

Designing a Complete Streets Dashboard for Team iCity

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Agenda

- Introduction
- Motivation
- Complete Streets Dashboard
 - Design
 - Implementation
- Complete Streets Dashboard & Esri Platform
- Future Work

Introduction



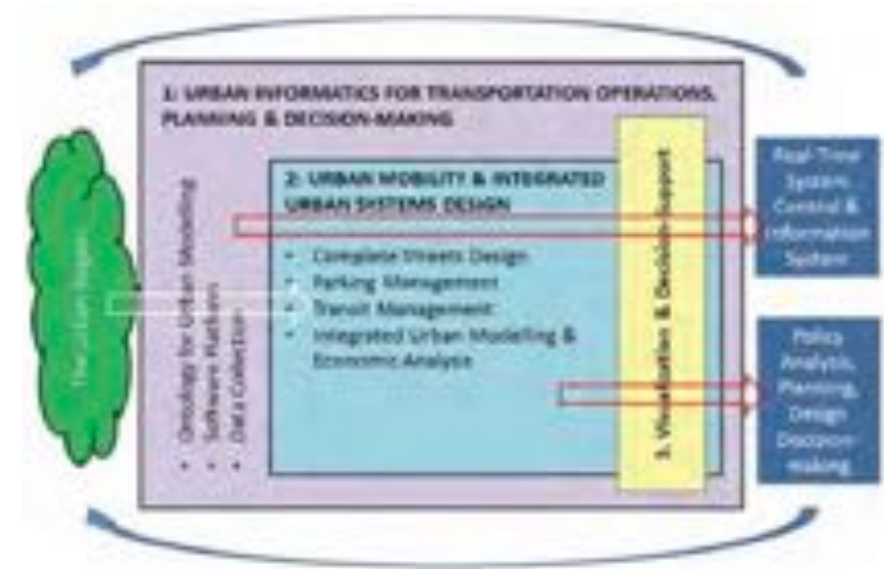
Source: City of Boulder Colorado

Motivations & Considerations

Create a tool that can act as a bridge between governance and urban design, to allow planners to focus on user needs and optimize their processes.

Considerations:

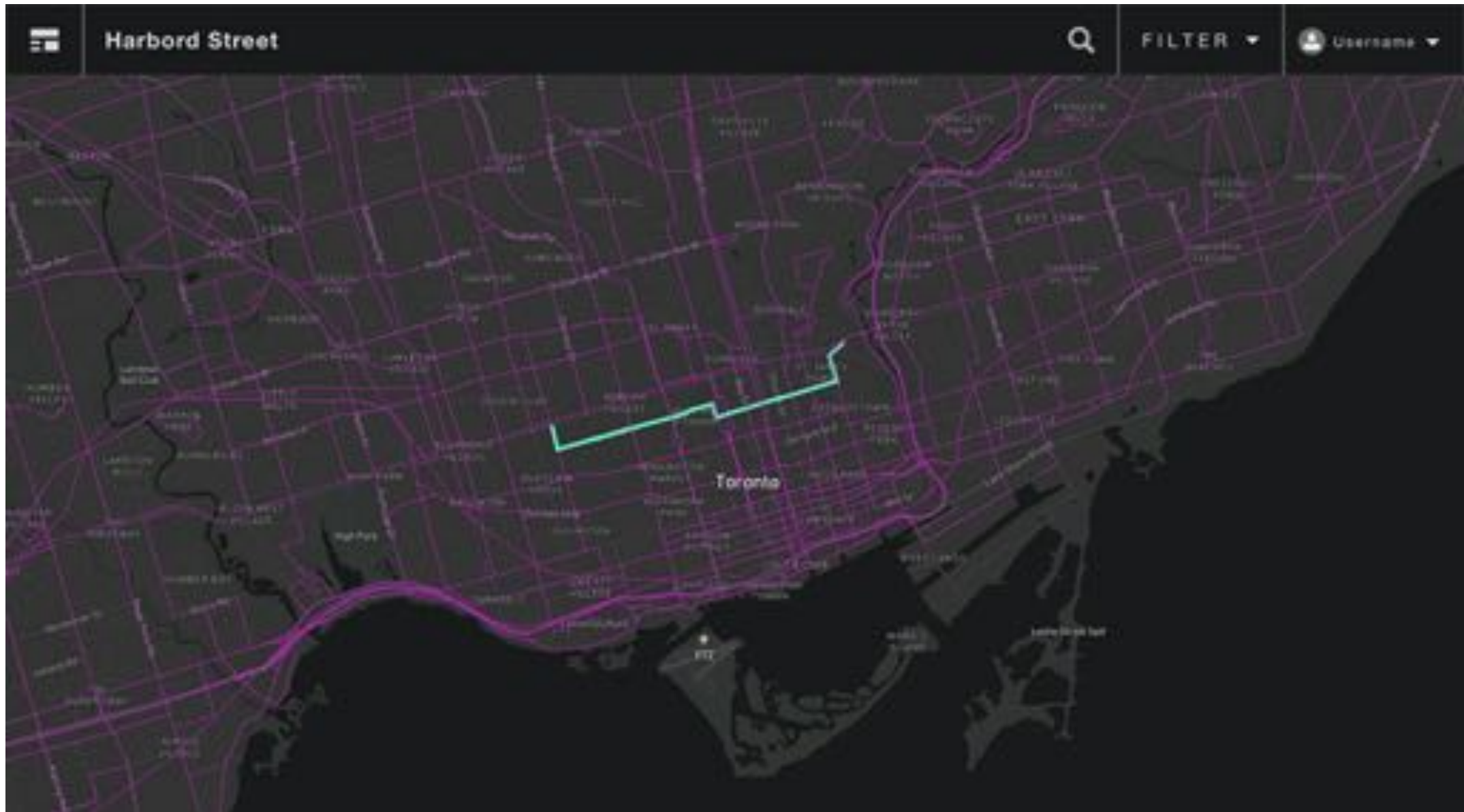
- User Friendly
- Scalable
- Universal
- Adaptive



