PRIORITIZING TRAFFIC SAFETY SERVICE REQUEST

The City of Oakland takes service requests from SeeClickFix and other sources into Cityworks, utilizes Esri GIS tools, and prioritizes the requests to advance safety and equity in our service to the community.

City of Oakland

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OakDOT
Oakland Department of Transportation

Traffic Safety Service Request Prioritization

Introduction

The City of Oakland strives to make objective, data-driven decisions on service requests in compliance with the safety and equity goals outlined in the Department of Transportation (DOT) Strategic Plan. The collaboration between ESRI and Cityworks technologies is instrumental through the development of a data-driven model to prioritize these service requests.

Data-Driven Approach

The prioritization model for service requests had its first launch in 2016. This is an update to the prioritization model with further enhancements in features. The updated prioritization model continues to adopt the data-driven approach. The prioritization model is intended to leverage technologies from SeeClickFix, Cityworks, and ESRI. The model assigns a numeric value to each street segment within the City through GIS analysis processes and calculations. Three factors are used in the prioritization model: collision history, land use, and equity. These numbers are weighted scores resulting from an aggregation of individual prioritization calculations based on the three factors. The resulting prioritization scores from each of the factors are subsequently normalized. A weighted value is then applied to each of the prioritization scores for each factor.

The final prioritization score on each street segment is the composite value of the normalized and weighted score for each factor. Once this GIS data is composed, Cityworks incorporates the GIS layer, provides map visualization, and displays the final prioritization scores in the context of the Cityworks map. When a service request is received, either from SeeClickFix or by other means, staff can enter the relevant address and the map will zoom in to that location, where the map shows the final prioritization score for the corresponding street segment. The user transcribes the prioritization scores from the Cityworks map into a field on the service request screen. Therefore, every service request carries a prioritization score. This way we have a data-driven approach to prioritize these service requests

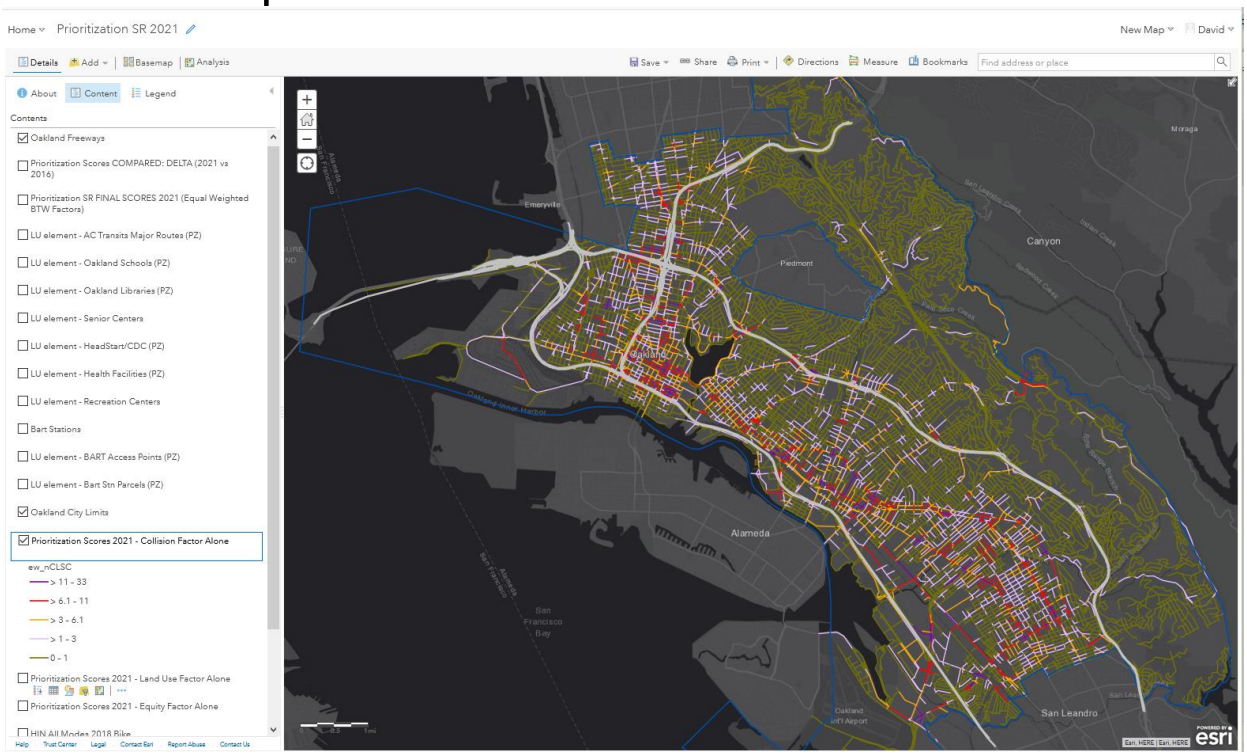
Traffic Collisions Factor

In calculating individual prioritization collision factor scores, the concept of weighted impacts is used on traffic collisions. Note that the total number of collision records involved in the calculations is large: 20,000+ records. Each of the traffic collision incidents receives an Equivalent Property Damage Only (EPDO) value depending on the degree of injury. Fatal incidents receive the maximum weighted EPDO value (9.5) in the calculation, whereas incidents involving property damage receive the lowest value (1.0). The EPDO weighting scheme used in the model is the same in the Highway Safety Manual published by AASHTO (The American Association of State Highway and Transportation Officials). This allows for observation of the standards established across the United States and makes it easier to relate to or to cross-reference other regional data should it become available.

The traffic collision data used in the calculation is extracted from the raw data published by SWITRS CHP through the proprietary software Crossroads. With further GIS operations, each street segment within the City of Oakland receives an aggregated EPDO prioritization score for the traffic collision factor. Because the last two years of SWTRIS data are often considered provisional, the periods to be adopted into the model are between 2014 to 2018.

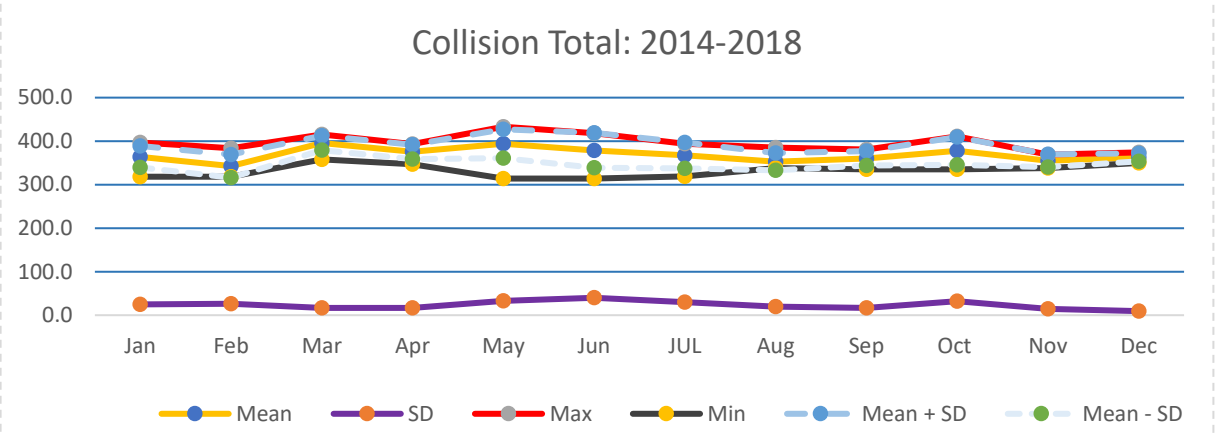
PERIOD	SOURCE	CHARTERTERICS
2014 - 2018	SWITRS	Reasonably complete, balanced data distribution, avoid provisional data

Illustration map of the results on Collision Factor



Collisions Data Distribution

The diagram below shows the data distribution of the Statewide Integrated Traffic Records System (SWITRS) collision data from 2014 to 2018. The 2019 data is provisional and the 2020 data is not immediately available. The mean value of record counts over the five years indicates that the collision dataset is well-balanced and evenly distributed without major gaps or spikes.



