Input Sensitivity Analysis for Macroscopic Analytical Models

Max Moreland | Traffic Data Inc.
Ben Hao | Hennepin County

Capacity focused macroscopic analytical models are a great tool that are used in many traffic studies. These models can give great insight into how intersections are performing or are likely to be performing in a real-world setting. Although macroscopic analytical modeling doesn’t model traffic operations at the individual vehicle level as a micro-simulation model does, a large amount of intersection data can be modeled at the same time making macroscopic modeling very beneficial. It is a safe bet that most people reading this article have used macroscopic traffic analytical software at some point in their career.

There are a number of different macroscopic analytical software packages available on the market. With different user interfaces and capabilities, each of these software packages have their own strengths, but they generally rely on the same underlying traffic engineering principles. One big question that looms over the user of any of these software packages is which of the parameters in the software need to be adjusted from the defaults when performing traffic analysis? More specifically, if a user adjusts one parameter in the software how much of an impact will that have on the results? And will those impacts be the same across different software packages?

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[www.nc-ite.org](http://www.nc-ite.org)
2017 is underway and we’ve hit the ground running! Our 2017 board has already met twice, and this year’s technical committees have started out strong. Our January section meeting was informative and very well attended. Our Younger Member Committee is starting their first full year of existence and has held their first event of the year, and we’re all excited to see this group continue to grow.

Even though 2017 has just begun, we’ve already set the stage for some unique and exciting events. For the first time since I can remember, we’re taking a section meeting to North Dakota! There has been quite a bit of energy coming out of our neighbor to the west in the last few months, and on March 22nd the meeting will be held in Fargo. Those of you that are already attending the ATSSA How-To conference, you are invited to stick around for lunch immediately following the conference. If you can’t make the trek to Fargo, we’ll be setting up a simulcast here in the Twin Cities. One way or another, we hope you can join us!

We’re also going to combine our summer social event with our scholarship fund-raising event. Our goal is to take less time out of your busy summers while increasing the overall excitement for our summer event. Stay tuned for more details.

Two other initiatives for this year build on previous accomplishments. First, now that we have regained 501(c)(3) status, we will be working with ITE to understand if and how much section insurance is appropriate for our organization. Second, with a full year of revamped website under our belt, we continue to use this platform to explore ways to make advertising packages more valuable. Thank you to all of our advertisers for continuing to support us!

By now, many of you have heard that Minneapolis will be hosting the ITE 2018 Annual Meeting and Exhibit. Planning will kick into full gear later this year. Some of our Executive Board and Local Arrangements Committee members will be traveling to Toronto for the 2017 Meeting (July 30 to August 2) to get a feel for what it takes to host a meeting of this magnitude.

I’d like to close by introducing the 2017 board and welcome all of you to share any ideas that can make our section stronger.

Vice-President: Scott Poska, SRF Consulting Group
Secretary: Jeff Preston, Stantec
Treasurer: Jake Folkeringa, SRF Consulting Group
Director: Nick Ollrich, Metro Transit
Director: Abby Rieckman, Alliant
Director: Mark Wagner, SEH
Past President: Joe Gustafson, Washington County

I look forward to seeing you all at this year’s events,
Mike Martinez, HDR
2017 NCITE President
ITE Midwestern District Conference
June 18-20, 2017
The Concourse Hotel | Madison, WI

New Highway Capacity Manual
8 Part Webinar: ITE Learning Hub available here:

2017 Joint ITE/CITE 2017 Annual Meeting
July 30 - August 2, 2017 | Toronto, Canada

For professional development opportunities:
http://nc-ite.org/content.php?page=Professional_Development_Meetings

NCITE Calendar:
http://nc-ite.org/calendar.php
Get to know the 2017 board!!

**Mike Martinez, 2017 NCITE President**

**Job Title and Employer:** North Central Regional Traffic Leader, HDR Engineering, Inc.

**Past Work:** Short Elliott Hendrickson, Inc.

**Education:** B.S. Civil Engineering from Iowa State University (1998)

**Where You Live:** Brooklyn Park, MN

**Family:** Wife, Tara

**Pets:** 2 dogs, Hobbes and Suzie

**Hobbies:** Golf, MN Twins

**Restaurant:** Manny’s

**Favorite Car:** Acura MDX

**Desired Superpower:** The Force

**Pet Peeves:** Traffic congestion, texting while driving, when Nick Punto stepped into the batter’s box as a MN Twin

**Most Embarrassing Moment:** Spilling coffee on shirt in meeting (repeat offender)

**Instruments Played:** Baseball glove (retired)

**Languages Spoken:** English, Spanglish, Germish

**Interesting Facts:**

- Partial Twins season ticket owner
- Member of 2003 CSC Outdoor Volleyball Championship Team
- “Uncle Mike” (3 times over)
- Shot personal best 88 (round of golf) in 2012
- Ran the mile in 5:10 (many, many, many years ago)

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**Scott Poska, 2017 NCITE Vice President**

