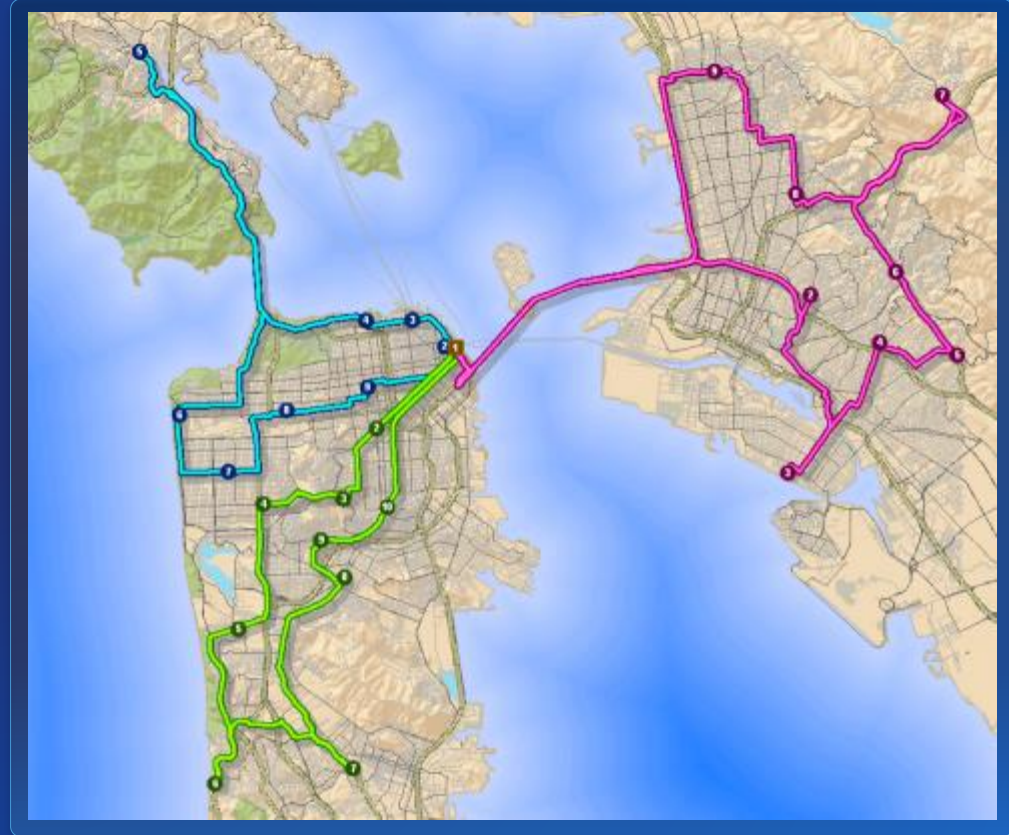


Demo: Determine accessibility to health centers

Use Service Area analysis to count the number of health centers within certain drive times

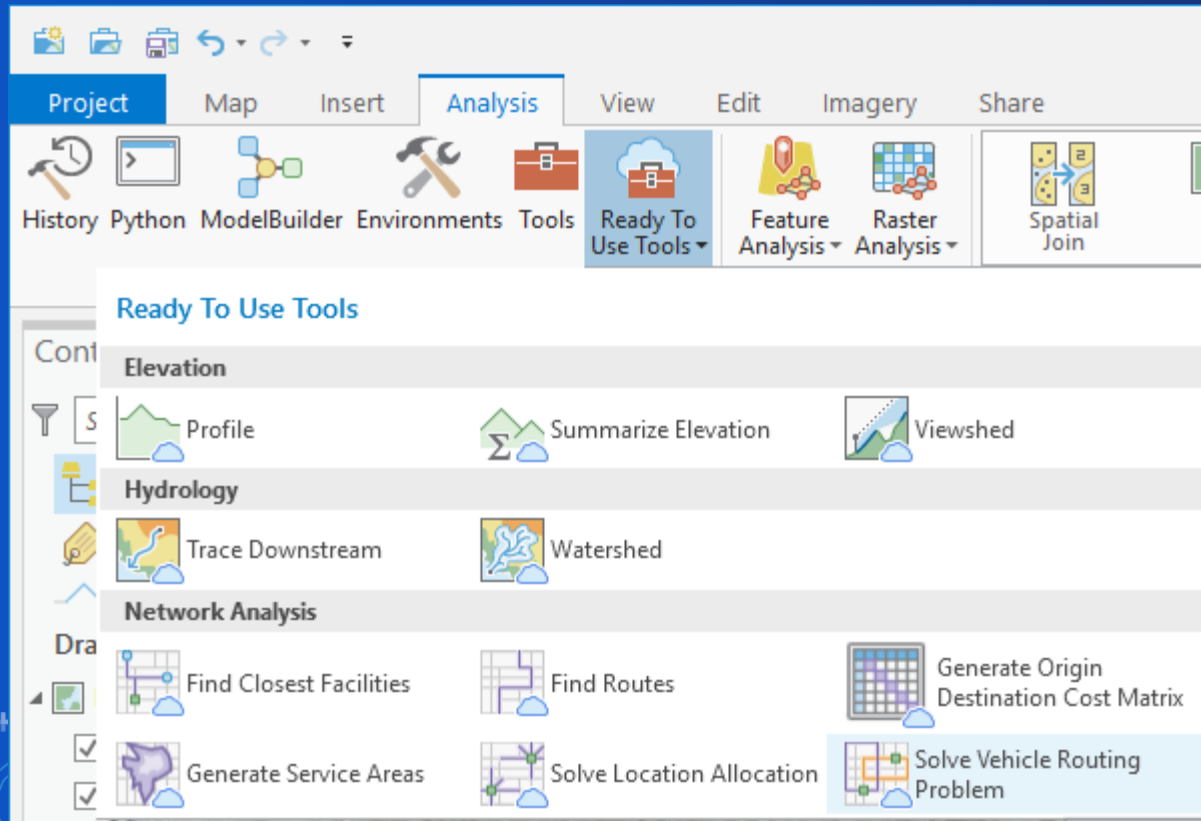
Vehicle Routing Problem (Fleet Routing) service