Weighting within Collision Factor on Degree of Injury

Various approaches have been established to quantify the cost of traffic collisions by severity. For example, one of the schemes uses 542:1 as the ratio of costs for fatality versus property damage collisions. On the other hand, the EPDO scheme uses 9.5:1 as the ratio of fatality to property damage. After careful consideration, the EPDO scheme is adopted in the model for the reason that the ratio of 9.5 to 1 will provide a more balanced approach to avoid the risk of a skewed contribution by one single factor.

Degree of Injury	**weightings** (EPDO* costs)
Fatal	9.5
Severe Injury	9.5
Visible Injury	3.5
Complain of pain	3.5
Property Damage	1

Notes: **EPDO Crash Cost by Max Police-Reported Injury Severity within Selected Crash Geometries FHWA-HRT-050051 Oct 2005*

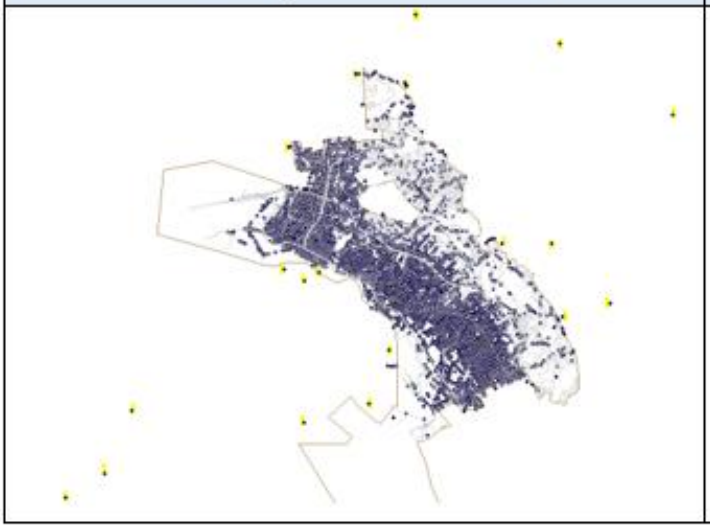
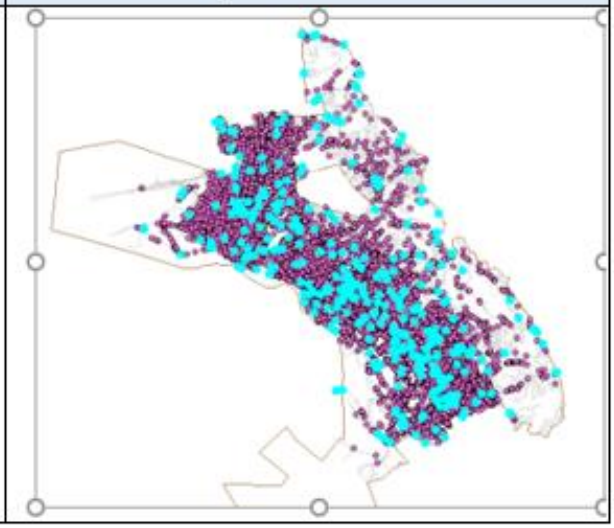
SWITRS Traffic Collision Raw Data

The SWITRS traffic collision data comes in a tabular format from the California Highway Patrol (CHP). The SWITRS data is subsequently processed by third-party software, Crossroads, for record hosting, inquires, reporting, and manipulations on a tabular level.

There are over 22,000 collision records from SWITRS for the five years from 2014 to 2018. The tabular collision records were subsequently spatialized for downstream operations.

The initial yield rate on spatializing the tabular collision records was about 98%, leaving about 2% (or slightly less than 500 records) subject to further spatial refinement.

Collisions Data (SWITRS)	Tabular/Report Record #	SWITRS 2014-2018 (Spatial conversions) Record #	Diff.	Yield (spatially)
2014-2018	22131	21750	381	98.3%
		Manually Aligned	Manually Aligned (%)	
		467	2.15%	

Before Spatial Enhancement	After Spatial Enhancement
	

Land Use Factor

One of the enhancements in this prioritization model update is to bring in gradients on the land-use factor by expanding its elements. In the previous model, the focus was only on school proximity. The updated model adds a number of public facilities and social services to the land-use factor.

Land Use Factor Expanded **

1. Oakland Schools (covers private schools; excludes closed schools)
2. Oakland Libraries (does not double-count special collections located at the same address)
3. Oakland Senior Centers
4. Oakland HeadStart Centers (updated to include selected early child development centers [ECD])
5. Oakland Health Facilities (does not double-count student-only health facilities at school sites or health facilities under different names located at the same address)
6. Oakland Recreation Centers
7. BART Stations within the City of Oakland (500-ft buffer dissolved around Bart station multi-access points or around BART parcels)
8. AC Transit-Major Routes within the City of Oakland (multiple routes are dissolved)

** most elements use the 500-feet buffer in the calculations.

Highlights on Land-use Factor

1. Schools are the most dominant element in the Land Use factor.

2. For AC Transits Routes, calculations are on dissolved lines and do not apply to the side streets.

3. Contributing datasets have been updated, such as removing closed schools from Oakland Schools dataset.

4. HeadStart data has been expanded to include 4 Oakland Unified School District (OUSD)-run early child development centers (ECDC). Because most of the other ECDC sites are on school sites, these other locations are counted under schools.
    - Jefferson ECDC - 2660 East 16th Street Oakland
    - Prescott ECDC -3550 64th Ave., Oakland
    - Manzanita ECDC - 2410 10th Ave., Oakland
    - Highland ECDC - 291 10th St, Oakland

5. Health centers at school sites and student-only health centers at school sites are not included in the calculation to avoid double counting because they are reflected by the school element.

6. Facilities like library special collections, some of which have different names, but are at the same address as a library, are not included in the calculation to avoid double-counting.
    a. American Indian Collection
    b. Second Start Adult Literacy
    c. Temescal Tool Lending Library
    d. Bookmobile

7. The max value of the land use score is 3. In other words, locations with more than three land-uses receive a maximum score of 3.

8. Some BART Stations have their locations specified by access points to each station. For those stations, the calculations are evaluated against their 500-ft dissolved buffers around these access points.

Use Multiple Access Points
- Rockridge Station
- MacArthur Station
- 19th Street Station
- 12th Street Station
- Fruitvale Station

These Bart stations below are evaluated using their 500-ft dissolved buffers on their corresponding parcels.

Use Bart Parcels
- West Oakland Station
- Lake Merritt Station
- Coliseum Station

Land Use Factor Elements Overviews

	Land Use Factor Elements	Records	Raw Data Type	Operations/Calculations
1	Schools (Parcels - Public, Charter, Private)	163	Polygon feature	500-feet buffer
2	Libraries [a]	18	Point feature	500-feet buffer
3	Senior Centers	8	Point feature	500-feet buffer
4	HeadStart Centers [b]	31	Point feature	500-feet buffer
5	Health Facilities [c]	42	Point feature	500-feet buffer
6	Recreation Centers	25	Point feature	500-feet buffer
7	Bart Stations (Multi-access Points)	5	Point feature	500-feet buffer
	Bart Stations (Parcels)	3	Point feature	500-feet buffer
8	AC Transits Major Routes	--	Line feature	dissolved

[a] *Facilities with different names at the same address not double counted*

[b] *Selected ECDC Early Child Development Centers*

[c] *Exclude facilities at school sites*

Equity Factor

In Oakland, the City defines equity as fairness. It means that identity—such as race, ethnicity, gender, age, disability, sexual orientation, or expression—has no detrimental effect on the distribution of resources, opportunities, and outcomes for our City's residents. The Oakland equity scoring is based on the final scores from the Priority Neighborhood Layer. This equity scoring reflects the scoring adjusted locally relative to the characteristics of the City of Oakland.