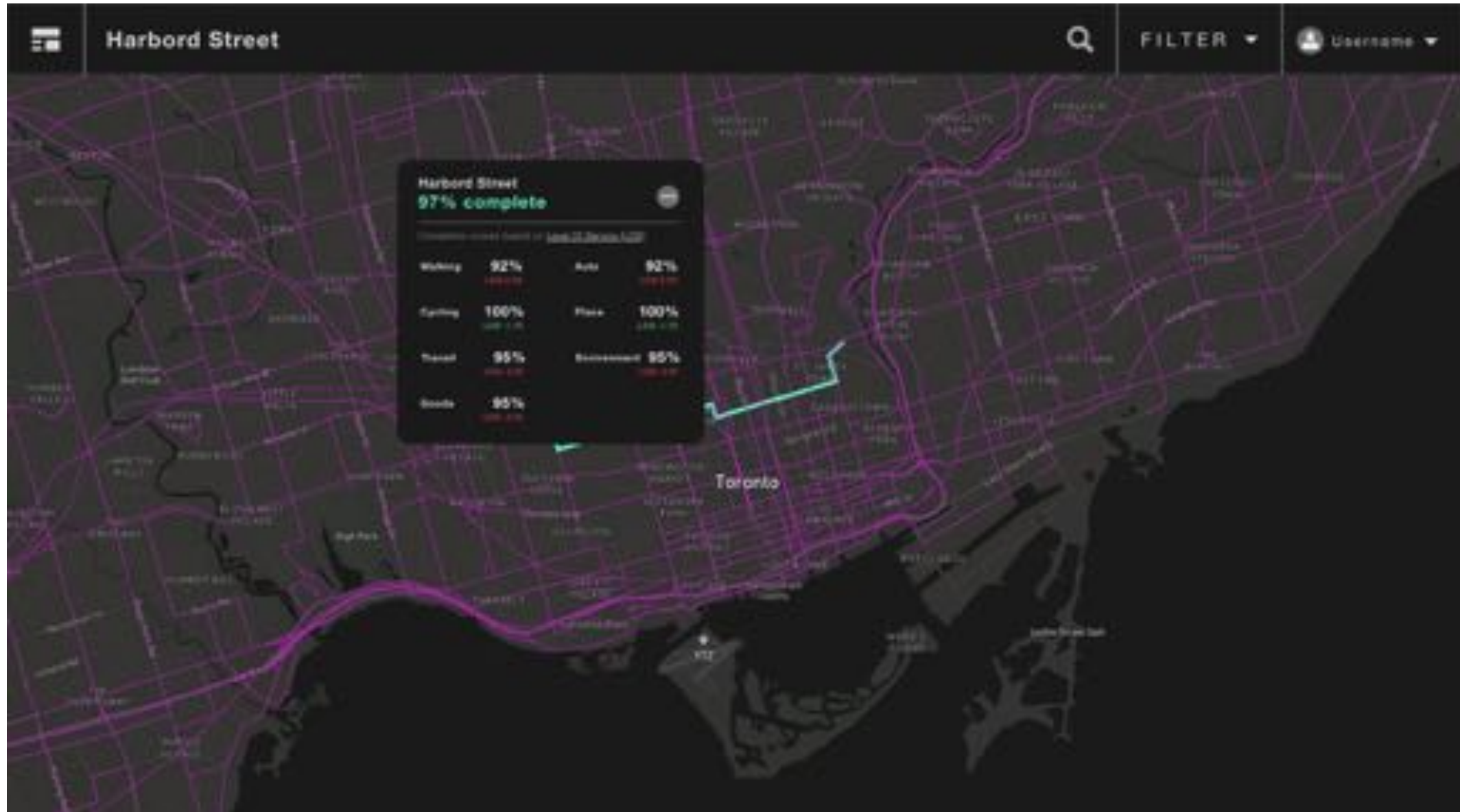
Complete Streets Dashboard



Complete Streets Map View



Complete Streets Map View Pop Up



Complete Streets Map View with Filter

Harbord Street

SEARCH

FILTER

Username

Completeness

- WALKING
- CYCLING
- TRANSIT
- ENVIRONMENT

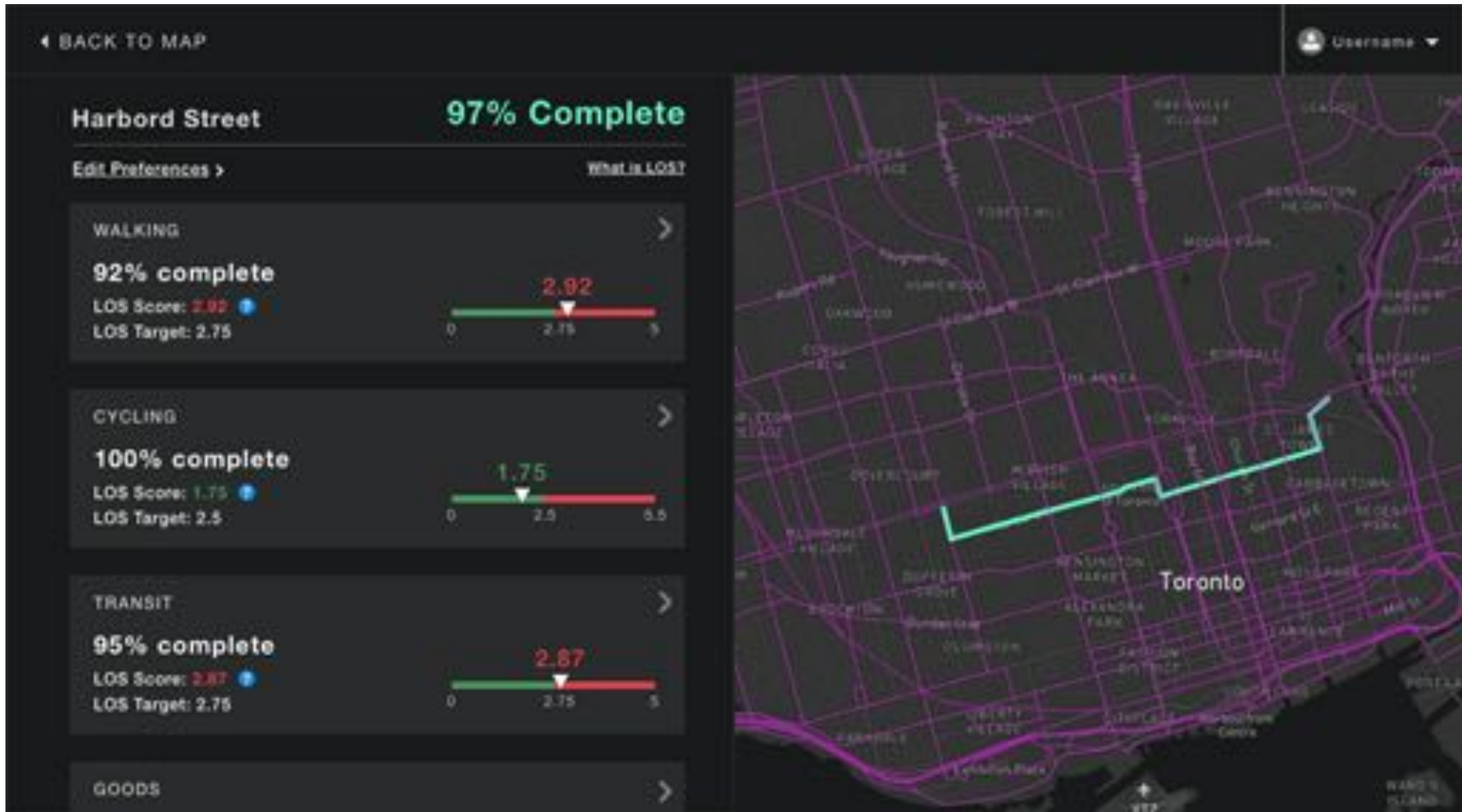
Street Type

- ARTERIAL STREET
- LOCAL ARTERIAL
- PARKWAY
- PRIMARY COLLECTOR
- COLLECTOR
- RESIDENTIAL STREET
- INDUSTRIAL ARTERIAL
- URBAN BOULEVARD
- NEIGHBOURHOOD BOULEVARD
- ACTIVITY CENTER STREET
- INDUSTRIAL STREET

Street Length (m)

0 34 1246 2000

Complete Streets Detail Street View



Complete Streets Detail Street View

← BACK TO MAP

Username ▾

Harbord Street

97% Complete

Edit Preferences > What is LOS?

WALKING
92% complete
LOS Score: 2.92
LOS Target: 2.75

CYCLING
100% complete
LOS Score: 1.75
LOS Target: 2.5

TRANSIT
95% complete
LOS Score: 2.87
LOS Target: 2.75

GOODS

Level of Service Score (LOS)

NCHRP Project 3-70 developed and calibrated a method for evaluating the multimodal level of service (MMLOS) provided by different urban street designs and operations. This MMLOS method is designed for evaluating "complete streets," context-sensitive design alternatives, and smart growth from the perspective of all users of the street. The analyst can use the MMLOS method to evaluate the tradeoffs of various street designs in terms of their effects on the auto driver's, transit passenger's, bicyclist's, and pedestrian's perceptions of the quality of service provided by the street.

The MMLOS method estimates the auto, bus, bicycle, and pedestrian level of service on an urban street using a combination of readily available data and data normally gathered by an agency to assess auto and transit level of service. The data requirements of the MMLOS method include geometric cross-section, signal timing, the posted speed limit, bus headways, traffic volumes, transit patronage, and pedestrian volumes.