- Route a fleet of vehicles to service a set of orders
- You can also specify...
 - Vehicle capacities
 - Driver specialties
 - Work breaks
 - Time windows on orders

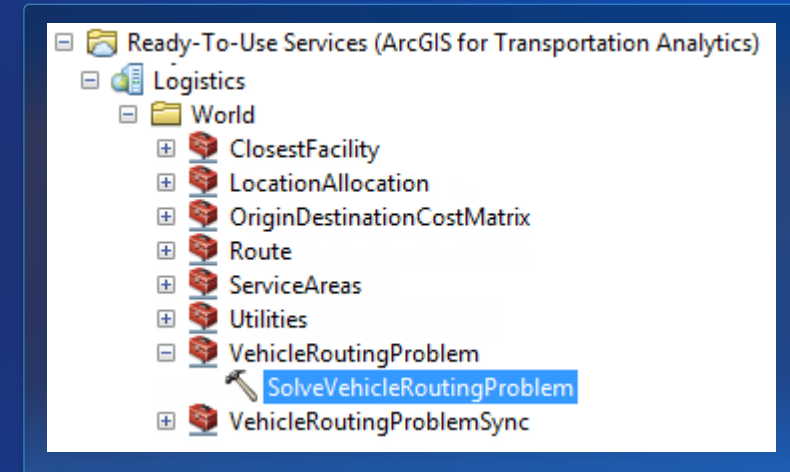


Using the Vehicle Routing Problem service

Use Solve Vehicle Routing Problem Ready-To-Use tool in ArcGIS Pro



Use SolveVehicleRoutingProblem geoprocessing tool from Ready-to-Use Services in ArcMap