This Oakland Geographic Equity Toolbox differs from other geographic equity maps, like the Metropolitan Transportation Commission's Communities of Concern map. The methodology used by the City of Oakland is distinct in three ways: this tool uses similar, but not identical, factors to MTC's COC maps; our prioritization is a scale (from lowest to highest) instead of a binary of yes/no, and every Census tract's data is compared to citywide data. These aspects of our methodology provide us with more granular data which is helpful for Oakland-scale analyses rather than a regional scale.

For more details about OakDOT Geographic Equity Toolbox, please refer to https://www.oaklandca.gov/resources/oakdot-geographic-equity-toolbox

Reference

Health Facilities
https://achealthcare.org/

***AC Transit's Major Route** - AC Transits Major Corridors are the highest-ridership corridors, and together, they transport over 50 percent of the District's overall ridership.*

***Child Development Center Program,** Oakland Unified School District*
https://drive.google.com/file/d/1fwCk3EHMPDaYwSsEj4zDrVQoQaIpUYfw/view

Prioritization on Service Request Score Visualization

Below is the screenshot of the visualization map for the prioritization score – all factors.

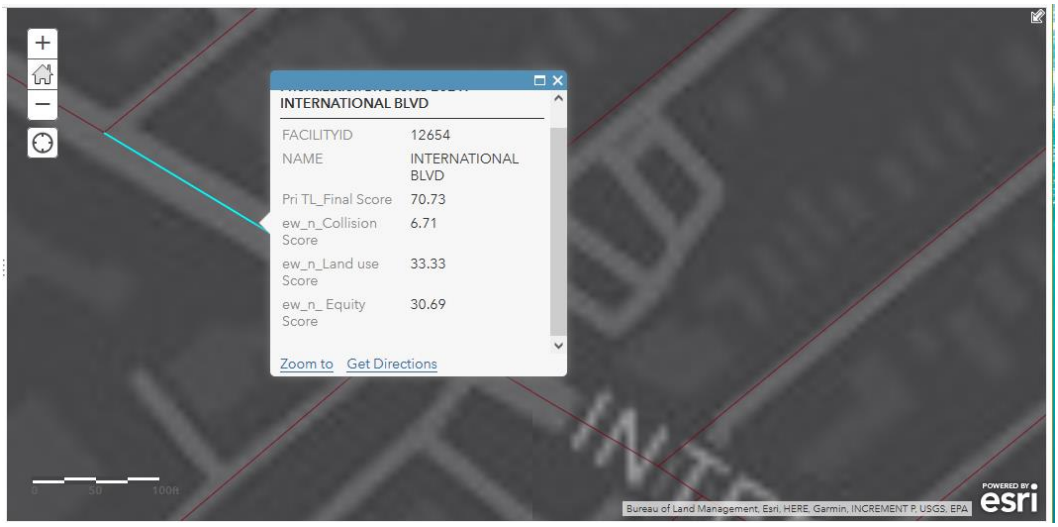
Weightings between Factors

- Collision Factor: 1/3 (33%)
- Land Use Factor:1/3 (33%)
- Equity Factor: 1/3 (33%)

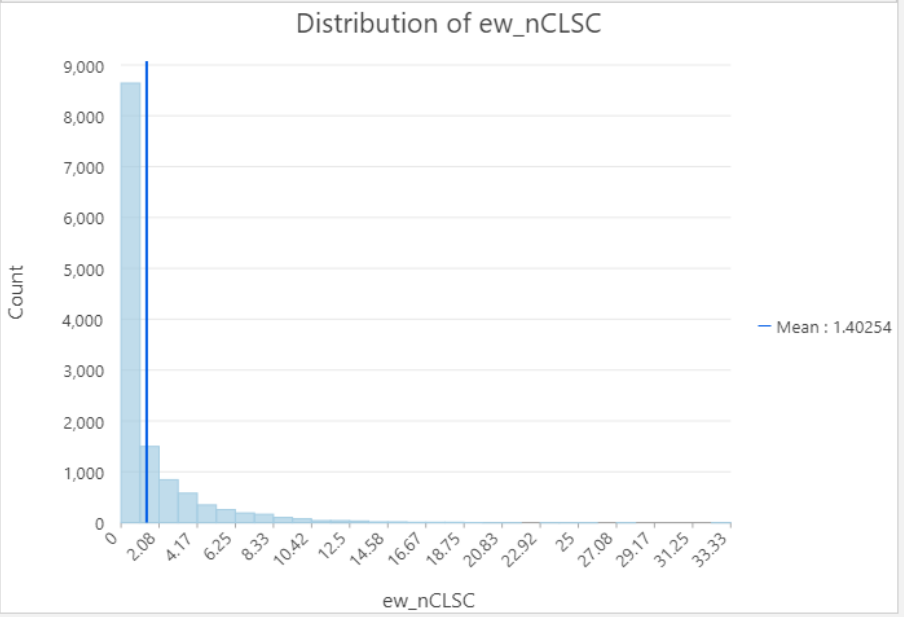
The prioritization scores for service requests are composite scores, normalized on the scale of 0 to 100 with the minimum values in 0 and possible maximum value in 100. This final score is the sum of the individual scores from its three governing factors, on an equal-weighted basis. The contribution from each of the factor scores toward the final score is in the ratio of one-third, one-third, and one-third. The minimum value for each of the factor scores is 0, and the possible maximum value is 33.3. “

For Example, International Blvd (68th Ave to 69th Ave) has a total score of 70.73. This score is the sum of the collision score (6.71), the land use score (33.33), and the equity score (30.69).

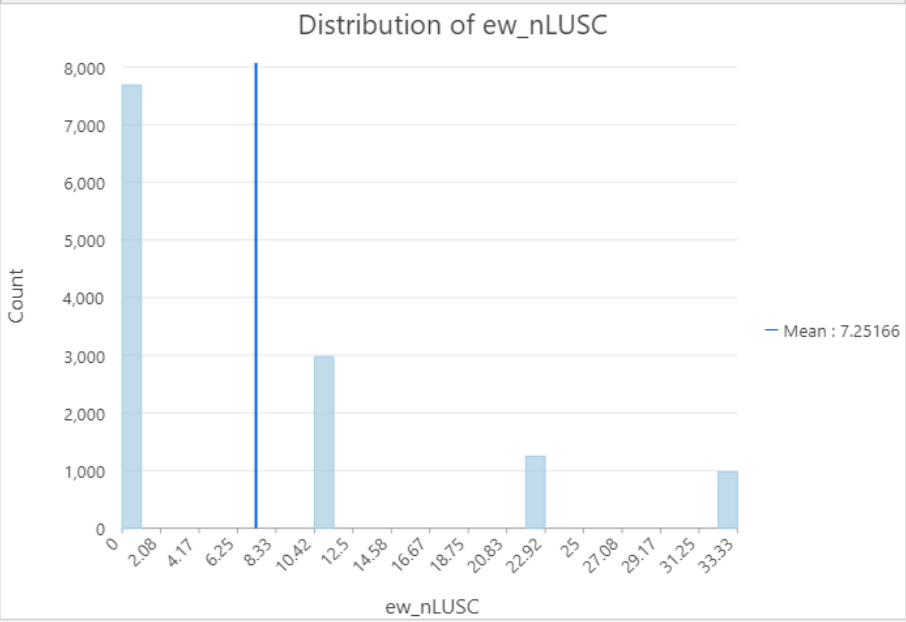
The collision score is based on this block and the adjoining intersections having 0 fatal, 1 severe, 10 injuries and 17 property damage crashes over five years. The land use score is from the block’s proximity to an elementary school and a public library, plus International Blvd having a major AC Transit bus route. The equity score is based on the socioeconomics of the residents in the adjoining census tracts, which include 96% people of color and 62% to 73% low-income residents.