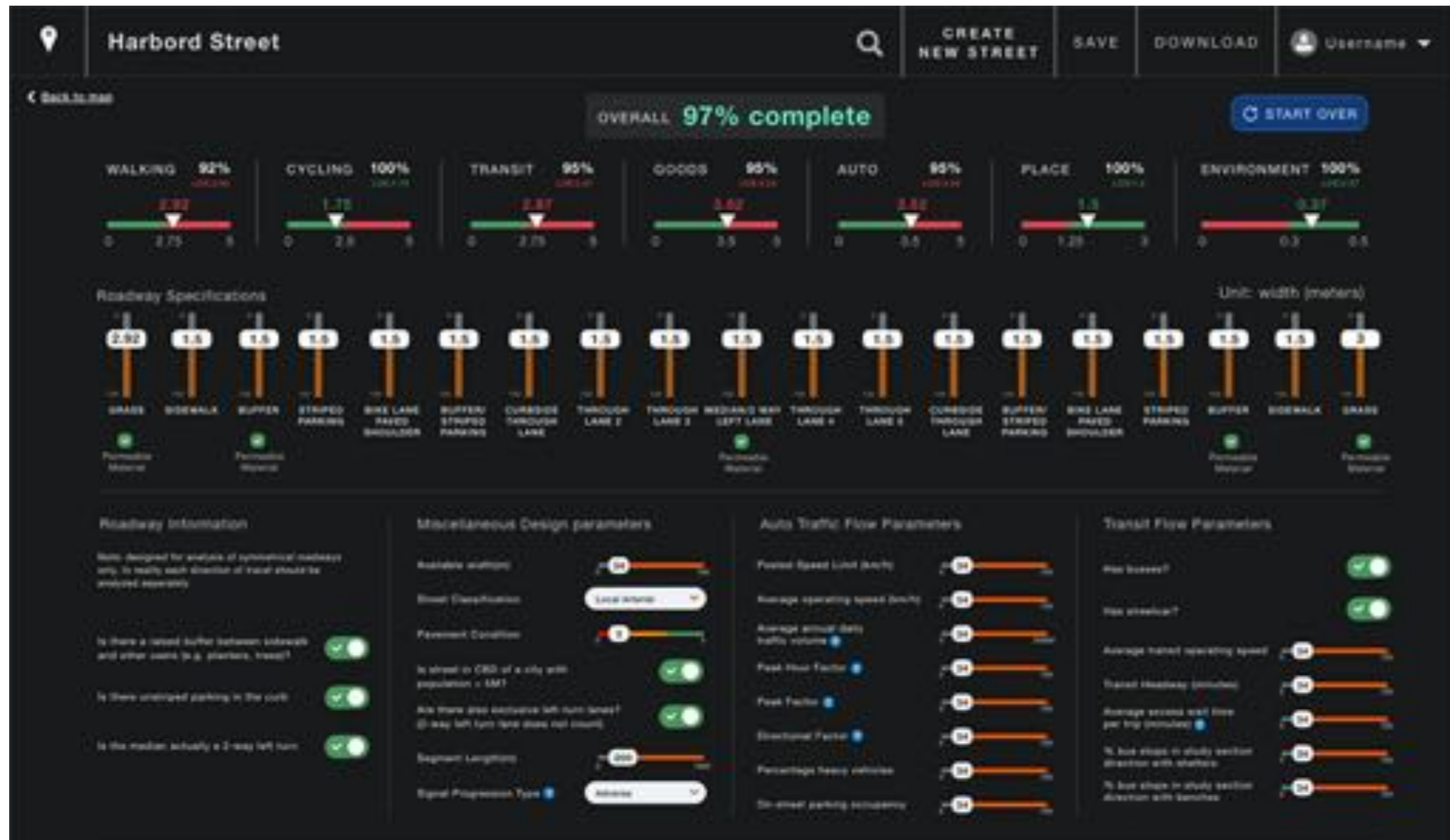
Learn more through the [NCHRP Report 616](#)

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Complete Streets Dashboard Control



Complete Streets Dashboard Search

Search for Existing Streets

CREATE NEW STREET SAVE DOWNLOAD Username

10 Carlin Road
10 Guildford Parkway
1041 Birchmount Road
10th Street
110 Town Haven Place
1155 Warden Avenue

98% LAYOUT PLACE 100% ENVIRONMENT 100%

Lst: width (meters)

BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS BIAS

Roadway Information

Is this designed for analysis of residential roads only? To really reach potential of road should be analyzed separately.

Is there a raised buffer between sidewalk and other curb (e.g. planter, tree)?

Is there protected parking in the road?

Is the roadway actually a 2-way left turn?

Microlevel Design parameters

Asynchronous

Street Classification

Placement Condition

Is street in CBD of a city with population > 500?

Are there any residential/retail/amenity? (2-way left turn with flag not count)

Segment Length

Signal Progression Type

Auto Traffic Flow Parameters

Percent Road Lane

Average spacing (meters)

Average speed (km/h)

Peak Hour Traffic

Peak Factor

Shoulder Type

Percentage heavy vehicles

Do street parking occupants

Transit Flow Parameters

Bus lanes?

Bus stop?

Average transit boarding speed

Transit frequency (min)

Average speed and time per the boarding

Is bus stop in study corridor direction with boarding?

Is bus stop in study corridor direction with boarding?

Complete Streets Dashboard Archive

Note: Designed for analysis of symmetrical roadways only. In reality, each direction of travel should be analyzed separately.

Is there a raised buffer between sidewalks and other curbs (e.g. planters, trees)?

Is there unshaded parking in the curb?

Is the median actually a 2-way left turn?

Available width:

Street Classification:

Pavement Condition:

Is street in CBD of a city with population > 1M?

Are there also exclusive left turn lanes? (2-way left turn lanes does not count)

Segment Length:

Signal Progression Type:

Posted Speed Limit (mph):

Average operating speed (mph):

Average annual daily traffic volume:

Peak Hour Factor:

Peak Factor:

Directional Factor:

Percentage heavy vehicles:

On-street parking occupancy:

Max Busses?

Max streetcar?

