PLANIMETRIC DATA USE CASES

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DRCOG

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Public Sector Uses

Planimetric roofprint data ensures safer and more cost-effective floodplain management

Article submitted by Ryan Huffman, geographic information systems/database systems analyst at Arapahoe County. Ryan can be reached at 720-874-6685 or rhuffman@arapahoegov.com.
Featured in the April 2018 DRDC Newsletter.

DRCOG's planimetric building roofprint data is helping Arapahoe County more efficiently increase community floodplain safety and decrease flood insurance costs for its residents. The planimetric data has been a powerful resource for the county's participation in Community Rating System (CRS). CRS is a voluntary program administered by the Federal Emergency Management Agency (FEMA) as part of the National Flood Insurance Program (NFIP). CRS rewards communities for engaging in activities that reduce flood risk with discounts on flood insurance premiums. Each CRS activity earns the community points — the more points, the larger the discount on flood insurance for the community.

Numerous DRCOG member governments already participate in CRS, but might not be aware how DRCOG's planimetric roofprint data can help. Specifically, roofprint data provides a creditable, existing resource in performing spatial analysis on, and reporting of, insurable structures that fall or no longer fall within continuously changing FEMA and other regulated floodplains. CRS requires such activity as part of its initial and annual recertification reporting process.

Before using planimetric roofprint data it would take Arapahoe County and the Southeast Metro Stormwater Authority staff weeks to visually inspect imagery and digitalize new structure roofprints. With the planimetric data resource, the county and authority have been able to reduce staff effort on the project to just a few days.

Arapahoe County appreciates the hard work and collaborative efforts of DRCOG and its participating partners to make planimetric features, especially roofprints, possible. Andy Kuster, GIS manager at Southeast Metro Stormwater Authority and Candida Velasquez, GIS technician at Arapahoe County deserve recognition for their continuing contributions to Arapahoe County's CRS recertification efforts.

COMMUNITY RATING SYSTEM ANNUAL RECERTIFICATION

CRS Program Data Table	A. In the SFHA	B. In a regulated floodplain outside the SFHA
1. Last report's number of buildings in the SFHA (bSF) (line 6, last report)		
2. Number of new buildings constructed since last report	+	
3. Number of buildings removed/demolished since last report	–	
4. Number of buildings affected by map revisions since last report (+ or –)		
5. Number of buildings affected by corporate limits changes (+ or –)		
6. Current total number of buildings in the SFHA (bSF) (total lines 1–5)		

Denver Water uses planimetrics for a landscape classification project

Article submitted by Robert Stansauk, GIS Supervisor, and Phillip Segura, Division Senior Analyst, at Denver Water. Robert and Phillip can be reached at Robert.Stansauk@denverwater.org or Phillip.Segura@denverwater.org.
Featured in the October 2017 DRDC Newsletter.

Background

Roughly 40% of the water Denver Water treats is used outdoors (ex: irrigation). Without question we have the data necessary for accurate billing based on our rate structures. However, when it comes to better understanding water use behavior we have been lacking information about landscape preferences and trends which have a huge impact on decision making. The landscape classification project provides robust data to aid in the decision making and planning process that many of our groups do.

At a high-level this data allows us to understand trends in water use and prepare for major impacts to our system such as climate change and population growth. We are able to understand the unique characteristics that affect water use for the individual customer, giving us the ability to help them use water efficiently.

Specifically, this data helps:

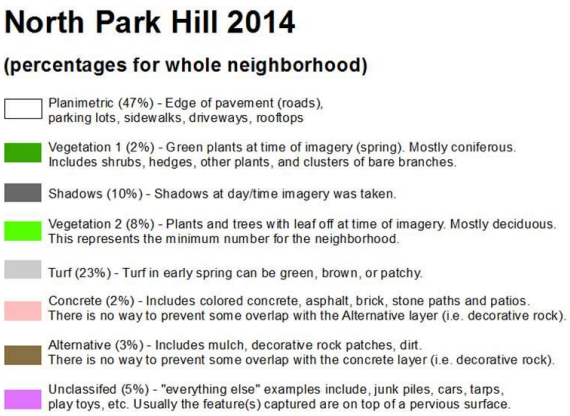
- Our Conservation group measure water use efficiency.
- Demand Planning understand customer water use and how it could change in the future, which in turn helps with facility sizing requirements.
- Our drought response by knowing what customers we can get reductions from.
- Understand water reuse based on water rights.
- Evaluate customer impacts to potential rate changes (ex: affordability)