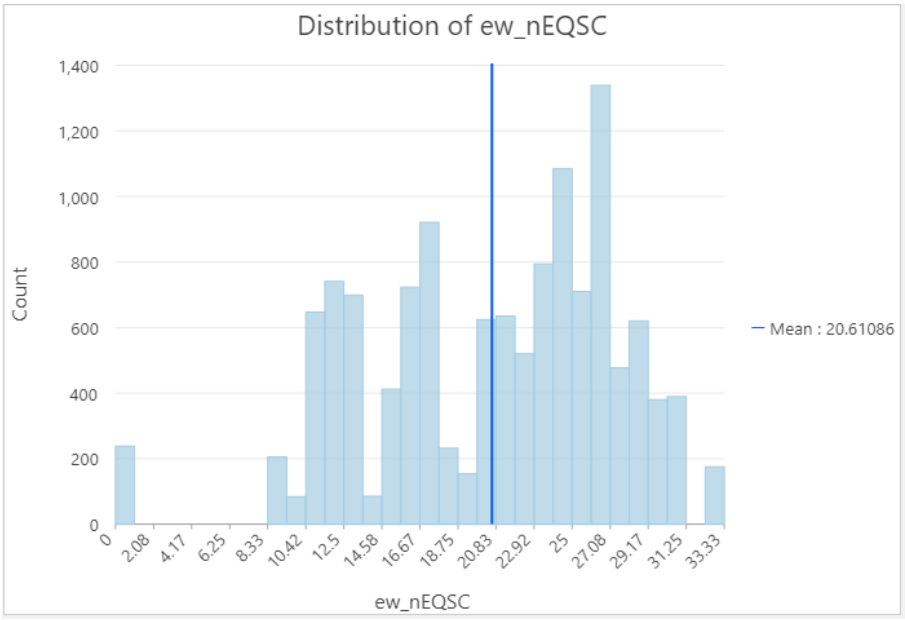
Data Distribution for Collision Factor Scores



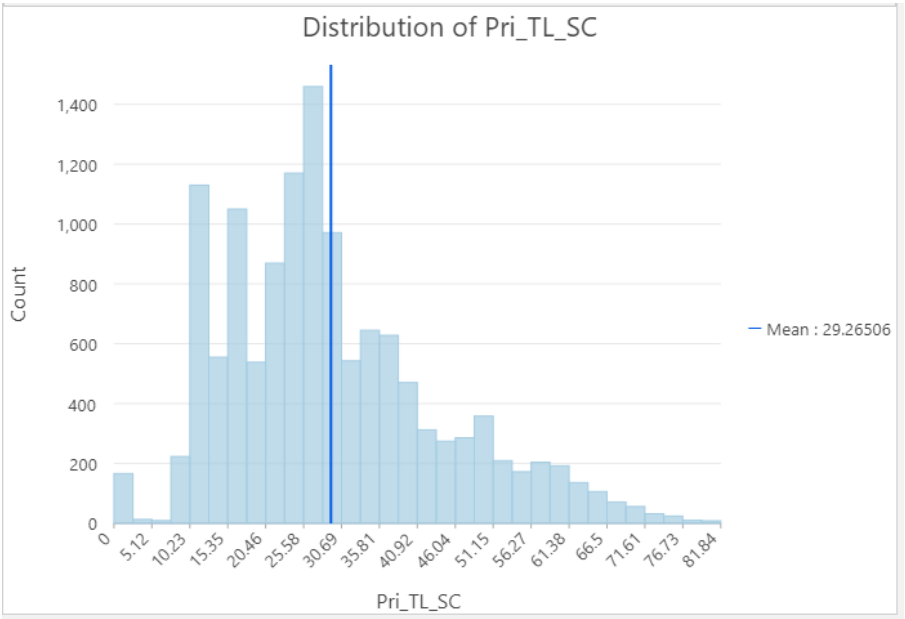
Data Distribution for Land Use Factor Scores



Data Distribution for Oakland Equity Factor Scores



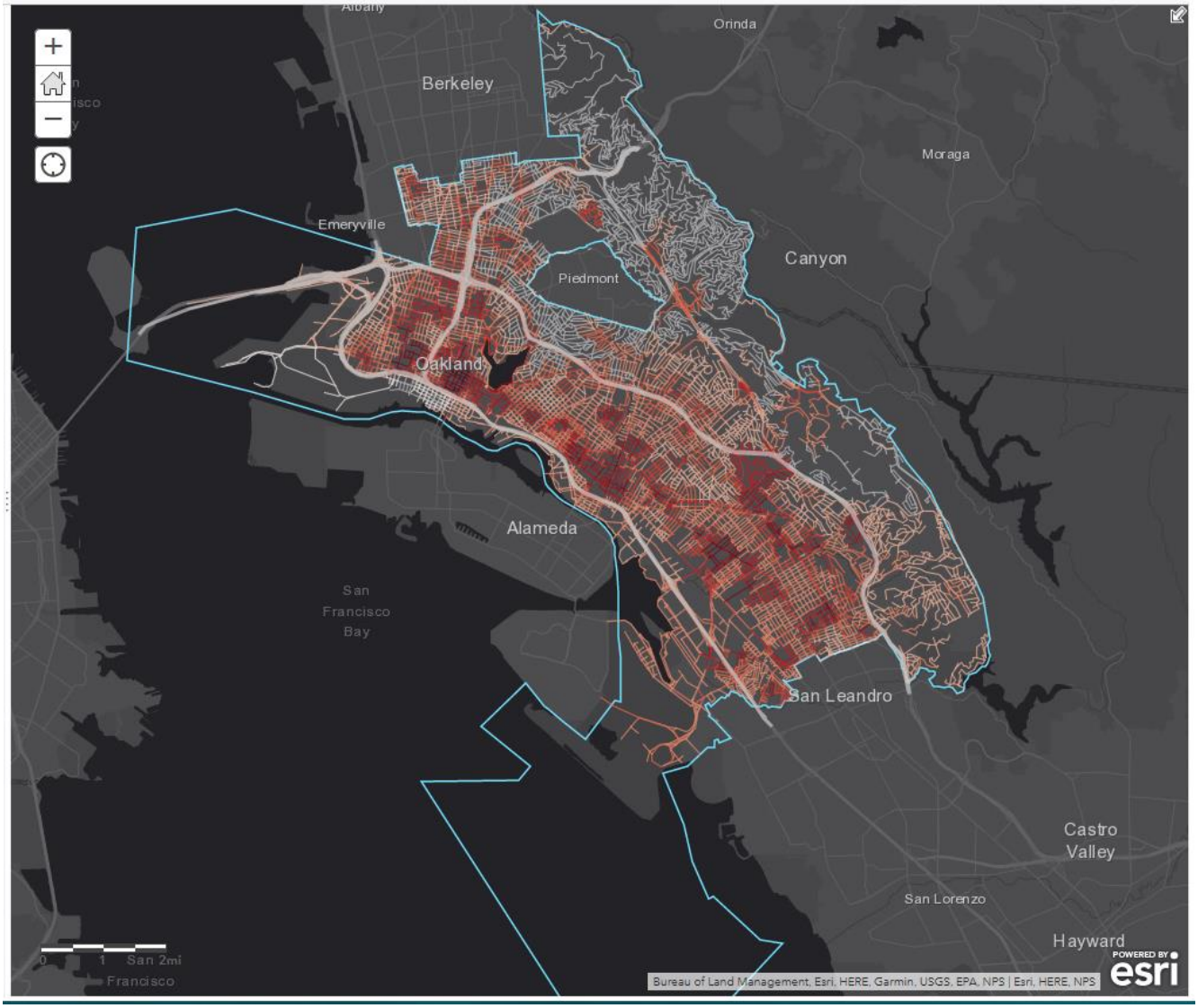
Data Distribution for Prioritization Final Composite Scores