Average transit operating speed:

Transit Headway (minutes):

Average excess wait time per trip (minutes):

% bus stops in study section direction with shelters:

% bus stops in study section direction with benches:

Saved Streets

Harbord Street trial 1 with big sidewalk Harbord Street 12th September 2016, 5:22PM	New Street Prototype 12th September 2016, 5:22PM	Harbord Street trial 1 with big sidewalk Harbord Street 12th September 2016, 5:22PM	Harbord Street trial 1 with big sidewalk Harbord Street 12th September 2016, 5:22PM
Harbord Street trial 1 with big sidewalk Harbord Street 12th September 2016, 5:22PM	Harbord Street trial 1 with big sidewalk Harbord Street 12th September 2016, 5:22PM	New Street 2 12th September 2016, 5:22PM	Harbord Street trial 1 with big sidewalk Harbord Street 12th September 2016, 5:22PM

Complete Streets Save Existing Street

The screenshot displays the 'Complete Streets' software interface for 'Harbord Street'. The top navigation bar includes a location pin, the street name 'Harbord Street', a search icon, and buttons for 'CREATE NEW STREET', 'SAVE', 'DOWNLOAD', and a user profile dropdown labeled 'Username'. Below the navigation bar, a progress indicator shows 'OVERALL 97% complete' with a 'START OVER' button. The main interface is divided into several sections: 'Walking' (97% complete), 'Cycling' (100% complete), 'Transit' (95% complete), 'Goods' (95% complete), 'Auto' (95% complete), 'Place' (100% complete), and 'Environment' (100% complete). Each section features a progress bar and a numerical value. Below these sections are various configuration options, including 'Roadway Specifications' (with sliders for 'Width' and 'Depth'), 'Roadway Dimensions' (with sliders for 'Width' and 'Depth'), 'Street Specifications' (with a dropdown for 'Street Type'), 'Permeable Pavement' (with a slider for 'Permeability'), 'Signal Synchronization' (with a dropdown for 'Synchronization Type'), 'Average Speed Limit' (with a slider), 'Post-Street Parking' (with a dropdown), 'Post-Street Parking' (with a dropdown), 'Permeable Pavement' (with a slider), and 'Signal Synchronization' (with a dropdown). A 'SAVE FILE' dialog box is open in the center, prompting for a 'FILE NAME*' (DefaultStreetName) and a 'STREET NAME' (DefaultStreetName), with a green 'SAVE' button at the bottom.

Complete Streets Save New Street

The screenshot displays the 'Complete Streets' software interface for 'Harbord Street'. The top navigation bar includes a search icon, 'CREATE NEW STREET', 'SAVE', 'DOWNLOAD', and a user profile dropdown labeled 'Username'. The main dashboard shows an overall completion status of '97% complete' with a 'START OVER' button. Below this, seven progress bars represent different street categories: WALKING (96%), CYCLING (100%), TRANSIT (95%), GOODS (95%), AUTO (95%), PLACE (100%), and ENVIRONMENT (100%). A central dialog box titled 'CREATE A NEW STREET' is open, featuring a 'FILE NAME*' input field with a placeholder 'Default StreetName0000000000' and a green 'SAVE' button. The background interface is dimmed and shows various configuration options for 'Publicway Specifications', 'Roadway Information', 'Street Specifications', 'Pavement Selection', 'Signal/Signage Type', 'Average roadway speed limits', 'Peak Hour Factor', 'Peak Factor', 'Shoulder Factor', 'Pavement Area Index', and 'Use speed setting categories'. On the right side, there are 'Link width (meters)' and 'Transit Flow Parameters' sections with various sliders and toggle switches.

Complete Streets Download Street

The screenshot displays the 'Complete Streets' tool interface for 'Harbord Street'. At the top, there are navigation buttons: 'GREATE NEW STREET', 'SAVE', 'DOWNLOAD', and a user profile 'Userame'. The main area shows progress bars for various street categories: WALKING (98%), CYCLING (100%), TRANSIT (98%), GOODS (98%), AUTO (98%), PLACE (100%), and ENVIRONMENT (100%). A central 'DOWNLOAD' modal window is open, featuring a 'FILE NAME*' input field with the text 'Harbord-CompleteStreets', four format buttons (PDF, CSV, JPEG, TXT), and a large green 'DOWNLOAD' button. The background interface includes sections for 'Roadway Specifications', 'Roadway Information', and various sliders for 'Street Classification', 'Permitted Features', 'Transportation Features', and 'Design Elements'.