Process

We began by using the 2014 DRAPP imagery and 2014 planimetric data. We use ERDAS Imagine and ERDAS Objective to classify the imagery by neighborhood (one neighborhood at a time). We use ESRI for most of the pre and post processing. To date we have completed North and South Park Hill. The general workflow is:

- Pre-processing
  - select and merge planimetric features by neighborhood
  - create image mosaics
  - create classification ".AOI" files for ERDAS
- Classification
  - Use ERDAS Objective to classify individual layers (vegetation, shadows, turf, concrete, alternative, and unclassified impervious)
- Post-processing
  - QA each layer
  - Merge all layers into one topologically clean vector layer

Results



Summary

There were several enabling components that came together at the right time to make this project possible. These include 1) DRAPP imagery 2) DRCOG planimetric data 3) a customer focus in our strategic plan 4) and a new model for tracking customer characteristics developed in the Conservation section.

There are also two important keys to our success. First, ERDAS Objective was the right tool for us. It classifies the image by providing tools that emulate the human visual system for image interpretation. It uses machine learning and interpretation cues (ex: shape, size, spectral, texture, associations, etc.). Not to mention all the other functionality that comes with ERDAS Imagine. The second key is the QA process. The layers we are creating have similar and overlapping spectral signatures (ex: sometimes old mulch can look like dead grass or a concrete patio could be stained with a natural color that looks like some variation of dirt). These characteristics make it necessary to review and edit the results.

National Renewable Energy Laboratory uses DRCOG building roofprints to estimate energy savings

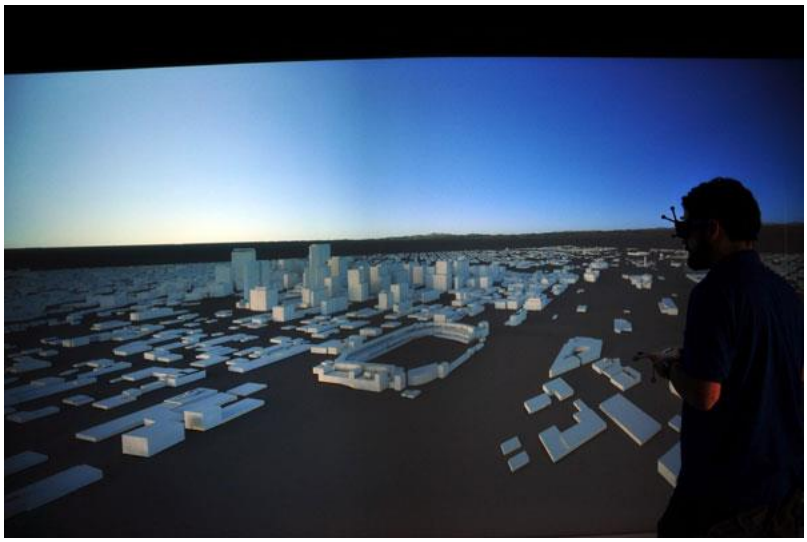
Article submitted by Dan Macumber, NREL commercial buildings engineer. Dan can be reached at Daniel.Macumber@nrel.gov.

Featured in the October 2016 DRDC Newsletter.

Researchers at the National Renewable Energy Laboratory in Golden have been generating city- and district-scale energy models based on public data sets including the new building roofprint data from DRCOG.