Using the Vehicle Routing Problem service

Use Plan Routes analysis tool in Map Viewer

Plan Routes

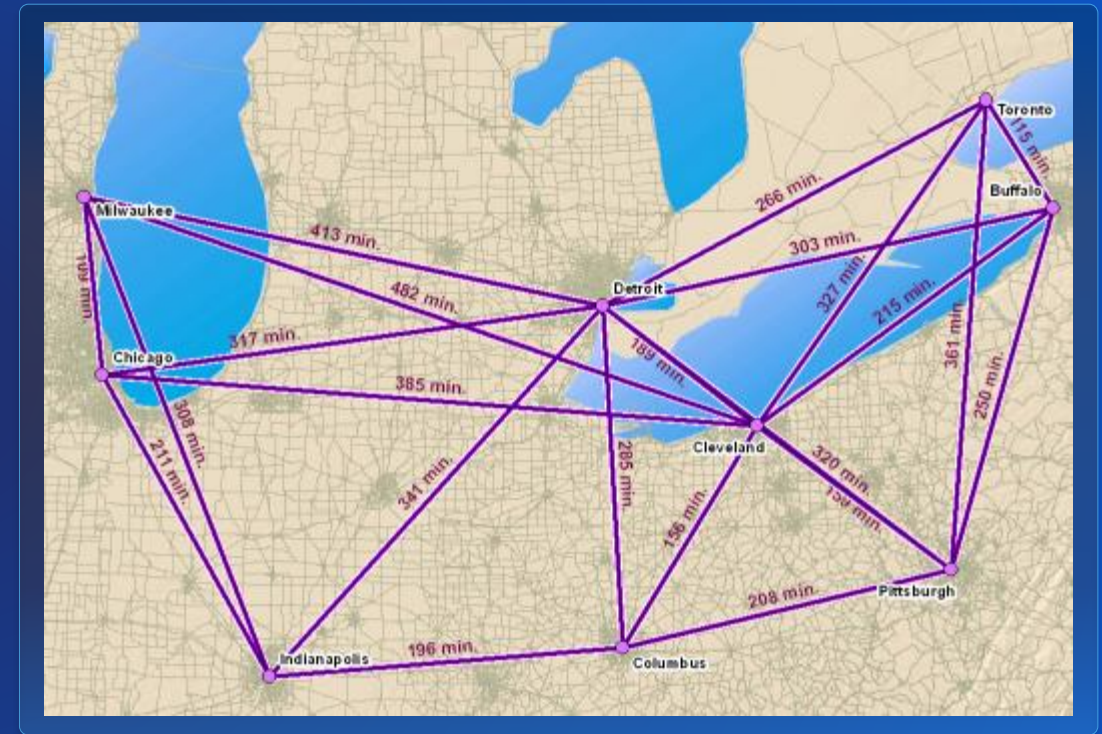
- 1 Choose point layer representing stops to visit**
San Francisco Stores
- 2 Travel mode for routes**
Trucking Time
- 3 Routes begin at**
Distribution Center
Start time for all routes
7/20/2015 8:00 AM
- 4 Routes end at**
☒ Return to start
Add point to map
- 5 Maximum number of vehicles to route**
3 Vehicles
- 6 Maximum number of stops per vehicle**
10 Stops
Your layer has 25 stops.
The current map extent shows 25 stops.
- 7 Time spent at each stop**
15 min 0 sec
- 8 ☒ Limit the total route time per vehicle**
8 hr 0 min
- 9 Result layer name**
Routes to San Francisco Stores
Save result in dmandloi

☒ Use current map extent [Show credits](#)

RUN ANALYSIS

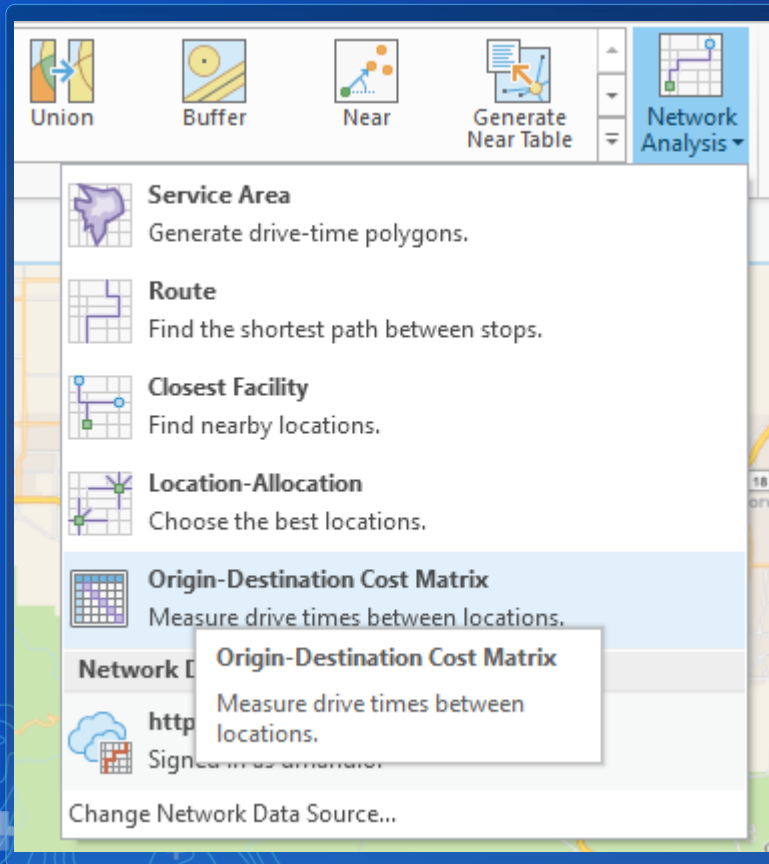
Origin Destination Cost Matrix service

- Generates a table containing travel times and travel distances between all origins and all destinations.
- You can also...
 - Specify a cutoff
 - Limit the number of destinations to find
 - Analyze for different times of the day