**Job Title and Employer:** Senior Associate Traffic Engineer, SRF

**Past Work:** Traffic Engineer, Crawford Bunte Brammeier, St. Louis

**Education:** BS Civil Engineering, Iowa State, 2004

**Where You Live:** Plymouth, MN

**Family:** Wife, Christy, Daughters, Kaitlyn (6) and Rebecca (2.5)

**Hometown:** Portage, MI. I moved to suburban Chicago when I was 13.

**Hobbies:** Avid hockey fan and player; I enjoy outdoor adventures/trips including hiking, backpacking, canoeing, fishing, camping, mountain biking; homebrewing; grilling; photography; and being a dad to my two girls

**TV Show:** Top Gear (UK) and Gold Rush

**Favorite Car:** Any red Ferrari

**Interesting Facts:**

- I’ve never lived in a city at the same time the local team has won the Stanley Cup. I hope this changes soon!
- In the 30 years I’ve been a hockey player, I’ve scored a goal six different ways: even strength, power play, shorthanded, penalty shot, empty net, and own goal.
- I’ve traveled to 9 countries.

**Biggest Accomplishment:** Graduating college, moving, getting married, honeymooning, and starting a new job all within 2 weeks in 2004

**Best Vacation:** 3 week trip to Europe and UK in 2008.

**Favorite Food:** Mexican

**Favorite MN Taproom:** Fulton Brewing
Get to know the 2017 board!!

Jeff Preston, 2017 NCITE Secretary
Job Title and Employer: Senior Transportation Engineer - Stantec
Past Work: City of Woodbury – Engineering Dept.
Education: BS Civil Engineering – Iowa State University
Where You Live: Blaine, MN
Family: Dina, Claire (8), Noah (6), Lilly (2)
Hometown: North St. Paul, MN
Hobbies: Coaching kids soccer/basketball, Sporting Events (Vikings/Timberwolves games), Home projects, Chauffeuring kids to the next activity,…
Best Vacation: Italy (Rome/Tuscany/Cinque Terre), National Dance Competition/Disney World (Daytona Beach/Orlando)

Jake Folkeringa, 2017 NCITE Treasurer
Job Title & Employer: Senior Associate, SRF Consulting Group
Past Work: SEH (intern), WSN (intern), Subway Sandwich Artist!
Education: Bachelor of Civil Engineer, University of Minnesota, 2008
Where You Live: Elk River, MN
Family: Wife Rachel
Pets: Dog (Dyno)
Hometown: Brainerd, MN
Hobbies: Hunting, fishing, and anything with my dog
Interesting Facts:
• I have two middle names making my full name Jacob Hendrik Willem Folkeringa
• I am obsessed with my dog. He is a Nova Scotia Duck Tolling Retriever. We even do dog shows where I “prance” around the ring with him.
• I am a lover of all things Google
• I was a trumpet player in the University of Minnesota Marching Band
• I’ve sung as a tenor in multiple barbershop quartets
Favorite Food: Anything as long as I don’t have to make it
Favorite Restaurant: I don’t know if it’s my favorite but everybody should try Raising Cane’s for the BEST chicken fingers
Instruments Played: Trumpet, piano, guitar, drums, (does recorder count?)
Get to know the 2017 board!!

**Abigail Rieckman. 2017 NCITE Director**

*Job Title and Employer:* Professional Transportation Engineer, Alliant Engineering  
*Past Work:* Started my professional career as an intern at Alliant.  
*Education:* B.S. Physics University of Wisconsin – La Crosse  
B.S. Civil Engineering University of Minnesota – Twin Cities  
*Where You Live:* Brooklyn Park  
*Family:* Husband - Brandon  
*Pets:* TBD – Discussions are ongoing.  
*Hometown:* Goodhue, MN  
*Hobbies:* Softball, Volleyball, and Fishing with my husband.  

**Five Interesting Facts About Yourself:**  
- I have a very large family with 40+ first cousins on my mother’s side of the family. This makes the holidays interesting!  
- I’ve never had a cavity.  
- I was the kid on the playground in elementary school who got their tongue stuck to a pole. This is still the most embarrassing moment of my life!  
- I graduated high school with a class size of 36 people.  
- While studying Physics for three years at UWL I successfully avoided dating any of my MANY male classmates, but after transferring to the U of M Civil Engineering program I ended up marrying one of my materials lab partners. Concrete strength tests are just so romantic.

**Mark Wagner, 2017 NCITE Director**

*Job Title and Employer:* Transportation Engineer, SEH  
*Past Work:* Intern, Dakota County Transportation Department; Traffic Engineer, SRF  
*Education:* Bachelor’s of Civil Engineering, University of Minnesota  
*Where You Live:* Centerville, MN  
*Family:* Wife and new baby as of Jan 16th  
*Hometown:* Saint Cloud, MN  
*Hobbies:* Hiking, reading, cooking/breaking out my smoker, Netflix  

**Five Interesting Facts About Yourself:**  
- I didn’t fly until I was 25.  
- I started college majoring in Psychology and switched to CE after one year.  
- I hate pickles. They are terrible.  
- I taught myself to swim when I was 10.  
- I was the last surviving boy in my 5th grade spelling bee. I finished 6th overall.  
*Favorite TV Show:* Parks and Recreation  
*Favorite Music:* Various, recently played includes Lady Gaga, Gary Clark Jr., and haunting covers of popular songs.  
*Favorite Food:* Pulled pork  
*Favorite Restaurant:* White Tablecloth: Ruth’s Chris or Pittsburgh Blue; Fast/Casual: Blue Collar BBQ and Pineda Tacos  
*Favorite Book:* Game of Thrones. It was the first book I read that threw *deus ex machina* entirely out the window.  
*Desired Superpower:* Time travel
Get to know the 2017 board!!