NREL's system combines data from multiple public data sources to create individual OpenStudio energy models for specific buildings. For cities with energy data transparency laws, actual energy use of buildings reported through the SEED platform can be used to calibrate the energy models to historic data. Once researchers create an energy model for a particular building they are able to estimate the energy savings of common energy efficiency measures. Doing this at a city scale allows cities and utilities to study the potential effects of energy efficiency programs as they seek to meet aggressive goals for energy and carbon savings. DRCOG's data set allows researchers to customize each building model to a unique building footprint, further reducing uncertainty in the model and improving its predictive capabilities.

Access to detailed public data, such as DRCOG's building roofprints, will enable NREL to provide more specific recommendations for cost effective energy efficiency upgrades. Public open data can provide a wealth of information and will help NREL improve energy use at a large scale.



A NREL engineer views building data in 3D. Photo credit: Kenny Gruchalla, NREL

West Meadows Metropolitan District uses DRCOG's planimetric data for asset management

Article submitted by Jim Castagneri, geographer at U.S Census Bureau (720-962-3882, James.D.Castagneri@census.gov). Featured in the April 2016 DRDC Newsletter.

As a geographer with the U.S. Census Bureau, I spend my days working with geospatial data from a variety of sources. So when my role as secretary of the West Meadows Metropolitan District required map information about the infrastructure of the district and surrounding neighborhoods, I naturally turned to GIS. Unfortunately, until the recent release of planimetric data from DRCOG, I had little option but to hand-digitize much of what I needed. My requirements were not quite engineering-level data, but more detail than what public data (like TIGER) could provide. I was faced with hand digitizing sidewalks and road edges, greenways, and rights of ways. For a small district, this is not a huge task. You might wonder; why does a special district need such things?

Metropolitan districts in Colorado often provide municipal services for unincorporated areas that might normally be provided by a city. In our small district, we are responsible for all landscape maintenance and facility upkeep along the right of way for West Coal Mine Avenue. This includes landscaping, sidewalk concrete, street lights, path lighting, sprinkler lines, turf, trees, flower beds, and park benches. The board of directors is responsible for executing and managing annual contracts for maintenance services and repairs. Without an accurate map of the district, it is very difficult to keep track of resources and improvements that have been made. This is where planimetric data in a GIS will prove invaluable for the West Meadows Metropolitan District. We can now plan, monitor, and evaluate work in a more efficient manner. We can produce work orders and request for proposal that include accurate maps of the area in question. This leads to more concise work descriptions and more clearly defined contracts. We can analyze distances, area measurements, and determine which housing units might be affected by trenching for water lines for example.

Creating such data in-house would be cost prohibitive for all but the largest districts. By providing open-source planimetric data to public, DRCOG has changed the face of managing special districts forever.

Aurora creates custom base map tiles for their webmaps

For more information, contact Bill Keever at wkeever@auroragov.org.

Example: https://auroraco.maps.arcgis.com/apps/webappviewer/index.html?id=7d6dd03f8fca47abadf32d270b41b8ea (turn off the Zoning layer to reveal the new streets base map)

Arapahoe County uses planimetrics in its Public Works and Development Department

Testimonial submitted by Ryan Huffman. Ryan can be reached at RHuffman@arapahoegov.com.

Planimetric Feature	Arapahoe County Public Works & Development (PWD) Department Utilization
Building Roof Prints	Used to supplement our annual FEMA CRS figures (strucutures in floodplains counts).
Edge of Pavement Polygons	Utilized to develop mapping of our County Right-Of-Way Medians/Frontage (Landscaped/NonLandscaped) areas. Frontage areas were generated overlays of Right-Of-Way areas, sidewalks, driveway, parking lot, trails, and edge of pavement areas. In the very future we hope to use this data as a starting point to respesent our Pavement Asset data, currently it's just a line feature class.
Driveways	Used to help generated Frontage areas (Landscaped/NonLandscaped) within County Right-Of-Way.
Parking	Used to help generated Frontage areas (Landscaped/NonLandscaped) within County Right-Of-Way.
Polygon Sidewalks	Had our contractor for new County Bike & Ped Plan enhanced this data for our new County Bike & Ped Plan. Added attributes of Width & Attached/Detached. This data will serve as base for our new sidewalk asset data for our Asset Management program. Also used to help generated Frontage areas (Landscaped/NonLandscaped) within County Right-Of-Way.
Trails	Utilized in our new County Bike & Ped Plan. Our existing data wasn't of good quality. Also used to help generated Frontage areas (Landscaped/NonLandscaped) within County Right-Of-Way.
Ramps	Was the missing gis puzzle piece we needed to launch curb ramp asset data for our Asset Management program.
Other	Cartographically, planimetric data is being utilized in various map products