Data Distribution for Collision Factor

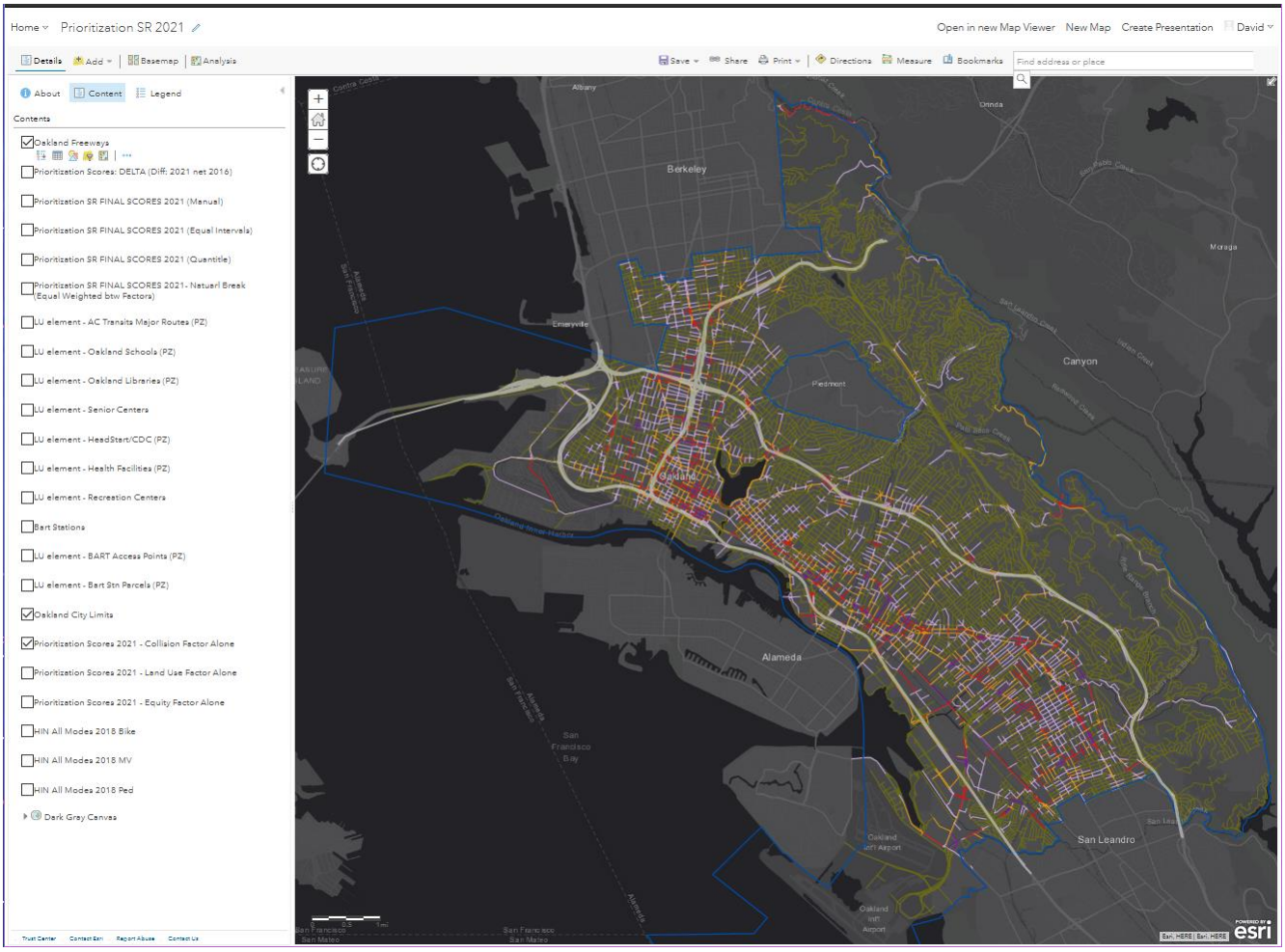
Visualization Illustration

Final Results



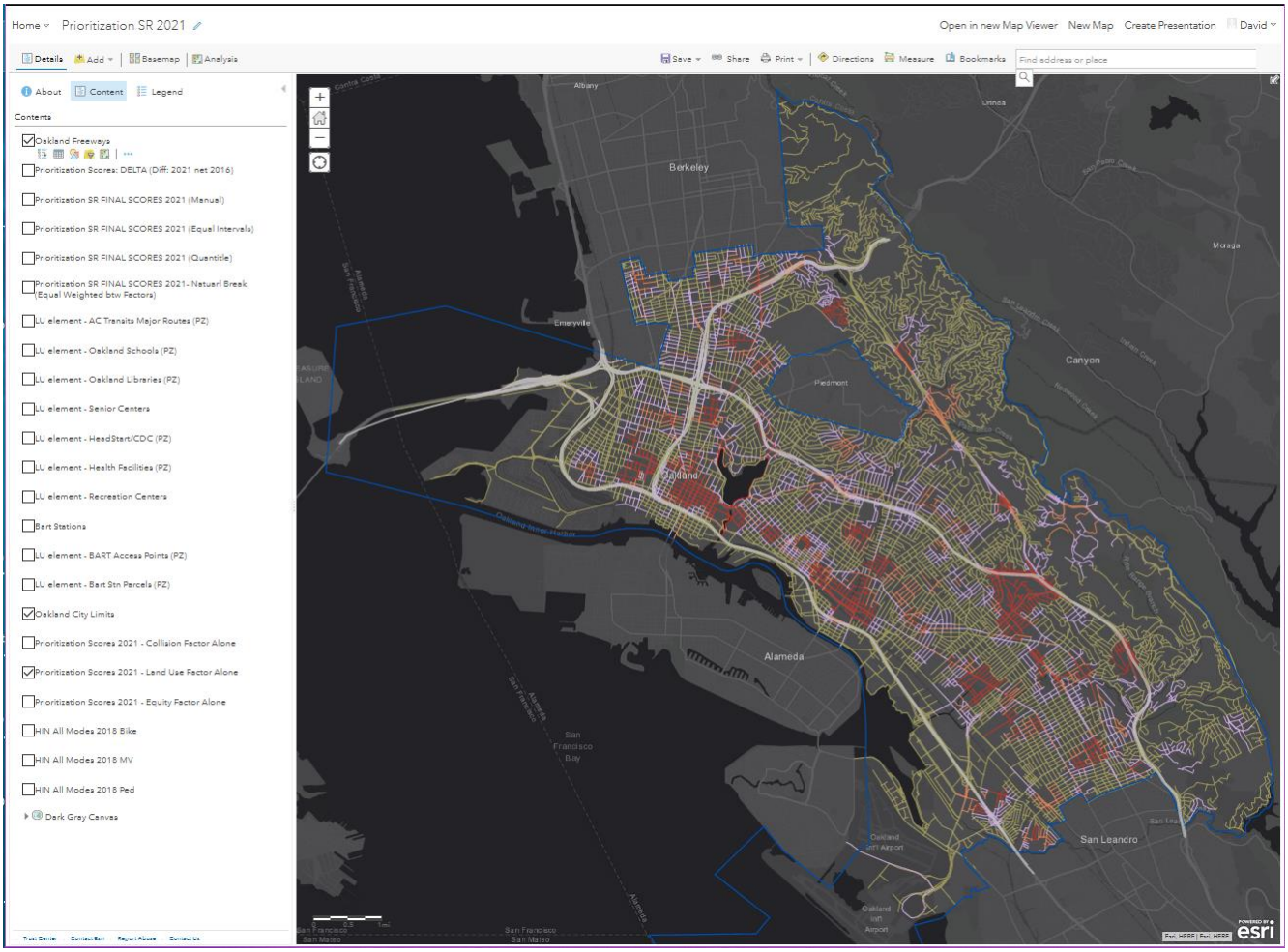
Prioritization of Service Request Score Visualization: Collision Factor Alone