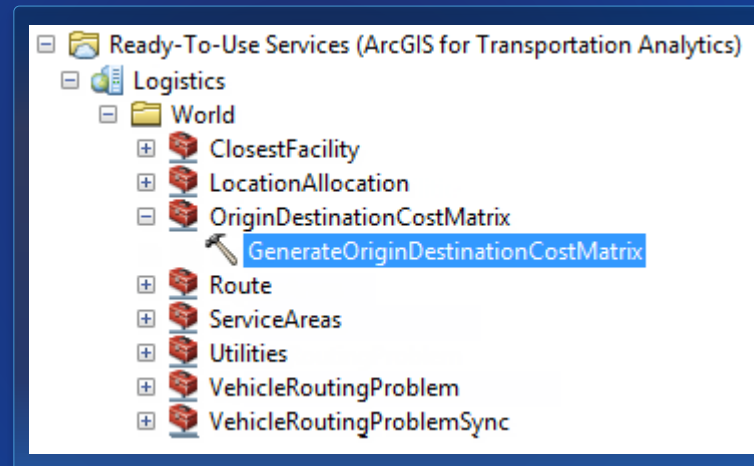


Using the Origin Destination Cost Matrix service

Use Origin-Destination Cost Matrix analysis layer in ArcGIS Pro



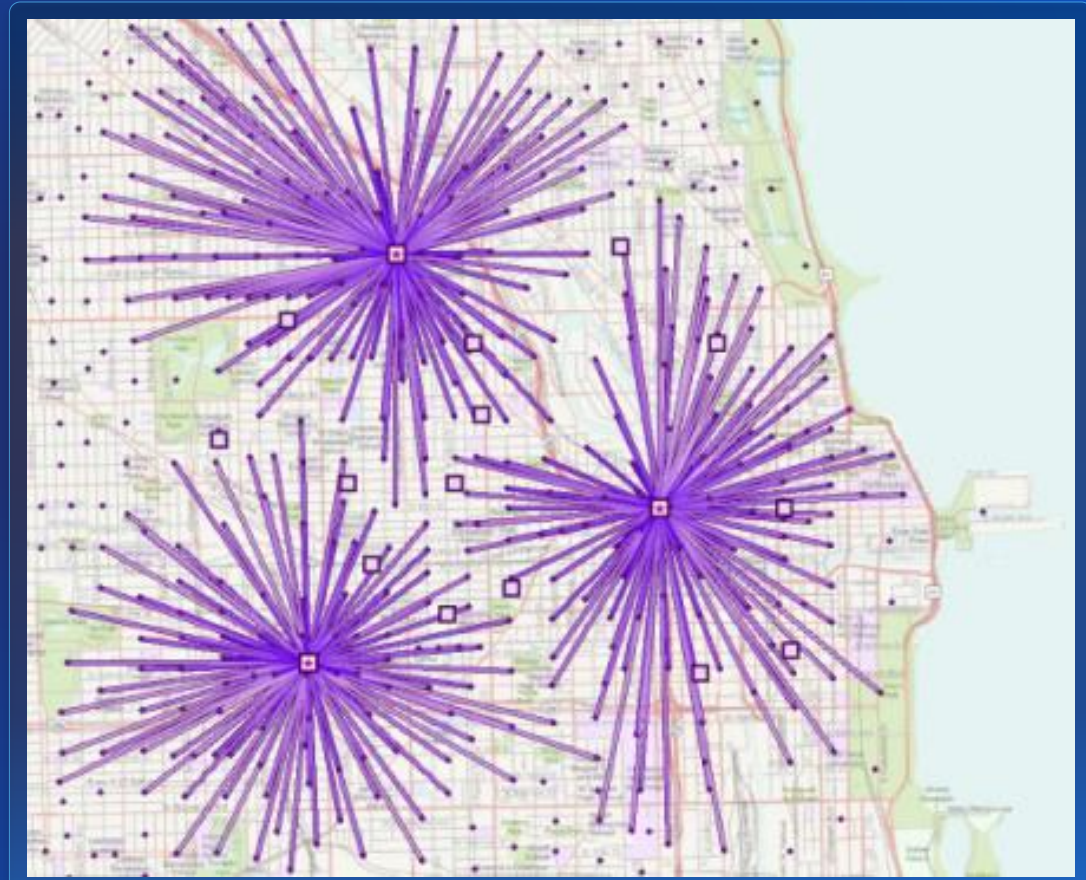
Use GenerateOriginDestinationCostMatrix geoprocessing tool from Ready-to-Use Services in ArcMap