Nick Ollrich, 2017 NCITE Director
Job Title and Employer: Blue Line LRT Extension Traffic Engineering Lead at Metro Transit
Past Work: Engineer at SRF Consulting, Instructor at Bethany Lutheran College
Education: Bachelor of Arts in Physics, Bachelor of Civil Engineering, Master of Science in Civil Engineering
Where You Live: Saint Louis Park, MN
Family: Wife, Elise
Pets: None
Hometown: Fertile, MN
Hobbies: Biking, hunting, fishing, concerts

ITE LOL

BACKWARD. I READ THINK ENGINEERS HIGHWAY
The January Section Meeting was held on January 23rd, 2017 at Rose Vine Hall (Grumpy’s), Roseville, MN. The meeting topics included: general items, news on an upcoming section meeting being planned in Fargo, North Dakota, the 2017 MWITE meeting will be in Madison, Wisconsin June 18-20, and presented the intern student scholarship winners: Hannah Johnson (Alliant) & Leah Klein (Alliant).

The presenter was Ray Starr from MNDOT and Brian Scott from SRF, presenting on The SPaT Challenge. Highlights of the presentation included:

What is SPaT? Definition – Signal Phase and Timing
SPaT enables applications: Red light violation warnings, Eco-Driving, Automated vehicles

- **What is the SPaT Challenge?**
  “AASHTO is challenging the state and local public sector transportation infrastructure owners and operators to cooperate together to achieve deployment of DSRC infrastructure with SPaT, MAP, and RTCM broadcasts in at least one corridor or network (approximately 20 signalized intersections) in each of the 50 states by January 2020 (referred to as the “AASHTO SPAT Challenge”)

- **Why the SPaT Challenge?**
  Provides groundwork for vehicle to infrastructure dimension of connected and automated vehicles. Demonstrate to vehicle manufacturers (OEMs) Infrastructure Owner Operator (IOO) commitment to SPaT
  Gain experience with procurement, licensing, installation, and operation
  Provide entry into DSRC-based V2I deployment
  Lay ground work for more advanced V2I deployments

- **Accepting the SPaT Challenge will:**
  Demonstrate to vehicle manufacturers (OEMs) Infrastructure Owner Operator (IOO) commitment to SPaT
  Gain experience with procurement, licensing, installation, and operation
  Provide entry into DSRC-based V2I deployment
  Lay ground work for more advanced V2I deployments
The February Section Meeting was held on February 21st, 2017 at Jax Cafe in Minneapolis, Minnesota. The meeting topics included: general items, news on the March Section Meeting scheduled for March 22, in Fargo, ND, coinciding with the ATSSA “How To” Conference, and the MWITE annual meeting is in Madison, Wisconsin June 18-20, 2017, and a technical presentation.

The presenter was Reed Leidle, from Safety Signs LLC, presenting on Temporary Traffic Control, Work Zone Safety, Design, and Administration from a Consultant’s perspective. Highlights of the presentation included:

Discussion:
- How can we make work zones as safe as possible?
- What is the problem? What are we trying to fix?
- Meeting with Consultants
- Partnership Opportunities

Statewide Workzone Safety Committee (SWWZSC):
Mission – The SWWZSC will influence the actions of those involved with work zones through the information that is shared through the innovations and best practices that are identified so that we achieve safer work zones and fewer fatal and life changing crashes.

SWWZSC Industry Liaison Group:
- Identify industry thoughts regarding existing state guidelines, standards, and procedures
- Determine actions that industry can implement or pursue to improve work zone safety (I-94 Example)
- NLATSSA Temporary Traffic Control (TTC) Committee
- To improve working relationships and communication with agencies
- Being willing to hear and gain understanding of agency perspectives
- To offer solutions on ways to improve training, safety, specifications, and enforcement
- Meet with different stakeholders to share Industry concerns so as to improve Work Zone Safety
- Focus on positive aspects, outcomes, and accomplishments
- Work with Prime Contractors regarding the communication of Traffic Control items, to ensure both specifications are being adhered and to achieve the utmost safety in Work Zones.
- Look at projects earlier (pre-letting) so as to afford ample time for clarification, when warranted.
- Provide examples of reoccurring “Specification Issues” so MnDOT can understand what we’re seeing and work towards improving.
- Traffic Control is one of the last items to be planned for
- Better communication…
- “Less is More” or “More is More”
- Quality & Safety vs. Cost – what’s the correlation?
- Suggest having a “Every Project should have these X things addressed” check list
- Suggest having a “What you need to know” document (Shalls, Shoulds, Best Practices)
- Have an annual meeting (with MnDOT, Industry & Consultants) to discuss lessons learned, best practies, opportunities for improvement and ongoing training. (Case Studies)