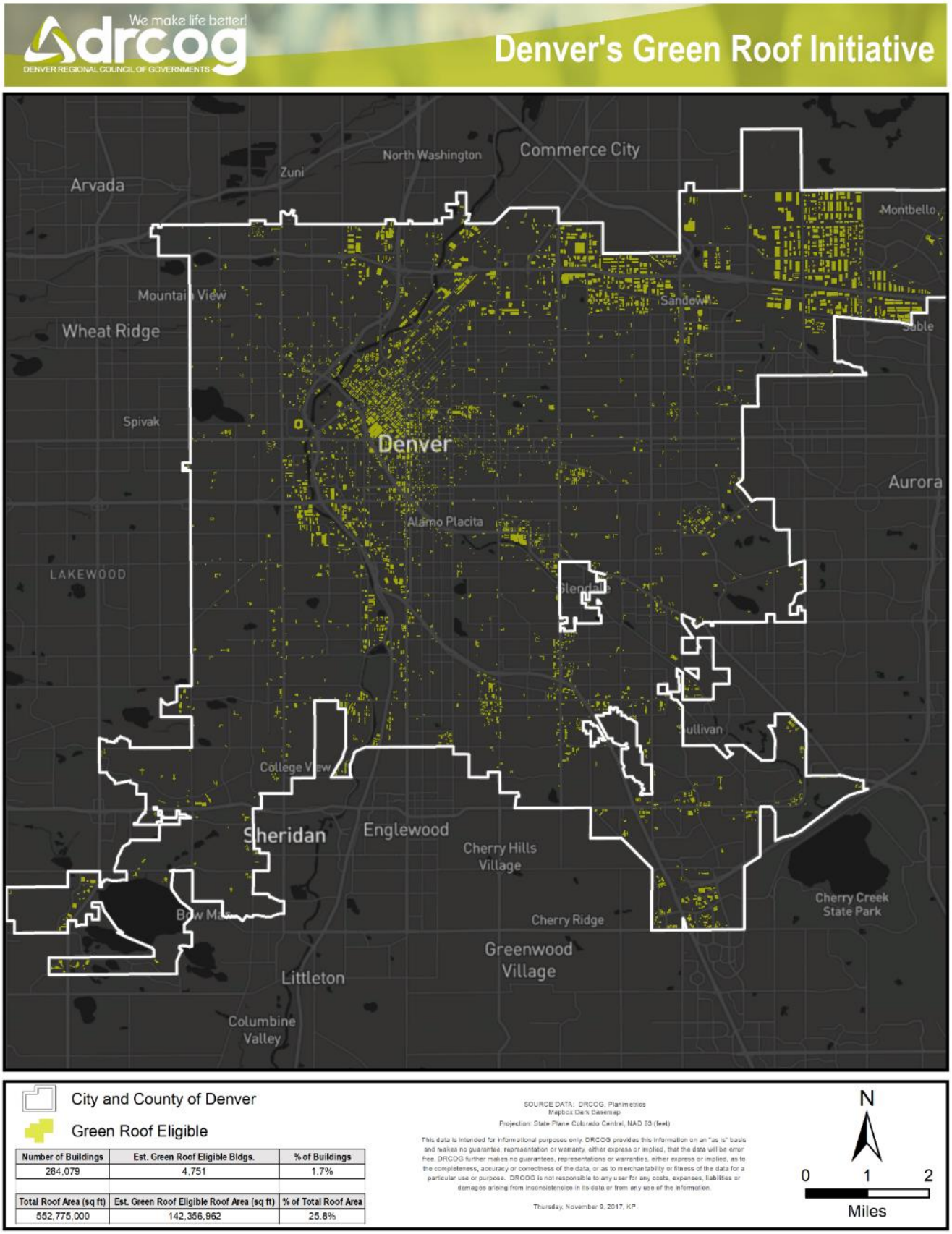
South Metro Fire Rescue uses planimetrics for evaluating response preplans

Testimonial from Heather Hoetling. Heather can be reached at 720.989.2656.