Complete Streets Data Structure

```

  ▾ object {3}
    ▾ mainParam {21}
      Grass : 2
      Sidewalk : 4
      Buffer : 1
      StripedParking : 2
      BikeLane/PavedShoulder : 2
      Buffer/StripedParking : 2
      CurbsideThroughLane : 2
      ThroughLane2 : 2
      ThroughLane3 : 2
      Median/2-wayLeftTurnLane : 2
      ThroughLane4 : 2
      ThroughLane5 : 2
      CurbsideThroughLane2 : 2
      Buffer/StripedParking2 : 2
      BikeLane/PavedShoulder2 : 2
      StripedParking2 : 2
      Buffer2 : 2
      Sidewalk2 : 2
      Grass2 : 2
    ▾ roadwayInfo {3}
      riasedBuffer : false
      UnstripedParking : false
      2-wayLeftTurnLane : true
    ▾ miscellaneousDesignParameters {7}
      availableWidth : 19
      streetClassification : 1
      PavementCondition : 8
      CBD : true
      exclusiveLeft : true
      segmentLength : 200
      signalProgressionType : true
    ▾ autoTrafficFlowParameters {8}
      postedSpeedLimit : 20
      averageOperatingSpeed : 20
      averageAnnualDailyTrafficVolume : 100
      peakHourFactor : 3
      peakFactor : 2
      directionalFactor : 4
      percentageHeavyVehicles : 10
      parkingOccupancy : 67

```

Dashboard Technologies



deck.gl
{ data visualization at scale }



Complete Streets Dashboard Tool

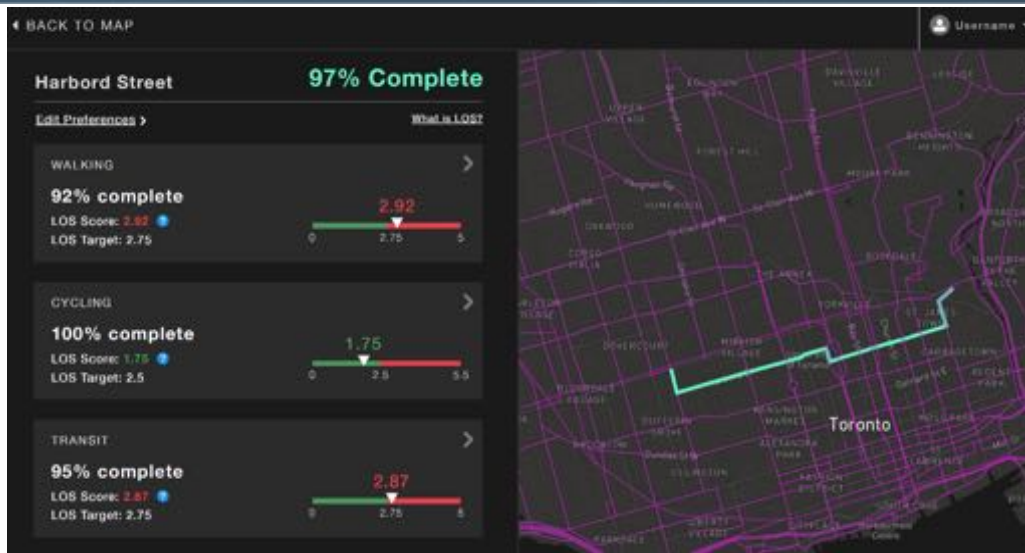
- Video

Complete Streets Dashboard & ESRI Platform

Main objectives:

- **Convert the existing prototype to Esri feature services** and the ArcGIS API for JavaScript.
- Maintain all functionality of the existing prototype.
- Take existing street network data from a GIS database, enrich it to **contain full parametric attributes** for distinct segments (sidewalks, paving materials, rail tracks, bike lanes, car lanes, public transit lanes, building abutments, greenery, sidewalk furniture etc).
- **Develop a 2D interactive cross-section design tool** that allows users to change the constituent parts of a selected street segment, and adjust parameters (e.g., right-of-way width, boulevard width, sidewalk width, building setbacks).
- **Develop a 3D viewer** that uses the common parameter set and street segment attributes (e.g., sidewalk materials, street tree presence and species, street furniture presence and type) **to generate a 3D Web scene** from an automated set of **CityEngine** procedural rules.