***No analysis tool currently available in Map Viewer**

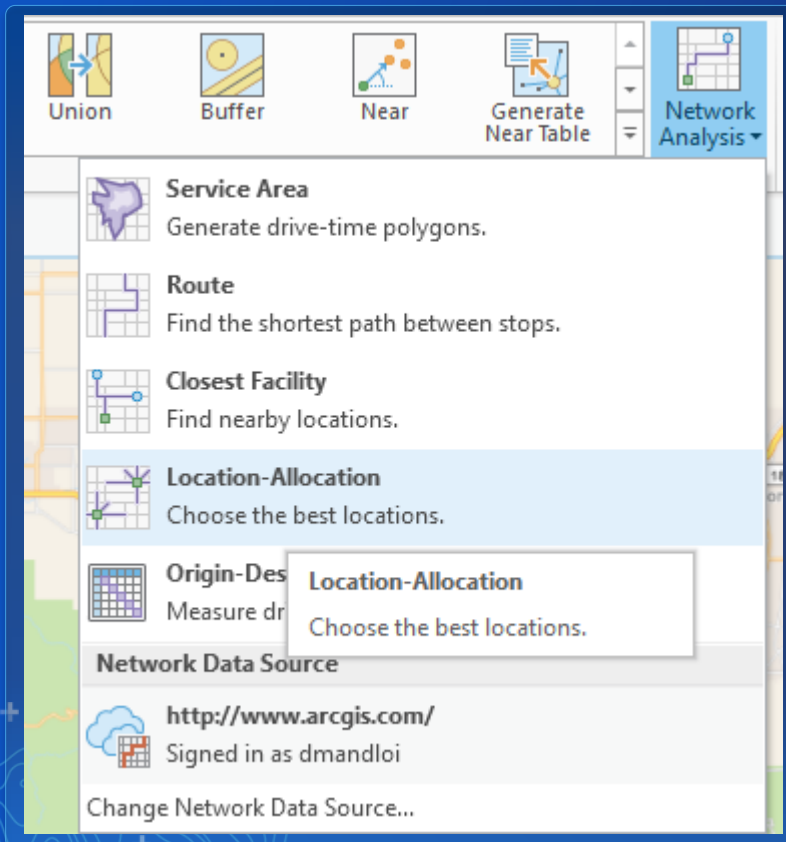
Location-Allocation service

- **Determine the best location for a facility, based on demand conditions**
 - Choose from many different analysis types
 - Limit the capacity of facilities
 - Analyze for different times of day

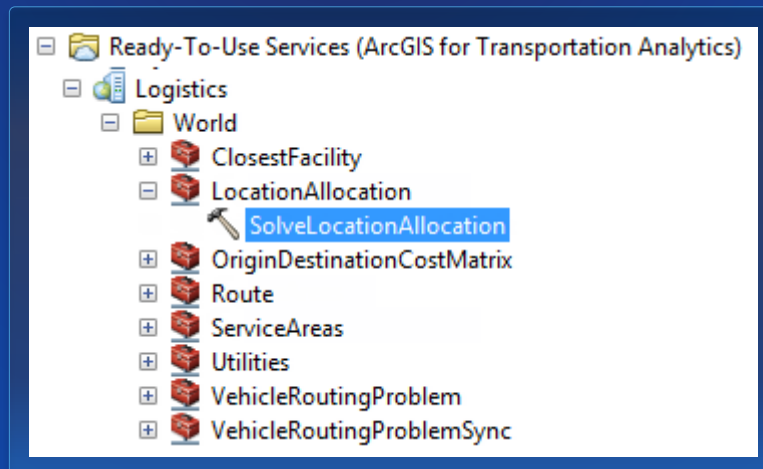


Using the Location-Allocation service

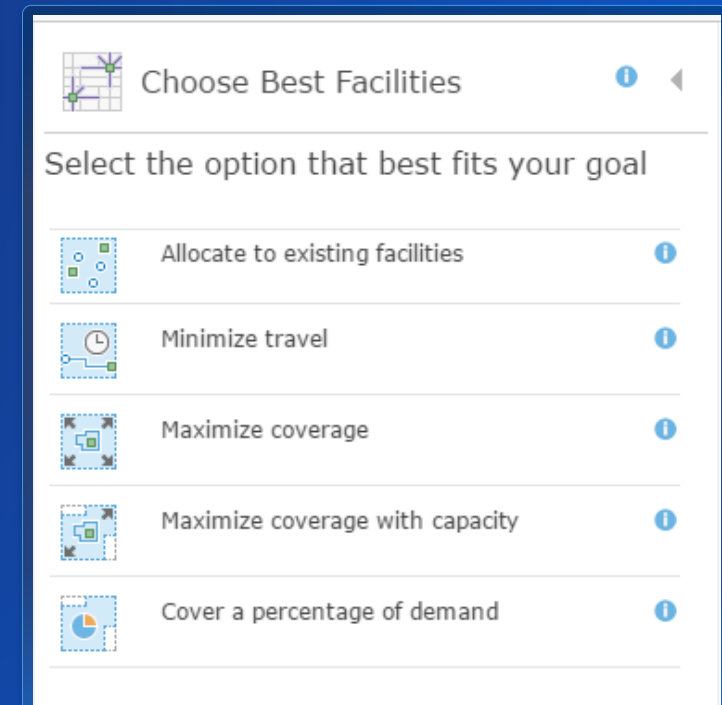
Use Location-Allocation analysis layer in ArcGIS Pro