We are very grateful for the roofprints. Having this data has saved hundreds of hours of digitizing. We specifically use business and multi-unit residence roofprints. This data is useful for dispatchers and firefighters to visually see the buildings on their maps and to reference the layout when they are reviewing building preplans. At this time building height is not being used in the GIS for our 9-1-1 purposes, but will be very useful for NextGen 9-1-1 in the years to come. Next we will be looking at DRCOG trails and updating our data with new or missing trails.

DRCOG assesses Denver's new Green Roof Initiative

For more information, contact Kevin Priestly at KPriestley@drcog.org.



Number of Buildings	Est. Green Roof Eligible Bldgs.	% of Buildings
284,079	4,751	1.7%

Total Roof Area (sq ft)	Est. Green Roof Eligible Roof Area (sq ft)	% of Total Roof Area
552,775,000	142,356,962	25.8%

Private Sector Uses

DRCOG's open data drives economic development

Article submitted by Karl Urich, president, BuildingFootprintUSA. Karl can be reached at karl@buildingfootprintusa.com. Featured in the April 2018 DRDC Newsletter.

Publicly produced data — made available to commercial, academic and nonprofit organizations for unrestricted use — can be used in beneficial ways that the original data producers couldn't even imagine.
BuildingFootprintUSA, based in Albany, New York, collects building footprint geospatial data from hundreds of sources nationwide and turns that data into a product. We license our products to industries as diverse as insurance, telecommunication, real estate, utility and mobile advertising.
For example, an insurance company can use building footprint-based address information to make more accurate determinations regarding whether a property is exposed to peril (such as hurricanes or floods). A telecom company might use the data to understand their existing cellular coverage and determine where it would be best to build a cell tower. A solar energy company can quickly identify the best rooftops for installations that meet its build-out criteria.
Open data makes it possible for us to collect the work of many and transform it into a product that supports national and local businesses. As a startup, it would be impossible for us to create such data ourselves. DRCOG data is an essential part of our nationwide product. As entrepreneurs who have become experts at determining the quality of public data, we assert that DRCOG data is in the top 10 percent of all data we have uncovered.
As we aggregate open data into our BuildingFootprintUSA products, DRCOG data is being used in innovative ways that benefit the residents of the region.

A real estate analytics company can use building footprint data and assessor data to visualize properties by use code (color) and valuation (height) in Arapahoe County.

A wireless telecom company placing rooftop infrastructure can visualize the infrastructure viewshed then perform complex radio frequency propagation analysis in downtown Denver.

DRCOG planimetric data used by GoCode Colorado winners

Article submitted by Margaret-Rose Spyker, GISP, LEED GA, GIS and data analyst at Xentity Corporation (269-806-1948 or mspyker.xentity@gmail.com) and Ashley Summers, GISP, PMP, information systems manager at DRCOG (303-480-6746 or asummers@drcog.org).
Featured in the July 2016 DRDC Newsletter.

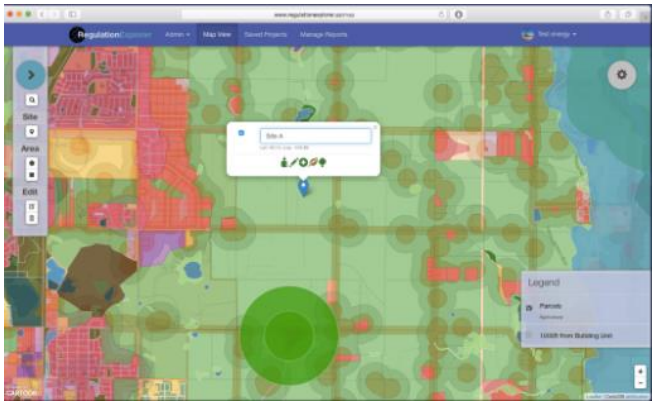
GoCode Colorado is a program sponsored by the Business Intelligence Center in the Secretary of State's office and supported by two contractors: Xentity Corporation and LadyCoders Productions. The former works with government agencies to make quality datasets available in the state's open data portal: the Colorado Information Marketplace. The latter is fostering a developer community oriented towards building businesses through the use of public data.