Pending Questions/Discussion Items:
- Designing Traffic Control should be the top priority
- Let’s work together so we’re doing everything we can, on every project, to make our Work Zones as safe as possible.
NCITE has a new standing committee, the **Younger Member Committee (YMC)** focusing on connecting the younger generation to the field of transportation engineering and NCITE. The YMC has held two successful events thus far. The first event was held in conjunction with the NCITE Annual Meeting on November 10, 2016 at Whirlyball Twin Cities. A group of approximately 15 members gathered to learn more about the YMC, mingle among each other, and enjoy a drink prior to taking to the Whirlyball courts. During the second event on January 26, 2017, members were able to let off some steam and break out the ice skates. The event kicked off at The Depot, where attendees learned about The Depot’s historical significance to the development of the Twin Cities. With the declining reliance on rail, The Depot transitioned from a transportation hub to a cultural and social hub. Attendees were able to experience the new face of The Depot while skating under the cover of the old station. The event concluded at Alliant Engineering where everyone shared in drinks, food, and laughs.

Stay tuned for notification of our upcoming event in March or April!

YMC Update

[Images of YMC at Whirlyball and The Depot]
North Dakota State University

North Dakota State University’s ITE Student Chapter is an active chapter in the Midwest region. It is engaged in regular activities such as monthly meetings, participating in the MWITE conference, and field trips.

Midwestern Conference & Student Leadership Summit

NDSU ITE student chapter has had a significant involvement in the MWITE conference in the last few years; participating in the traffic bowl, design competition, and poster presentation. NDSU ITE Student Chapter team reached the finals in 2014, and the semifinals in 2015, and 2016! Peter Henson, Jennifer Vanderheidan, and Niloy Saha constituted the traffic bowl team at the 2016 MWITE conference, held in Chicago, Illinois.

The chapter also participated in the first Midwest student leadership summit, held at Iowa State University. Eighty two students from 13 universities attended this summit. It provided great networking opportunities for students and professionals.

Field Trip

In October 2016, the chapter arranged a field trip to Hector International airport, Fargo, North Dakota. Jon Scaper, PE, from Mead and Hunt, Inc., led, supervised, and briefed the touring ITE student members about a taxiway reconstruction project.
In the past few months, the Interdisciplinary Transportation Student Organization (ITSO) has hosted four TRANSPOTalk seminars and a farewell luncheon for former professor David Levinson. We have also increased our outreach efforts and started building up our relationship with the Center for Transportation Studies and the NCITE Younger Member Committee. Many of the ITSO officers and member attended the 2017 Transportation Research Board (TRB) Annual Meeting in Washington D.C. Our time at TRB gave us the opportunity to network with other ITE Student Chapter members from around the country and will help us prepare for presenting at the 2018 TRB conference.

This semester ITSO plans on hosting our monthly TRANSPOTalks while adding several other events. Events are to include a facility tour of the St. Paul airport, a speed networking event with the NCITE YMC, and participating in the College of Science and Engineering Expo. Later in the semester we will start planning for the 2017 ITE Traffic Bowl and officer transitions.
NCITE’s Simulation and Capacity Analysis Committee (SimCap) formed a task group that targeted to address these questions by conducting testing experiments on these software packages. The analysis presented here is intended to be part of a living and growing document to aid macroscopic analytical software users in better understanding the impacts of adjusting parameters while developing intersection models and performing capacity analysis.

Three software packages were selected for the experiments; Highway Capacity Software (HCS), Synchro, and Vistro. Each software package was used to model the same five intersections. Default values were set for five different parameters and individually these parameters were incrementally changed from the default values and the overall intersection delay was recorded. The five parameters looked at were:

- Peak Hour Factor (PHF)
- Saturation Flow Rate (SFR)
- Heavy Vehicle Percentage (HV%)
- Volume Adjustment Factor (VAF)
- Central Business District (CBD)

The testing experiments were conducted on five typical intersections types including one with all-way stop control, one with two-way stop control, two with signalized control, and one roundabout.

The entire testing experiment was done for two different traffic volume sets in each software package at the five intersections. The first round of testing used traffic volumes that put each of the default intersections in the level of service (LOS) B to LOS C range based on the overall intersection delay. This is referred to here as LOS Low. The second round of testing increased the traffic volumes to put the intersections with the default parameters in the LOS D to LOS E range. This is referred to here as LOS High. The results of the analysis show that the overall intersection delay is more sensitive to changes when the intersection is in the LOS High range than in the LOS Low range.

While all of the parameters have a noticeable impact on the intersection delay, the testing results indicated that PHF and VAF have the biggest impact with incremental adjustments changing the overall intersection delay by up to two-hundred percent of the original. Though there are differences in delay times, these trends were consistent across all three software packages tested. The sensitivity testing results for each parameter are summarized next:
Peak Hour Factor

In the LOS Low range, the PHF had minimal effect on the signalized intersections. However, in the LOS High range the PHF had an impact on overall delay of over 150% to over 200% depending on the software. The impact to the smaller signalized intersection (intersection 3) was greater than the larger signalized intersection (intersection 4). The stop controlled intersections were generally the most influenced by PHF with overall delay changes of over 200% even in the LOS Low range.