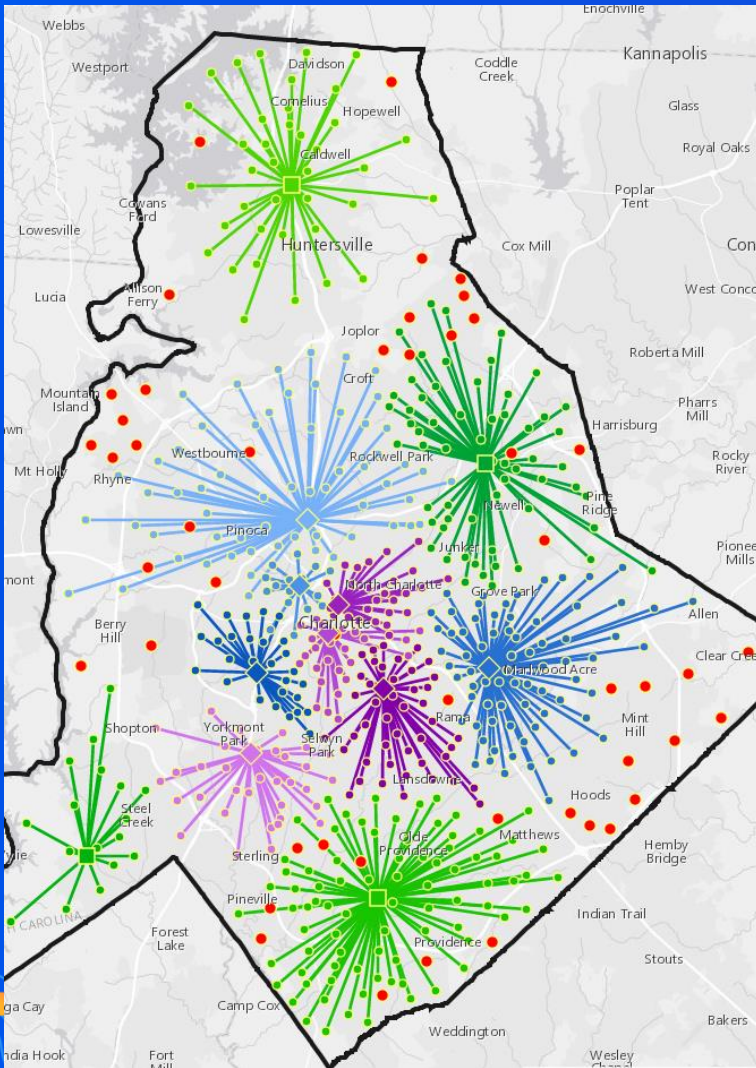


Use SolveLocationAllocation geoprocessing tool from Ready-to-Use Services in ArcMap



Use Choose Best Facilities analysis tool in Map Viewer

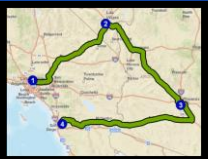
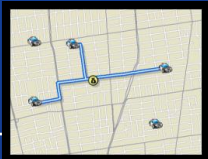

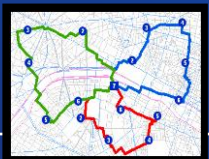

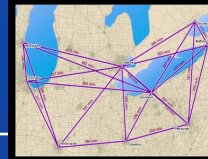

























Demo: Site Flu Clinics

Use Choose Best Facilities tool to site mobile health clinics for providing immunizations

Summary - Network Analysis Services

							
	Route	Closest Facility	Service Area	Vehicle Route	Location Allocation	OD Cost Matrix	Traffic
ArcGIS Online Map Viewer	  Directions Connect Origins to Destinations	 Find Nearest	 Create Drive-Time Areas	 Plan Routes	 Choose Best Facilities	Not Available	
ArcGIS Pro				Coming Soon			
ArcMap							