GoCode Colorado just finished its third annual app challenge in which teams competed to create apps that leverage data in the public domain. Ten finalist teams advanced from the first round of competition. During this process, GoCode Colorado partnered with many public data providers, and served as a data liaison, helping developers to better understand and use the data they needed to build insightful applications. Public entities contributed to this entrepreneurial endeavor
by making data publicly available and machine-readable for the coding community.

Three of the 10 finalists were awarded $25,000 toward the development of a business around their app. Almost all of the ten finalist teams used DRCOG datasets. Two of the winning teams are described below:

Foodcaster helps food trucks find the best location to park by informing food truck owners of parking regulations, foot traffic and other tips such as local events and activity through its mobile app. Foodcaster used public datasets showing bicycle and pedestrian foot traffic (to find concentrations of people), cellular service data (to ensure that mobile merchant systems can be used), parking regulations, Google Maps, Twitter social data and Facebook events. DRCOG data was also used: zoning (to quickly find commercial areas and places eligible for seasonal festivals) and planimetrics (to identify sites that can physically accommodate temporary parking of oversize vehicles near buildings).

Regulation Explorer helps oil and gas companies find the best locations by putting Colorado oil and gas regulations on the map in combination with environmentally and culturally sensitive areas. Regulation Explorer streamlines the permit process for energy companies, providing these companies with all of their options before they invest heavily in a well location. Datasets used include: community anchor institutions, roads, parks, county parcels and land management datasets. DRCOG data was also used, including: zoning, planimetrics, nursing homes and assisted living facilities.



Start-up uses DRCOG's planimetric data to help the visually impaired

Article submitted by Sumanth Channabasappa, Co-founder and CTO at eyeBot (Sumanth.asap@gmail.com).
Featured in the *April 2016 DRDC Newsletter.*

At eyeBot LLC we are building solutions to help the blind and visually impaired solve a big everyday problem: How to safely navigate city streets and indoor areas. Challenges for blind and visually impaired people range from an absence of spatial awareness to, unfortunately, collisions with obstacles and vehicles. Just ask our colleague and CEO Mike Hess!

As a Colorado startup, we want our cities to lead the nation in enabling accessibility and welcoming blind and visually impaired users. To realize our initial mobile app based interface we needed local geographic data with more granularity than what Map providers were offering. We were recommended the DRCOG Planimetric data by friends who work for the City and County of Denver and the State of Colorado. This proved to be a fruitful suggestion. This data is now a part of our solution that provides spatial awareness.

We are in the process of testing and refining our solution with the help of BVI friends, and in early discussions about trials to make cities more accessible. As one can imagine our solutions have many uses beyond the blind and visually impaired community.

Logan Simpson uses planimetrics as a foundation for community and environmental planning

Testimonial from Kristy Bruce. Kristy can be reached at KBruce@LOGANSIMPSON.COM

I use footprints for a number of projects. As a community and environmental planner, I am currently using building footprints from a variety of sources as a base for multiple projects including.

- Analyzing urban form (Building massing) on Parker Road in Parker CO
- A Bus Rapid Transit (BRT) study on State highway 7 to determine level of development
- They improve the aesthetic of municipal maps
- I plan to use them to illustrate corridor viewsheds
- They are incorporated in the FAR model created for DRCOG
- Other ways I use building footprints in other jurisdictions include
- To compare the number of buildings that can see a the new building on top of Pikes Peak
- As a base to compare existing conditions and illustrate density at buildout under current zoning- Utah
- To help identify homes that would be impacted by a new transmission line-Weld County

In short, it is a great service to have free building footprint data because it serves a lot of analytical purposes and is very time consuming to build.