Saturation Flow Rate

The sensitivity testing for SFR was only conducted for the two signalized intersections. SFR in the LOS High range can have impacts of nearly 200% on the overall intersection delay while SFR in the LOS Low range only changed the overall delay by about 10%.

Heavy Vehicle Percentage

HV% can change the overall delay by about 10-15%. Volumes in the LOS High range had very minor increases in overall delay for the unsignalized intersections, while the signalized intersections had as much as a 10% difference in overall delay change between the LOS Low and High ranges.

Volume Adjustment Factor

Similar to the PHF, the VAF generally had significant impact on the unsignalized intersections. In the LOS High range, VAF adjustments impacted overall delay by as much as 500% to 600% for the two-way stop controlled intersection (intersection 2). The signalized intersections see little impact in the LOS Low range, but can have overall delay changes of as much as nearly 300% in the LOS High range. Similar to the PHF, impacts of VAF adjustment were greater in the smaller of the two signalized intersections.

Central Business District

Whether or not the intersections were selected to be in a CBD had significant results in Vistro and Synchro especially for the LOS High range values.

Based on the testing results, adjustments to inputs in macroscopic analytical models can have significant impacts on results. Whenever possible inputs you have measured in the field are preferred over the defaults or estimations.

Parameters that directly impact the traffic volumes, such as PHF and VAF, can have the most significant impact on the intersection delay. Changing parameters when the intersection delay is starting in the LOS High range has more of an impact than when it is in the LOS Low range. Therefore, while it is important to always be careful when adjusting parameters in a macroscopic analytical model, extra caution should be used when adjusting volumes and making any changes when intersections are nearing LOS E.

To see the report with full results including charts showing in detail the sensitivity of different parameter adjustments, please contact NCITE’s SimCap Committee.
**Geometric Design Technical Committee**
Committee Chair: **Kelly Besser** - kbesser@stonebrookeengineering.com
Recent Agenda Items: Roundabout Design presentation by MnDOT Roundabout Steering Committee, Part 1 (2/16/17)
Future Agenda Items: Roundabout Design presentation by MnDOT Roundabout Steering Committee, Part 2
Next Meeting: April 20th, 2017 8:30am – 10:00am, Stantec 2335 Highway 36 West, St. Paul, Minnesota

**Intersection Traffic Control Technical Committee**
Committee Chair: **Tyler Krage** - tkrage@alliant-inc.com
Recent Agenda Items: Roundabout workshop.
Future Agenda Items: Audible Pushbutton volume issues with Sonya Piper and Sue Zarling.
Next Meeting: TBD

**ITS Technical Committee**
Committee Chair: **Derek Nieveen** - dnieveen@alliant-inc.com
Recent Agenda Items: Vikings Stadium tour.
Future Agenda Items: Metro Transit A Line – Lessons Learned
Next Meeting: April 4th, 2017, 1:00pm - 3:00pm, MnDOT Waters Edge Conference Room A

**Pedestrian and Traffic Safety Technical Committee**
Committee Chair: **Caitlin Wotruba** - caitlin.wotruba@kimley-horn.com
Recent Agenda Items: Brainstorming topics for the 2017 meeting year.
Future Agenda Items: Presentation by Jeremy Ellison of the St. Paul Police discussion the “Stop for Me” Campaign and “Towards Zero Deaths.”
Next Meeting: TBD

**Planning Methods and Applications Technical Committee**
Committee Chair: **Steve Wilson** - swilson@srfconsulting.com
Recent Agendas Items: No recent meetings
Future Agendas Items: Tentative topic Metropolitan Council activity based model and travel behavior inventory.
Next Meeting: March 16th, 2017 11:30am – 1:30am, MnDOT Waters Edge 1500 W. County B-2, Roseville

**Traffic Operation and Maintenance Discussion Group**
Committee Chair: **Adam Bruening** - adam.bruening@co.washington.mn.us
Future Agenda Items: Tour of Washington County Public Works newly renovated facility. Discussion of how agencies deal with bus stop benches placed by advertising companies.
Next Meeting: TBD

**Simulation and Capacity Analysis Technical Committee**
Committee Chair: **Joe DeVore** - jdevore@srfconsulting.com
Recent Agenda Items: Comparisons of Mesoscopic Traffic Simulation Programs presented by Derek Lehrke.
Future Agenda Items: TBD
Next Meeting: TBD
Minneapolis 20 Year Streets Funding Plan

JoNette Kuhnau, PE, PTOE | Kimley-Horn

The Neighborhood Park and Street Infrastructure Ordinance enacted by the Minneapolis City Council in April 2016 partially closed the identified long-term gap in the maintenance of and investment in neighborhood parks and city streets. Beginning in 2017, the city’s street paving budget – part of the City’s larger Capital Improvement Plan (CIP) – will be increased by $21.2 million per year annually for 20 years. The primary purpose of the additional funding is to maintain the pavement condition of City streets, but the funding is being used in opportunistic ways to achieve multiple City goals. The additional funding and the focus on equity prompted a new way of evaluating and selecting street paving projects in Minneapolis.

