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New Guide Shows How to Improve Bike Network Connectivity with Modest Changes
Mineta Transportation Institute's free report can help planners reduce riders' stress levels.

San Jose, Calif., May 31, 2012 – The Mineta Transportation Institute (transweb.sjsu.edu) has released a peer-reviewed research report, *Low-Stress Bicycling and Network Connectivity*. As part of its work, the research team created measures of low-stress bicycle route connectivity that can be used to evaluate and guide bicycle network planning. As a result, the team proposed a set of criteria by which road segments can be classified into four levels of traffic stress (LTS). The report includes a sample case study in which every street in San Jose, Calif., is classified by LTS. Principal investigator was Maaza C. Mekuria, PhD, PE, PTOE; with Peter G. Furth, PhD, and Hilary Nixon, PhD. The free 68-page report is available for download at transweb.sjsu.edu/project/1005.html

“For a bicycling network to attract the widest possible segment of the population, its most fundamental attribute should be low-stress connectivity,” said Dr. Mekuria. “In other words, we should be providing routes between people’s origins and destinations that do not require cyclists to use links that exceed their tolerance for traffic stress, and that do not involve an undue number of detours. So we proposed and tested the practicality of a new way to define the bicycle network as the set of streets and paths that people consider acceptably safe for bicycling.”

To fulfill a second goal, the researchers developed metrics for low-stress connectivity, or the ability of a network to connect travelers’ origins to their destinations without subjecting them to unacceptably stressful links.

To make bicycling safer and more appealing, cities often make bicycle-related improvements to certain streets. However, those improvements do not necessarily represent the network of paths and streets that people deem safe enough to use. This research proposes a new scheme for classifying road segments by one of four levels of traffic stress:

- Level of traffic stress 1 (LTS 1): the level that most children can tolerate
- LTS 2: the level that will be tolerated by the mainstream adult population
- LTS 3: the level tolerated by American cyclists who are enthusiastic and confident but still prefer having a dedicated space for riding
- LTS 4: a level tolerated only by those characterized as “strong and fearless”

Using San Jose, Calif. as a case study, the research team demonstrated how relatively modest improvements could bring about substantial gains in connectivity. The analysis showed an overall improvement in the fraction of work trips connected at LTS 2 or lower from 4.7 percent to 12.7 percent of all work trips (for trip lengths less than 6 miles) and a 5.8 times (580 percent) increase in node-to-node connectivity for the same LTS.

The LTS criteria can distinguish four levels of a street network’s stressfulness, corresponding to identified user profiles, and they offer cities a way of mapping their bicycling networks according to which populations they serve rather than according to facility types. The research also highlights the importance of intersection approaches and street crossings in network connectivity.

The report includes several new analysis tools for visualizing connectivity, including stress maps, shortest-path trees, and maps highlighting barriers and islands. Illustrations and figures include examples of bike lanes, various stress maps, sample connectivity graphs, and more. Tables include levels of traffic stress for various configurations, distribution of center-line miles by level of traffic stress, proposed improvements, and more. Free copies may be downloaded from transweb.sjsu.edu/project/1005.html

ABOUT THE AUTHORS

Maaza Mekuria, PhD, is founder and principal of ADEC (www.axumcorp.com), where he has been doing consulting and research work in engineering since 1998. He is also an adjunct faculty at Evergreen Valley College in San José, California. He has over 25 years' experience in both public and private sectors. He has a BSCE from Anna University, Chennai, India, and an MSc and PhD from Northeastern University, Boston.

Peter Furth, PhD, is a professor of civil and environmental engineering at Northeastern University, Boston. He is a three-time graduate (BS, MS, and PhD) of the Massachusetts Institute of Technology. For the last 30 years, he has taught, conducted research, and consulted in transportation planning, transit operations and management, traffic engineering, and bikeway planning.

Hilary Nixon, PhD, is an associate professor of urban and regional planning at San José State University. Her research and teaching interests in environmental planning and policy focus on the relationship between environmental attitudes and behavior, particularly with respect to waste management and linkages between transportation and the environment. She has a BA from the University of Rochester in environmental management and a PhD in planning, policy, and design from the University of California, Irvine.

ABOUT THE MINETA TRANSPORTATION INSTITUTE

The [Mineta Transportation Institute](http://www.minetainstitute.org) (MTI) conducts research, education, and information and technology transfer, focusing on multimodal surface transportation policy and management issues, especially as they relate to transit. MTI was established by Congress in 1991 as part of the Intermodal Surface Transportation Efficiency Act (ISTEA) and was reauthorized under TEA-21 and again under SAFETEA-LU. The Institute has been funded by Congress through the US Department of Transportation's (DOT) Research and Innovative Technology Administration, by the California Legislature through the Department of Transportation (Caltrans), and by other public and private grants and donations, including grants from the US Department of Homeland Security. DOT selected MTI as a National Center of Excellence following competitions in 2002 and 2006. The internationally respected members of the MTI Board of Trustees represent all major surface transportation modes. MTI's focus on policy and management resulted from the Board's assessment of the transportation industry's unmet needs. That led directly to choosing the San José State University College of Business as the Institute's home. Visit transweb.sjsu.edu or Twitter [@minetatrans](https://twitter.com/minetatrans)

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