Below is the screenshot of the visualization map for the prioritization score – Collision



Prioritization on Service Request Score Visualization: Land Use Factor Alone

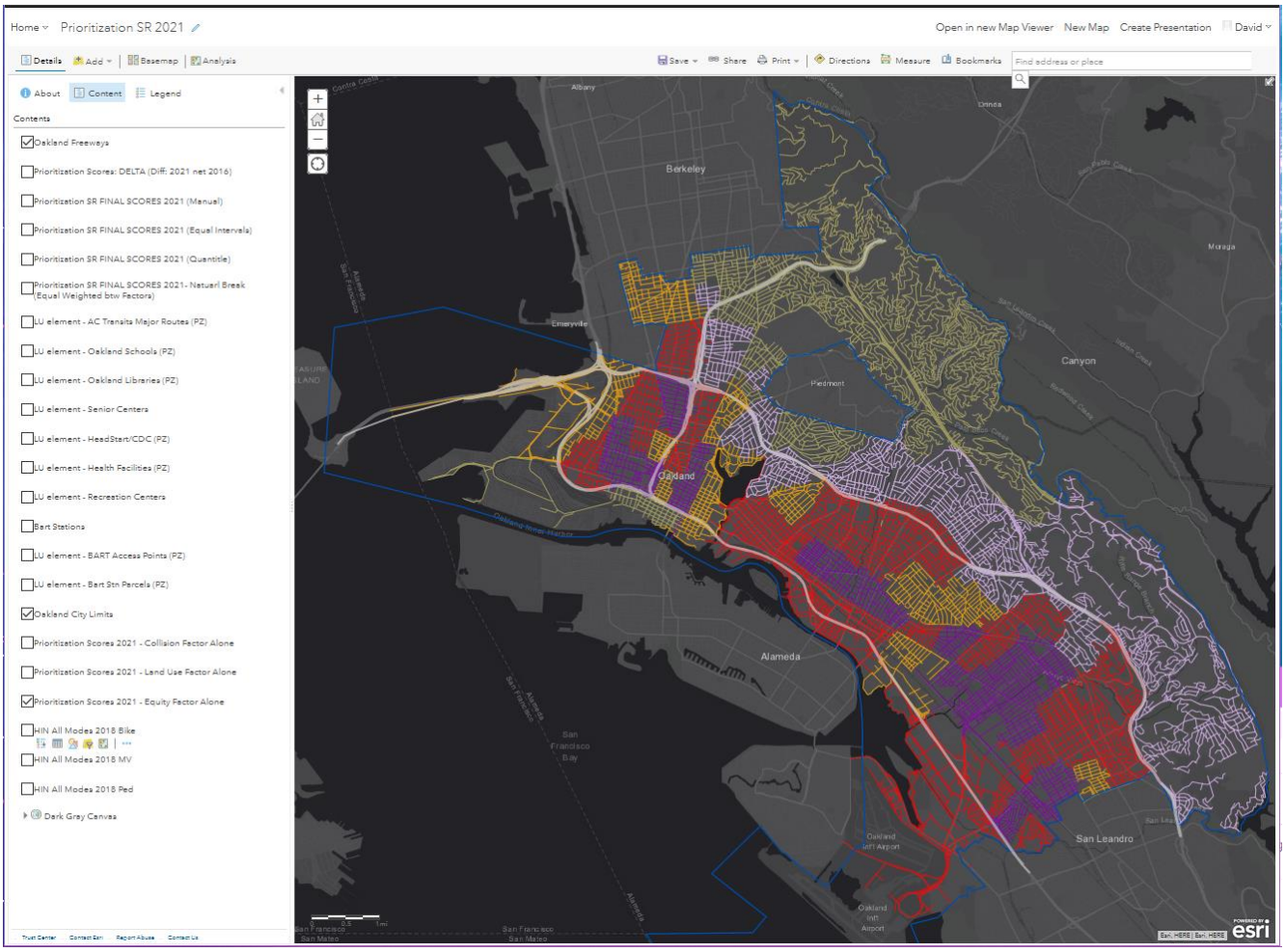
Below is the screenshot of the visualization map for the prioritization score – Land use



Prioritization on Service Request Score Visualization: Equity Factor Alone

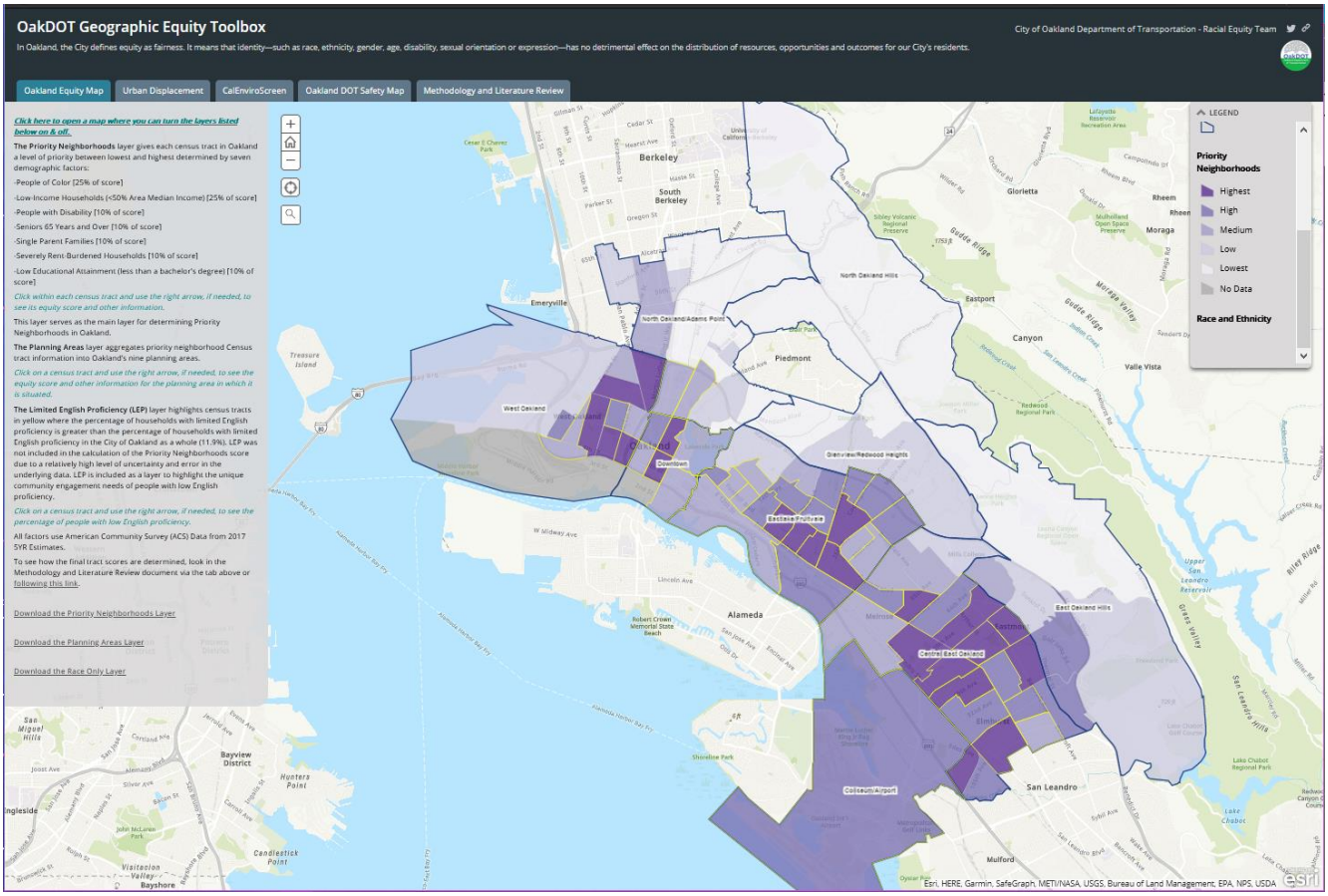
Below is the screenshot of the visualization map for the prioritization score – Equity

Oakland equity scores are transformed onto Oakland Street segments. When the street segment passes through more than one polygon on the equity map, the higher equity value is used.