Background
In 1966, there were 580 miles of unpaved Minneapolis residential streets, 64% of all city street mileage. The very poor street condition and significant maintenance costs of unpaved streets prompted the City to start a 30-year residential paving program, a significant investment in streets that has served the City well for more than 50 years. Today, streets first paved in the 1960s are reaching the end of their useful life. Pavement condition of city streets was projected to decline over the next 20 years without additional investments in street infrastructure and maintenance.

A New Process
To allocate the additional funding equitably, Minneapolis Public Works worked with Kimley-Horn to develop a new criteria-based project selection process with a focus on racial and economic equity. A new evaluation framework needed to be created and a new CIP developed in only 5 months. The quantitative criteria were focused on measurable data that were readily available and reflected the city’s priorities and goals. Relative weighting of the criteria were informed by staff, public, and stakeholder input, which was gathered through working group meetings, an open house, and an online survey. In addition to the quantitative evaluation, the process also includes qualitative screening to deliver a balanced and well-thought capital program. The new process, illustrated below, will be used annually to develop the street paving portion of the CIP.

Process for Selection of Minneapolis Street Paving Projects
Source: City of Minneapolis 20 Year Streets Funding Plan, December 2016, Kimley-Horn and Associates.
Kimley-Horn used a GIS platform, along with extensive data sets from Minneapolis, the US Census Bureau, and Metro Transit, to evaluate and score the 900+ miles of city streets for each of the criteria. The scores and qualitative screening were used to create a list of recommended street paving projects for each year of the CIP, which were incorporated into the Mayor’s 2017 proposed budget.

Results
The street paving projects in the resulting 2017-2022 CIP reflect the pavement management needs of the city while seizing and creating opportunities to achieve other Minneapolis priorities and goals, such as improving the pedestrian realm, filling sidewalk gaps, implementing the protected bikeway network, and investing in infrastructure throughout all neighborhoods.

With the additional funding created by the Neighborhood Park and Street Infrastructure Ordinance, the city’s 2017-2022 CIP includes reconstruction of 46 miles of city streets, a 178 percent increase over the original CIP, as well as continuing its resurfacing and sealcoating programs and introducing a concrete rehabilitation program and a residential reconstruction program. These street projects will also create opportunities to potentially implement 6 miles of protected bikeways and improve 33 miles of pedestrian realm.

This criteria and project selection methodology is the first iteration of a process that will continue annually over the next 20 years. New and updated data sets, stakeholder input, and process refinements will continue to improve the results of the project selection and prioritization process. Each year, the evaluation process will be used align the capital improvement program with the evolving needs and priorities of the city’s streets and known city priorities and goals.

Source: City of Minneapolis 20 Year Streets Funding Plan, December 2016, Kimley-Horn.
While school zone beacons are designed for pedestrian and traffic safety, if they’re not in proper repair or timed incorrectly, they can deliver the opposite effect. When drivers see the flashing light at inaccurate times they lose trust in the system, begin to ignore the beacons, and stop slowing down.

Over time, drivers become immune to the flashing lights and disregard them altogether. The advantages of a beacon system are far too important to let slip away due to a lack of trust. With the emergence of the smart beacon system as part of a suite of smart city solutions, it can easily be restored.

The importance of building trust

Building trust in the beacon system is critical to its overall success. It’s important to keep the beacons timed correctly so when a driver sees the flashing light, there is no question as to its accuracy. Drivers will know to slow their speed and to be on the lookout for pedestrians. Even one inaccurate event could damage the system’s reliability. Is today a delayed start to the school day? The beacons should be adjusted for the correct time. They should also be programmed so as not to flash on holidays, snow days, and accommodate for any other modification to the standard schedule.

Managing the beacon’s programmed schedule is not the only way to help build trust. Maintenance is also a key factor. Keep batteries, lamps, solar panels and equipment in proper working order and replace them as necessary.

How a smart system can help

A smart school zone beacon system includes an intelligence feature that helps manage the beacon system more efficiently. In addition to making schedule changes, counties and cities are able to remotely monitor the field equipment and its operation 24 hours a day, 7 days a week, thus allowing for proactive maintenance and quicker response to any performance issues.

Older beacon systems required physical inspection at each location during hours of operation to confirm proper functioning and to determine any maintenance needs. The ability to generate a beacon health report is an important tool that proactive departments use to maintain trust in the system. New systems also allow for over-the-air (OTA) upgrades to be simultaneously installed with just one click—a significant improvement over the older models that require a manual chip change to each individual beacon.

Valuable benefits to smart beacon systems

An accurate and driver-trusted system improves pedestrian, driver, and passenger safety. Installing the system helps reduce the number of accidents and ultimately saves lives. It also offers the added benefit of streamlining what once involved very manual, time-consuming tasks into a more efficient use of resources and skills.
Is your city growing faster than your roads can sustain? Does your city have a busy intersection that backs up for blocks waiting for drivers wanting to take left turns?

Often, when an area grows faster than the roadways can support, intersections get backed up with drivers making left-hand turns that block traffic. Drivers turning left have to wait for oncoming traffic. Drivers behind the turning vehicle have to wait for it to turn before going through the intersection. This frequently happens around shopping center developments or businesses in busy areas, this can create long backups, and driver frustration.