HDR uses planimetric sidewalks to create walksheds

Testimonial from Andrew Parker. Andrew can be reached at Andrew.Parker@hdrinc.com.

I work as a transportation planner for HDR, an architecture and engineering consulting firm. We have benefitted greatly from the planimetrics sidewalk GIS data by providing our clients in the Denver Metro Region with more accurate walkshed information. This has been useful in communicating to the public the need for new sidewalks in certain areas, as well as informing local governments on where to prioritize improvements for people who walk. This is particularly important and desired information in the Denver Metro Area as new RTD FasTracks stations open in previously industrial or undeveloped areas.

Public-Private Partnerships

Cesium works with DRCOG to create 3D models from planimetric building roofprints for scenario planning

Featured on the Cesium blog: https://cesiumjs.org/demos/DRCOG/

The Denver Regional Council of Governments (DRCOG) brings together local governments to collaborate, set policy, and allocate funding in the areas of transportation and development. One of DRCOG's many roles is to develop data, information, and visualizations that help local governments and other stakeholders understand current and predicted conditions in the region.

DRCOG develops and deploys a wide array of technical tools, including web-based tools to map and visualize data. DRCOG recently adopted Cesium to handle large datasets and present those datasets in an aesthetically appealing way for end users, including local and regional planners. DRCOG's latest Cesium application is Scenario Manager, an urban planning tool that helps planners define and evaluate alternative real estate development scenarios. Cesium's 3D mapping helps urban planners visualize the potential effects of policies and development-related decisions, such as parking requirements, building height maximums, and density requirements. Visualizing how different assumptions effect potential real estate developments, including limitations to profitability, can reveal challenges and obstacles that may lie ahead for planners, developers, and decision makers. DRCOG's Scenario Manager also incorporates the UrbanSim API, a series of open source land use modeling tools, to help planners evaluate the profitability and scope of real estate projects. These tools help planners understand how their plans and policies influence potential private developments through a visual representation of future development scenarios and patterns.

Scenario Manager relies on large, high quality regional datasets. For example, building roofprint data is used to visualize current conditions and future scenarios. These data are the result of a unique regional data acquisition project facilitated by DRCOG and funded by nearly two dozen partners. The data were collected in a 1,100-square-mile area of the Denver region using highly accurate, high-resolution data as a source. The result is a detailed set of standardized building roofprints used for everything from preparing first responders as they arrive on a scene to impervious surface analysis to 3D modeling. The roofprints and accompanying datasets are freely downloadable and currently being updated.

Academic Uses

Planimetric data provides insight into urban clear zones, street trees and road safety

Article submitted by Dr. Wes Marshall and Nicholas Coppola, University of Colorado Denver. Wes can be reached at wesley.marshall@ucdenver.edu,and Nick can be reached at nicholas.coppola@ucdenver.edu.
Featured in the April 2018 DRDC Newsletter.

Since the 1960s, transportation engineers have followed the practice of establishing clear zones along the roadside area where fixed-object hazards are explicitly minimized. Mounting evidence, however, is beginning to cast doubt on what we think we know about the effect of roadside clear zones on actual safety outcomes. For example, street trees in urban contexts – which provide economic, environmental and livability benefits – are also widely considered to be a road-safety detriment. Using spatial data, we reviewed the association between street tree location and tree canopy coverage of select roadways in Denver relative to crashes across different severity levels.

We collected data for our research from multiple sources, including extracting road corridor and intersection areas identified in DRCOG's edge of pavement data set and crosswalks identified in DRCOG's sidewalk data set. DRCOG's data saved time and greatly improved the quality of our research.

Results suggest that the expected road safety benefit of reduced clear zones in urban areas may be overstated. In fact, when controlling for other known factors, street trees and tree canopies that extend over the street are associated with fewer crashes.

When assessing the safety impact of street trees, we encourage planning agencies to be cognizant of context and the potential influence of street design on road user behaviors such as speed.