Managing Credits



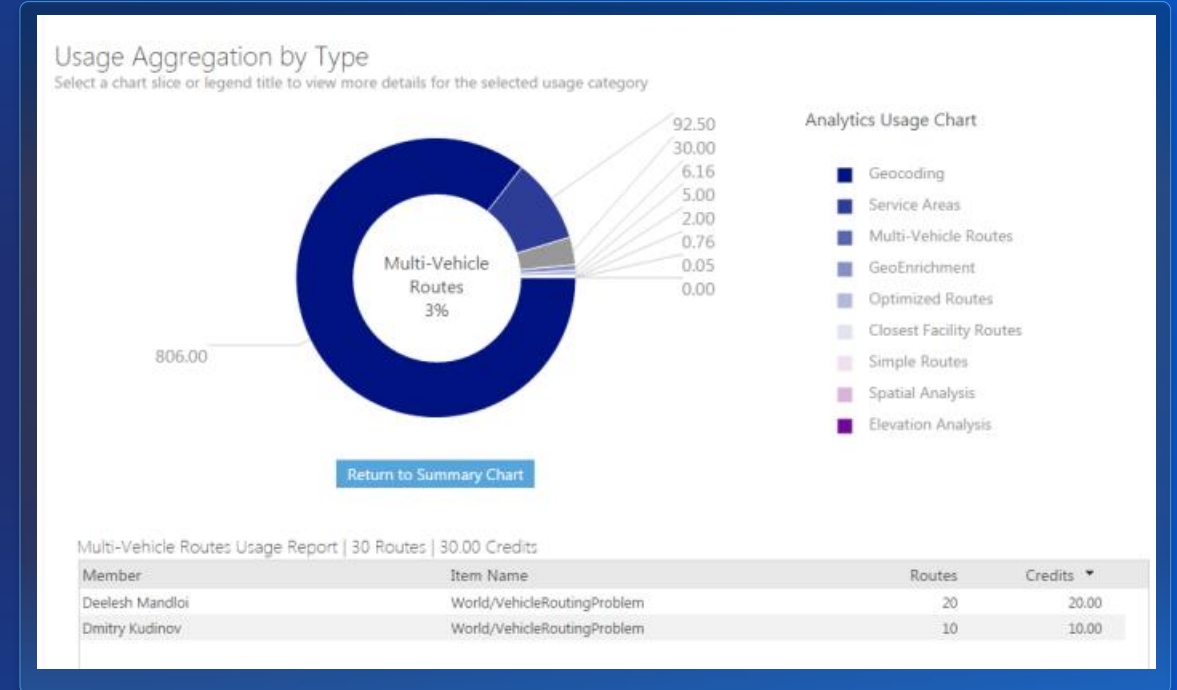
Service Credits

- **Every successful request deducts credits from your organization**
- **How many service credits does network analysis services use?**
- **Credits explained**

Network Analysis	Credits Used
Simple Routes	0.005 credits per route
Optimized Routes	0.5 credits per optimized route
Drive Time (Service Areas)	0.5 credits per drive time
Closest Facilities	0.5 credits per closest facility route
Multi-Vehicle Routes(VRP)	1 credits per route
Location-Allocation	0.1 credit per allocated demand point
Origin Destination Cost Matrix	0.0005 credits per input origin and destination pair
Traffic	0 credits

Monitor service credits used by your organization

- Reports can be accessed by the administrators in your ArcGIS Online organization
- Monitor usage by individual users



Credit Budgeting and Allocation

- Control the amount of credits that can be used by a user

OverviewMembersLicensesStatusSettings

SaveCancel


GeneralHome PageGalleryMapItemsGroupsUtility ServicesRolesMarketplaceCollaborationsCredits

Credits ?

Manage and control expenditures by crafting a budget that assigns a flexible allocation of credits to some or all organization members. An allocation of any amount can be assigned to your members one at a time or as part of a bulk operation. Allocations for members may be modified at any time.

If this method does not meet your needs you can revert to solely making use of the default organization-wide credit monitoring strategy.

Credit Budgeting and Allocation



Check the checkbox below to budget credits. Once you have enabled the credit budgeting tools you can set allocations for one or more members by clicking the button that will appear below and opt to specify that each member's available credits will appear on their profile page. You can also set the allocations in the Action menu associated with an individual member in the Organization page Members grid.

☒ Enable credit budgeting tools

☐ Show each member's available credits on their profile page

Set Default AllocationManage Budget

Network Analysis privilege

- Control which users can run network analysis services using custom roles and the network analysis privilege

Overview Members Licenses Status Settings

Save Cancel

General

Home Page

Gallery

Map

Items

Groups

Utility Services

Roles

Marketplace

Collaborations

Credits

Security

Open Data

Roles ?