Transforming Equity Scores from Census Tracts onto Street Segment for Prioritization on Service Request

Below is the screenshot of the Equity map for the City of Oakland – Equity

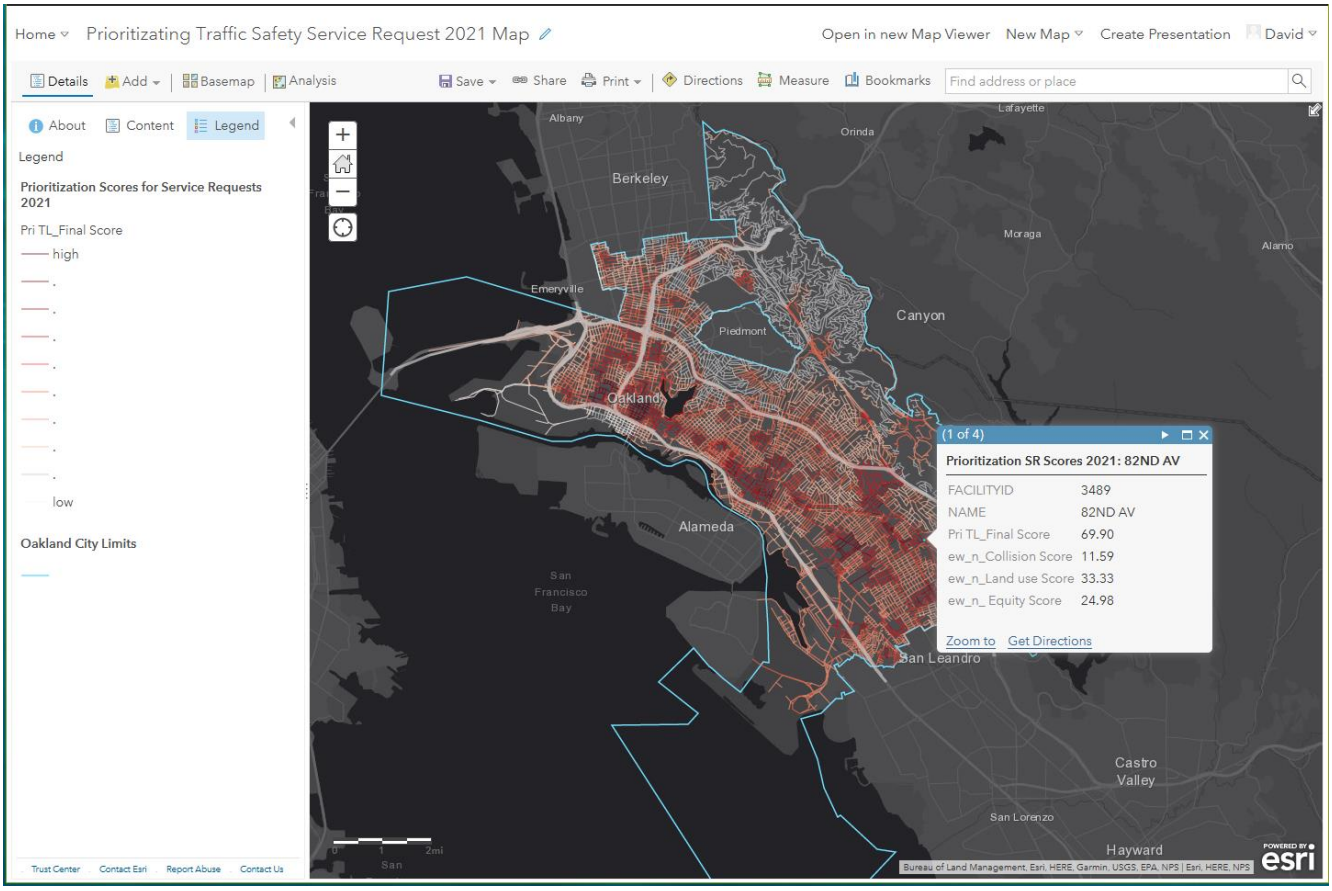


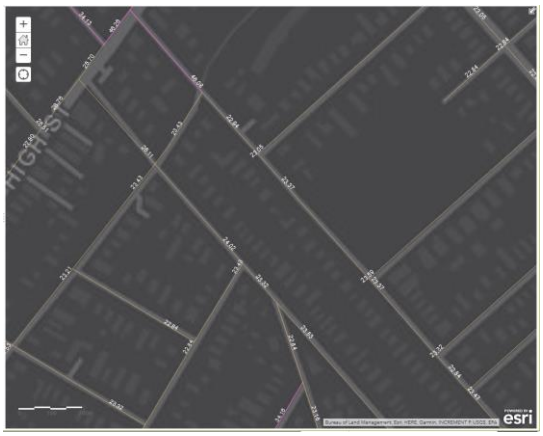
For more details about OakDOT Geographic Equity Toolbox, please refer to https://www.oaklandca.gov/resources/oakdot-geographic-equity-toolbox

Prioritization on Service Request Web Map

Below is the screenshot of the visualization map of the updated prioritization model for service requests. When a street segment is clicked on, the final score and score break-down for each factor are shown in the pop-up window. Link to the map:

https://oakgis.maps.arcgis.com/home/webmap/viewer.html?webmap=a912daf1499e42a5a1c4c0915d2467fc