Complete Streets Dashboard & ESRI Platform



Current Prototype developed by OCAD team



Streetmix 2D cross-sectional complete streets tool



A 3D webscene of complete street options generated in CityEngine.

Future Work

- User Testing
- Further UI development
- Explore Scalability of the tool across different geographies
- Responsiveness
- Native Applications

References

- City of Toronto Homepage, Complete Streets Guidelines by Chapter.<https://www.toronto.ca/services-payments/streets-parking-transportation/enhancing-our-streets-and-public-realm/complete-streets/complete-streets-guidelines/>. Last accessed 30 Jan 2020.
- Complete Streets for Canada Homepage,<https://www.completestreetsforcanada.ca/locations/>. Last accessed 29 Jan 2020. Complete Streets for Canada, Complete Streets Guide, https://www.completestreetsforcanada.ca/wp-content/uploads/2014/09/www.calgary.ca_Transportation_TP_Documents_CTP2010_complete-streets-guide-2014-web.pdf (2014). Last accessed 30 Jan 2020.
- Dowling, R.-G., Reinke, D.-B., Flannery, A., Ryus, P., Vandehey, M., Petritsch, T.-A., Landis, B.-W., Rouphail, N.-M., Bonneson, J.: NCHRP report 616: Multimodal level of service analysis for urban streets. Transportation Research Board of the National Academies, Washington, DC (2008).
- Dowling, R.-G., Reinke, D.-B.: NCHRP Web-Only Document 128: Multimodal level of service analysis for urban streets: users guide. Transportation Research Board (2008).8. Gordon, M., Diamond, S., Zheng, M., and Carnevale, M.: Comparing Encounters in Theory and History of Education, 19, 163–185 (2018)9. Florida Department of Transportation, Quality Level of Service Handbook,https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/content/planning/systems/programs/sm/los/pdfs/2013_qlos_handbook.pdf?sfvrsn=22690bd2_0(2013). Last accessed 30 Jan 2020
- Hui, N., Saxe, S., Roorda, M., Hess, P., Miller, E.: Measuring the completeness of complete streets. Transport Reviews. 38, 1–23. (2017)11. IDEO Design Thinking Homepage, Design Thinking Today,<https://designthinking.ideo.com/#design-thinking-today>. Last accessed 29 Jan 2020.
- Keivani, R.: A review of the main challenges to urban sustainability. International Journal of Urban Sustainable Development 1, 5–16 (2009). Laplante, J., And, P., Mccann, B.: Complete streets: We can get there from here. Institute of Transportation Engineers (ITE) Journal, 78, 24–28 (2008).

References

- Lynott, J., Taylor, A., Twaddell, H., Haase, J., Nelson, K., Ulmer, J., McCann, B., Stoloff, E.-R.: Planning complete streets for an aging america, https://www.aarp.org/home-garden/livable-communities/info-08-2009/Planning_Complete_Streets_for_an_Aging_America.html(2009). Last accessed 29 Jan 2020.
- McCann, B.: Completing our streets: The transition to safe and inclusive transportation networks. DC: Island Press, Washington (2013)16. Nascimento, I., Silva, W., Gadelha, B., Conte, T.: Usability: a technique for the evaluation of user experience and usability on mobile applications. In International Conference on Human Computer Interaction, pp. 372–383. Springer, Cham (2016).
- National Complete Streets Coalition: The best complete streets policies of 2015.(2016)18. Nielsen, J., 10 usability heuristics for user interface design, <https://www.nngroup.com/articles/ten-usability-heuristics/>. Nielsen Norman Group (1995). Last accessed 26 Jan 2020
- Nielsen, J., Usability 101: Introduction to Usability, <https://www.nngroup.com/articles/usability-101-introduction-to-usability/>. Nielsen Norman Group(2012). Last accessed 26 Jan 2020.
- Nusrat, S., Kobourov, S.: Task Taxonomy for Cartograms, In: Bertini, E., Kennedy, J., Puppo, E. (eds) Eurographics Conference on Visualization (EuroVis) - Short Papers. The Eurographics Association (2015). <https://doi.org/10.2312/eurovisshort.2015112621>.
- Reynolds, G.: Presentation Zen Design: A Simple Visual Approach to Presenting in Today's World. 2nd edn. Pearson Education. (2014).22. Rowe P.: Design Thinking. The MIT Press, Cambridge (1987)23. Rowe P.: Design Thinking in the Digital Age. Harvard University Graduate School of Design, Cambridge (2017).

QUESTIONS?

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