In these situations, cities will often need to invest in updating the interchanges, which can be costly and take a long time to complete.

But what if there were another way?

The continuous flow intersection (CFI), also called a cross-over displaced left turn (XDL or DLT intersection) is an intersection design that solves these issues with a unique, efficient design. It eliminates the congestion caused by drivers making left turns.

“The idea is to have left-turning drivers start their turn 900-1,000 yards before the intersection,” says Paul Wells, SEH highway designer. “This is considered an undisturbed left. People wanting to continue forward can stay in motion, instead of being stuck behind someone who can’t get through an intersection.”

With this type of interchange, a single traffic signal that normally alternates between the eight different movements at the intersection is replaced by three signals that only control two separate movements at each signal.
There is the potential to stop three times: once at a midblock signal as you approach the intersection, once at the intersection and once at a midblock signal after leaving the intersection. However, with careful signal coordination, traffic can keep flowing significantly more efficiently, safely and smoothly.

“The reason congestion is growing at the Havana/Easter intersection in Centennial is twofold. First, the adjacent undeveloped land is filling in with commercial and office developments, and second, the major parallel roadway in the vicinity is over capacity and vehicles are diverting their routes through the Havana Street / Easter Avenue intersection,” said Jon Larson, SEH traffic engineer. “SEH performed a traffic study and came up with some different intersection options for the City to consider.”

Centennial ultimately chose the CFI to help alleviate the congestion and keep traffic flowing smoothly.

The design includes modifying the current four-way intersection into a three-way intersection, something Larson says will also cut down on congestion in the area.

What happens now?
The City of Centennial expects to bring the project to construction within the next five years, giving residents some much-needed relief to the congestion in the area.

An aerial view of a CFI design (in red) layered over an existing junction in Centennial, CO.
TKDA provided Three Rivers Park District (TRPD) with engineering services for a 3.6-mile long trail linking the City of Minneapolis with Richfield and Bloomington. The project filled the gap in the regional transportation and recreation system with a safe, efficient and accessible, off-road, multiuse trail from 86th Avenue in Bloomington to West Lake Nokomis Parkway.

The trail presented several design and access challenges, including a route that crossed over two extremely busy sections of metro highway.

The 12th Street Bridge over I-494 could not accommodate a trail addition due to its age, condition and substandard vertical clearance over one of the busiest stretches of freeway in the state, so a new multimodal bridge was constructed adjacent to the existing structure. In exploring design options to accommodate a busy frontage road and large storm sewer at the approach, the team discovered an in-place bridge substructure. The team tied into the substructure and designed an innovative approach span compatible with the existing bridge, accomplishing a feat that at first glance looked impossible, but ultimately saved costs and time on the project.

The second challenge was the Bloomington Avenue Bridge over Crosstown that offered a narrow, three-foot-wide sidewalk to cross over another very busy stretch of metro highway. Access was critical in design here as this link is located in a section of town where a high percent of the population do not own cars, and are heavily dependent on foot and bicycle traffic.
Initial plans considered constructing an adjacent bridge structure to accommodate the trail. After another critical look at existing infrastructure, the team worked with MnDOT to retool the entire top surface of the bridge instead, widening the structure for a multiuse trail, blending the old with the new to add a multiuse trail. The retooled bridge now includes audible pedestrian signals, ponded areas were elevated to eliminate standing water, and signals were upgraded to ADA compliance.

TKDA encountered and solved numerous instances of right-of-way conflicts on Three Rivers Park District’s Intercity Regional Trail project.

During Master Plan development, for example, the preferred trail alignment was along the west side of Old Cedar Avenue. To accomplish the desired alignment, the Master Plan indicated a curved, cast-in-place retaining wall should be reconstructed.

TKDA recognized there were numerous issues with implementing this trail realignment, including the fact that the wall supports a medical clinic parking lot. Reconstructing the wall to accommodate the trail would have effectively cut off the clinic’s entire north parking lot and required a number of utility relocations.

TKDA proposed an alternative that shifted the street alignment to the east that proved more economical than the original alignment, and allowed the retaining wall to remain in place, thus avoiding major impact and disruption to the clinic and adjacent utilities.

Sustainable design saved mature boulevard trees on the south side of Lake Nokomis. The TKDA team discovered that the existing road was wide enough to accommodate the addition of the trail. While it would have been cheaper to remove the boulevard and the trees, that option would not have been acceptable to the community in this heavily used area close to Lake Nokomis.

TKDA worked closely with partners, agencies, subcontractors and TRPD on the project that was completed in June 2016, on time and under budget for $5.4 million.

With unused, allocated federal funds available for this project, TRPD and TKDA sought and obtained MnDOT and Federal Highway Administration approval to add a short trail segment to the project that completed the corridor.
Centracs Adaptive Case Study

Traffic Control Corporation

In each issue, the INCITER features articles coordinated by NCITE’s sponsors.
This article is a contribution from Traffic Control Corporation.