Role Name:
Author

Description:
Can not run any credit consuming c

Minimum Level: ☐ 1 ☒ 2

Toggle All On Collapse All

General Privileges

☒ Members [-] ☒ Groups

☒ View

☒ Create, update, and delete

☒ Join organizational groups

☒ Join external groups

☒ View groups shared with organization

☐ Sharing [-] ☐ Premium Content

☒ Share with groups

☒ Share with organization

☒ Share with public

☒ Make groups visible to organization

☐ Make groups visible to public

☐ Geocoding

☒ Network Analysis

☐ Spatial Analysis

☐ GeoEnrichment

☐ Demographics

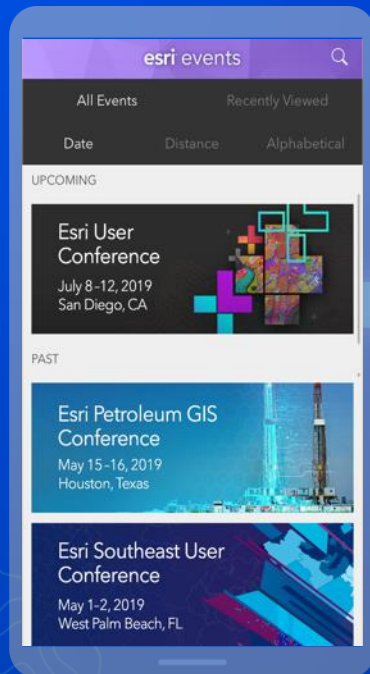
☐ Elevation Analysis

Support and Resources

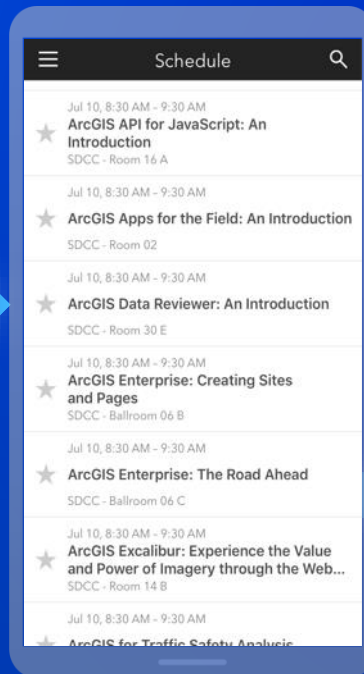
- **ArcGIS Pro:** <http://pro.arcgis.com/en/pro-app/help/analysis/networks/arcgis-online-services.htm>
- **ArcMap:** <http://desktop.arcgis.com/en/arcmap/latest/extensions/network-analyst/what-are-arcgis-online-network-services-10-2-.htm>
- **Map Viewer:** <https://doc.arcgis.com/en/arcgis-online/analyze/perform-analysis.htm>
- **Developers:** <https://developers.arcgis.com/features/directions>

Please Share Your Feedback in the App

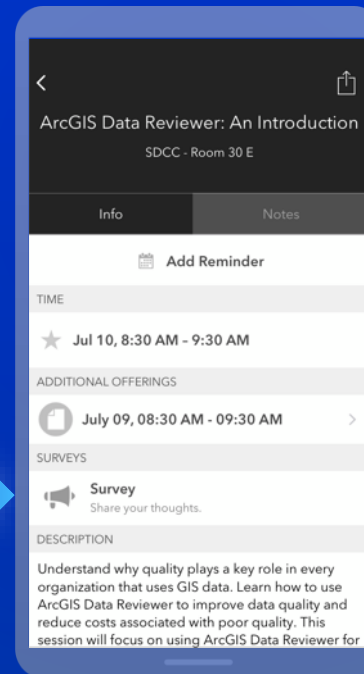
Download the Esri Events app and find your event



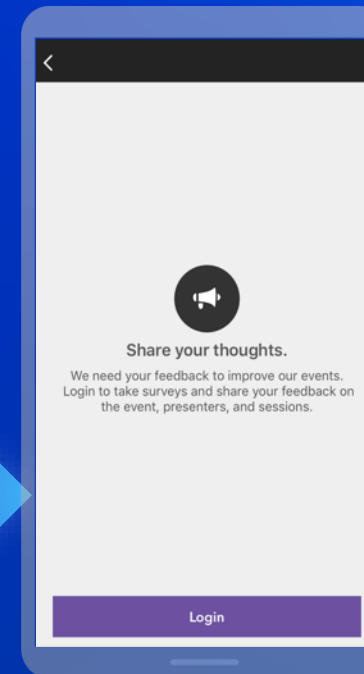
Select the session you attended



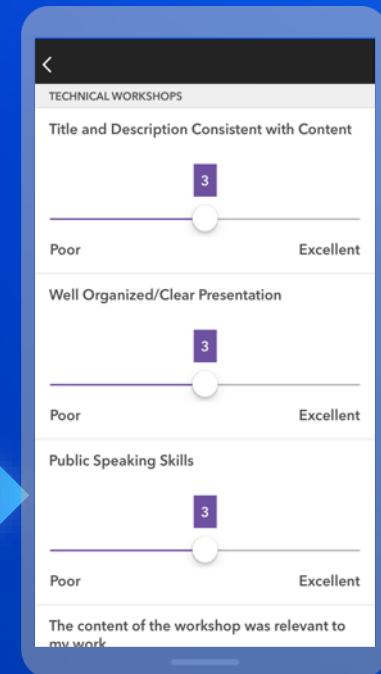
Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"



<http://esriurl.com/uc19nawago>

Questions?