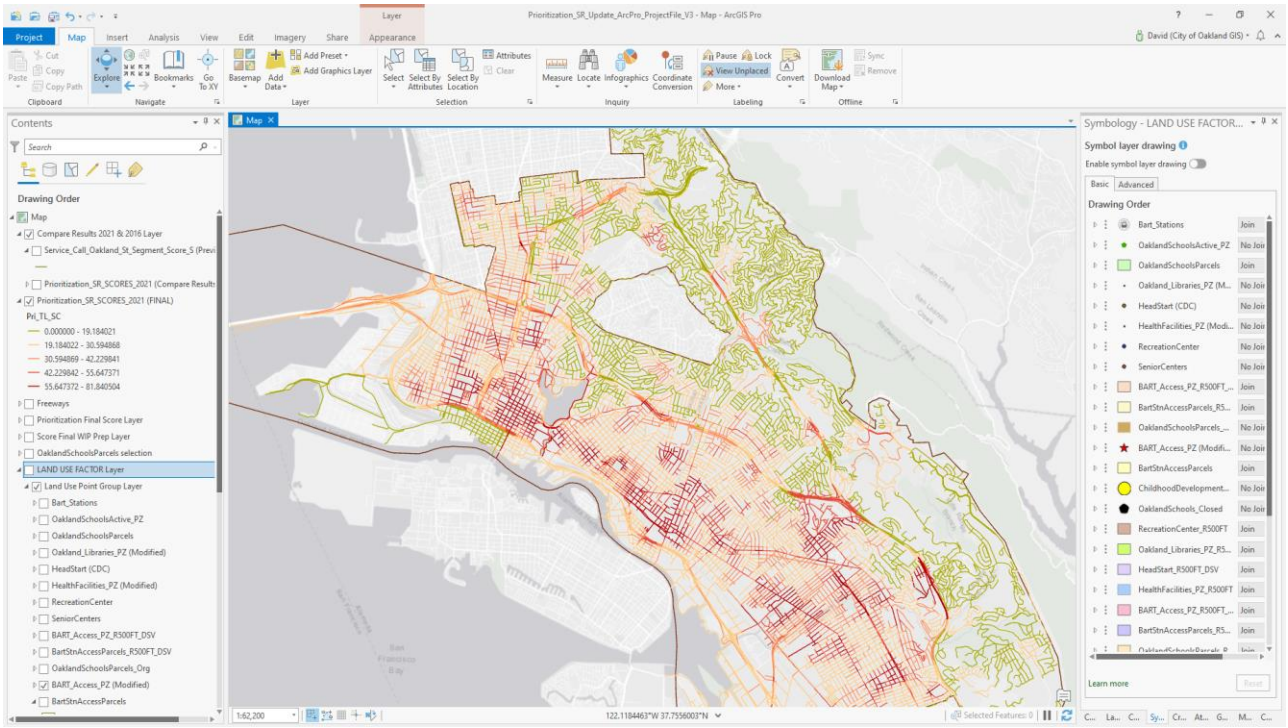




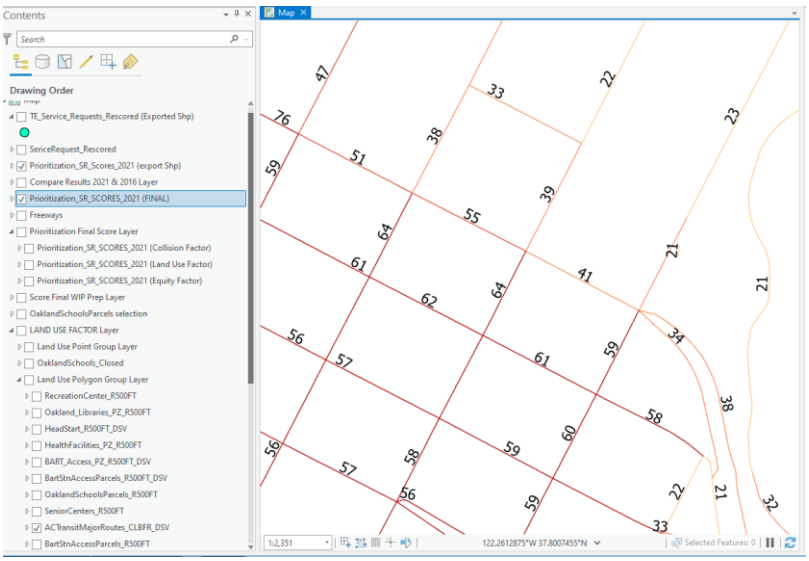
Prioritization on Service Request Score – GIS

Behind the Scenes – Driven by GIS Technology

Below is the screenshot illustrating part of the process of creating the analysis and calculations for service request prioritization scores.

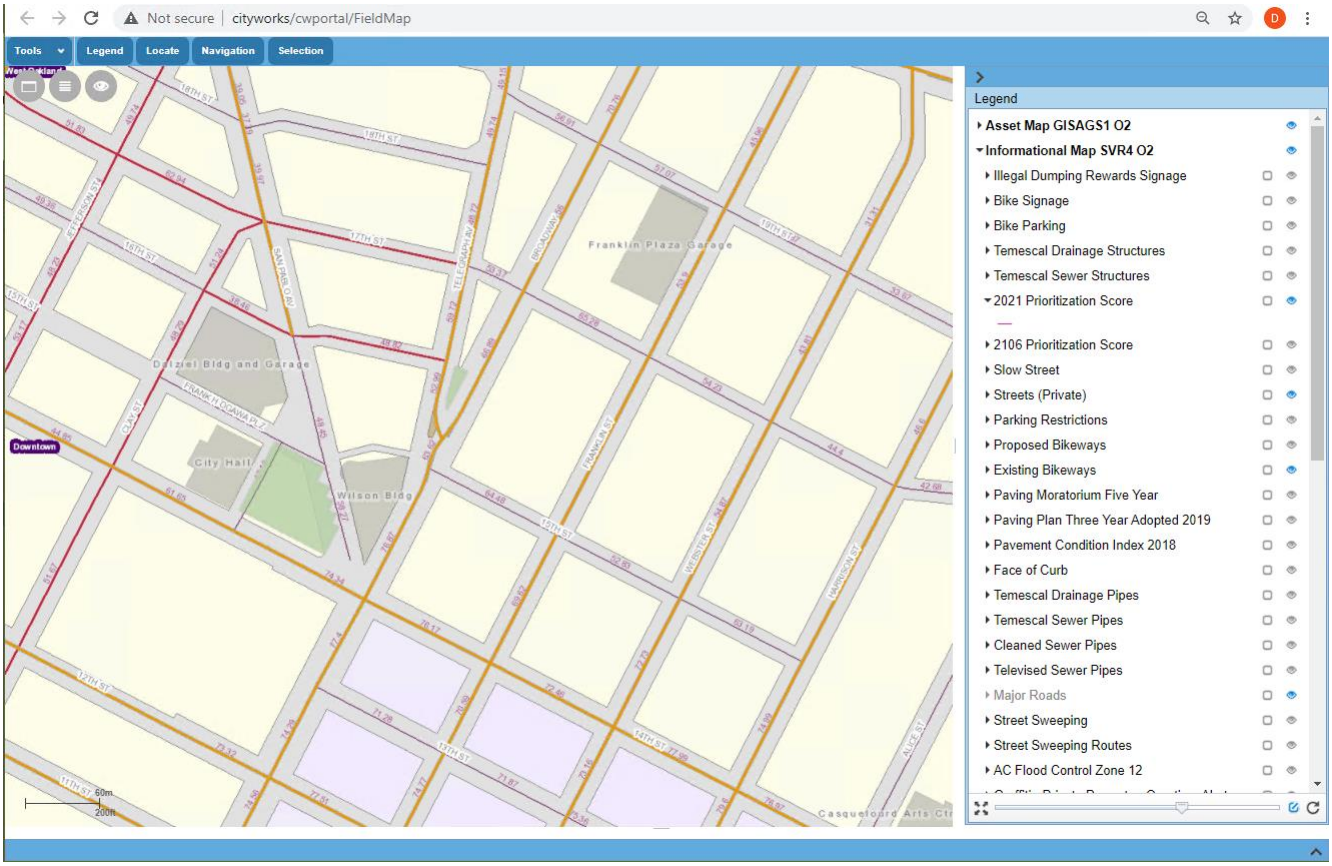


Every street segment receives a service request prioritization score.



Prioritization of Service Request Scores on Cityworks

The resulting GIS layer with service request prioritization scores is transferred to the Cityworks system to be featured on the resulting map. On the Cityworks portal, staff can see the street segment prioritization score values the same way as is illustrated in the GIS environment shown in the previous section. Staff transcribes the prioritization scores into the work order system to be used for prioritization. Cityworks is a service request and works-order system for managing logistics.



Language/Other Info

Language:	English
How Received:	SeeClickFix
Who Processed Web/SCF:	
Reopen:	
Alleged Premature Closure:	3 - N/A
Comments note Nothing Found:	
Score:	34
Plan Area:	Central East Oakland
Claim Number:	
SCF Issue Link:	https://seeclickfix.com/issue
SCF Photo Link:	http://seeclickfix.com/files/is

Listing of Land-Use Factor Data

For the land-use elements data listing, please refers to the Appendix to this document.

I. Oakland Schools
II. Oakland Libraries
III. Oakland Senior Centers
IV. Oakland HeadStart Centers (include selected early child development centers ECD)
V. Oakland Health Facilities
VI. Oakland Recreation Centers
VII. Bart Stations within the City of Oakland (multi-access points, parcels)
VIII. AC Transit-Major Routes within the City of Oakland