Well known for being the state capital of Wisconsin, Madison boasts a thriving recreational, cultural, arts, and community atmosphere combined with affordable housing, nationally ranked schools, one of the best health care systems, and low unemployment. Madison has seen an annual growth rate of ~1 percent since 1970 – estimated 2014 population is 245,691. As traffic volumes rise with the population growth, it has put a lot of capacity pressure on the roadways in and around Madison, and planners do not see relief anytime soon. The projected population growth rate is expected to continue at 1.1 percent through 2030. Moreover, as the city home of the University of Wisconsin at Madison, traffic volumes fluctuate greatly for events throughout the year.

As a result, transportation management is an important focus for the City of Madison and the Wisconsin Department of Transportation (WisDOT). WisDOT and the City of Madison identified that the Verona Road (US 18/151) corridor, a major commuter corridor for the area, began to see unacceptable levels of crashes that were occurring more often than highways. It was observed that the majority of collisions occurred at the intersections.

Traffic had exceeded the roadway capacity. WisDOT and the neighboring cities decided to re-construct the highway to improve the efficiency and increase the capacity of Verona Rd.

Named the Verona Rd. (US 18/151) Project, the two-phased re-construction project, scheduled to be completed in 2019, will re-configure the highway more like a freeway, eliminating left turns and providing right lane(s) exits. However, to accommodate the construction, traffic would need to be bypassed onto the McKee Rd./Fish Hatchery Rd. (north to the Beltline Highway) corridor as an alternate route. City planners and engineers projected a 20 percent volume increase on the already high-volume, four-mile corridor as a result of the bypassed traffic.

Execution

To proactively address the expected increase in traffic volume on the McKee Rd./Fish Hatchery Rd. corridor from Phase 1 of the project, the City and WisDOT turned to Centracs Adaptive.

First, the City re-timed the 13 signals along the 4-mile corridor to increase the efficiency as much as possible until Centracs Adaptive was deployed. Helping the City of Madison and WisDOT with the complex re-construction project are the engineering/construction firm Strand Associates (Madison, WI), and traffic management consultant Traffic Control Corporation (TCC) (Woodbridge, IL).
The Econolite Centracs Adaptive system was deployed in July 2014. The City of Madison leveraged a combination of vehicle detection sensors, including inductive loops, as well as above-ground video and microwave radar detection sensors to feed the necessary traffic data to the Centracs Adaptive module. The radar and Autoscope Encore video detection systems were primarily used for stop bar detection, while inductive loops were used for advance detection. In a few installations, the Autoscope Encore video systems were also used for advance detection as intersection departure detection – detecting vehicles leaving an intersection, providing traffic volume data ahead of the next intersection. By using a combination of detection sensor types, Madison is able to effectively meet the vehicle detection input data requirements for the adaptive signal control system, as well as enhance detection performance at various intersection types, and during varying weather and daylight conditions.

Results
Upon activation, City traffic engineers began to see immediate travel time and reduced number-of-stops improvements. This was an unexpected surprise, as it substantiated claims to the effectiveness of adaptive signal control for varying and unique applications. What was most surprising was the level of improvement. Before-and-after travel time reports indicated up to a 22 percent reduction in travel times and a 65 percent reduction in stops. This level of improvement is often associated with applications where adaptive signal control is deployed to corridors that have outdated signal timing, or that have never been timed.

Incident Response Performance
Another capability Centracs Adaptive provided that exceeded the City of Madison’s expectations is the system’s incident response performance. On October 21, 2014, Beltline Highway closed from 8 a.m. to 9:15 a.m. as part of the re-construction project. As a result, there was a significant traffic volume spike.

The main highway closure during the peak morning commute caused an approximate 40 percent increase to traffic volume onto the McKee/Fish Hatchery Rd. corridor. The sudden spike of traffic volume a few minutes before 8 a.m. for this corridor would have likely created gridlock-type conditions that might have taken hours to recover. At 8 a.m., Centracs Adaptive was able to immediately recognize the sudden increase in traffic volume and adapt the signal timing, bringing travel time back to nominal conditions for the corridor within 30 minutes.

Centracs Adaptive has proven to be highly effective at helping to reduce travel times and unnecessary stops for bypass traffic along the corridor during the re-construction/highway improvement project. Its performance has helped the City of Madison manage the unique traffic situation better than expected.
MEMBERSHIP UPDATE

New Members

Ethan Akerly – State of North Dakota

Kaare Festvog - Minnesota Department of Transportation

Jason Junge - Minnesota Department of Transportation

Mao Yang - Minnesota Department of Transportation

Saghar Sadeghpour

Thomas Jantscher – HR Green, Inc.

Robert Rapp – North Dakota State University

Chao Wu – University of Minnesota

Moves

Bryan Larson – KLJ, formerly with the University of Wisconsin – Milwaukee

Derek S. Nieveen – Alliant Engineering, formerly with Itelis, Inc

Ethan D Peterson – Minnesota Department of Transportation, formerly with Hakanson Anderson

Ellie Lee – HDR Engineering, formerly with the University of Minnesota

Chao Wu – University of Minnesota, formerly with Bolten & Menk

Kris Lijeblad – Retired from Akron METRO RTA

Jacob Rojer – Spack Consulting, formerly with Westwood Professional Services

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