

HealthScape Transportation Programming Tool (TPT)

Briefing Paper Prepared by LFC, Inc.

November 22, 2006

EXECUTIVE SUMMARY and KEY DISCUSSION POINTS

Purpose & Objectives:

The purpose of the TPT is to prioritize potential non-motorized transportation improvements based on air quality, health, and transportation outcomes. The TPT should meet the following objectives:

- Evidence-based
- Simple to use
- Transferable
- Consistent and Fair
- Aligned with existing processes and priorities

Potential Criteria:

- Transportation benefits
- Safety benefits
- Environmental benefits
- Economic benefits
- Equity benefits
- Health benefits

Potential Measures:

- Connectivity/Route directness
- Connections to Transit
- Reduced Conflicts with vehicle modes
- Size and Characteristics of surrounding population

Key Questions to Consider:

Keep these questions in mind as we go through the workshop:

- How can the TPT influence, fit into, or otherwise relate to larger planning, funding and programming decisions, such as funding source requirements, ability to piggyback on planned construction, the opportunity to acquire right of way, etc.
- What can we do to make this tool helpful to you in your local bike/ped planning?
- How do the potential criteria types fit in with existing jurisdictional priorities?
- Although some pots of money compare only nonmotorized projects to one another, some compare nonmotorized projects with road or transit projects. How might we develop something that can inform multimodal prioritization processes as well?

Next Steps:

The County and the consultant team will review the results of the survey and the workshop, and begin developing a final list of criteria and a draft version of the TPT in spring 2007.

I. Introduction

The first phase of King County's LUTAQH project focused on the assessment of relationships between land use patterns, travel behavior, air quality and climate change, and obesity and physical activity (see <http://www.metrokc.gov/kcdot/tp/ORTP/LUTAQH>). The current phase, Phase II, applies results from this research to the development of tools to evaluate the impacts of transportation investments and land use actions on travel, environment, and health related outcomes. The Transportation Programming Tool (TPT) is the first of these tools.

Purpose

The purpose of the TPT is to prioritize potential non-motorized transportation improvements based on air quality, health, and transportation outcomes.

Objectives

The goal is to move towards an approach to non-motorized project evaluation that is:

- **Evidence-based** – based on documented research.
- **Simple to use** – users will likely be non-technical and evaluating many projects, therefore an approach that is straightforward and sensitive to time requirements.
- **Transferable** – can be used in local, countywide, or other prioritization processes.
- **Consistent and Fair** – leads to reasonable, impartial outcomes.
- **Aligned with existing processes** – can supplement or nest into existing programming processes without redundancy and builds on current best practices.

In 2006, the Transportation Research Board reviewed the most recent methods for modeling demand and assessing non-motorized project benefits. They list several elements of a successful bike/ped transportation programming effort:

- Measured on a municipal or regional scale
- Central to assisting decision-makers about transportation/urban planning
- Estimable via available existing data or other survey means
- Converted to measures comparable to one another
- Described for both users and non-users (i.e., the community at large).

Background and Context

The effort to evaluate and prioritize non-motorized transportation projects is not a new endeavor. During the 1990s a number of attempts were made to develop methods to define levels of service and needs within the non-motorized transportation arena. Once needs were defined, it was thought that a more objective approach to evaluating relative benefits of different investments could be made and provide a more equal standing relative to roadway and transit investment processes. Non-motorized planners adopted two key concepts used in the roadway transportation planning process:

- 1) Demand forecasting, which identifies how much 'latent demand' there is for a proposed facility, or shows where demand is greatest.
- 2) 'Level of Service' (LOS) designations, which set performance goals and pinpoint system deficiencies.

In the process of adapting these concepts, they were altered substantially from their origins in highway planning. Without the benefit of 50 years of vehicle counts and modeling, non-motorized demand evaluation is at a much earlier stage of development and must rely on other data sources, often surrounding population or 'travel sheds'. In addition, bicycle or pedestrian

Levels of Service standards typically encompass broader and more qualitative goals than roadway LOS goals, which are congestion-focused. Many factors that increase the attractiveness of walking or biking, such as the presence of other pedestrians, contradict traditional volume to capacity metrics.

While these more sophisticated practices have had some success in bringing pedestrian and bicycle investment practices up to par with vehicular planning, the methods are generally limited and their application is not widespread. This is primarily because most non-motorized project prioritization and programming processes focus on addressing unsafe conditions, and are limited in calculating the many other benefits that a non-motorized project can have. As Litman (2006) notes, understanding the potential benefits that stem from a particular transportation investment is critical to the process of assessing its priority. Planners are beginning to recognize the need to systematically and consistently evaluate non-motorized projects across a range of goal-based, outcome-driven criteria and to view them more holistically (Walkable Communities 2006).

There is considerable opportunity to enhance the methods used by King County and by other cities in the region. Non-motorized project evaluation can encompass a wider array of benefits to physical activity, air quality, safety and accessibility. To the extent possible, advancements are required that are grounded in objective research. LUTAQH research (Frank et al. 2006) on the links between land use, travel behavior, air quality and physical activity/BMI, provided a means by which we can better understand the relative benefits from non-motorized investments. In addition, other research also offers information to aid in understanding non-motorized travel patterns to specific destinations (Moudon and Lee, 2006) and overall benefits for public health (Frank et al., in press).

Finally, we understand that transportation investments are inevitably a political endeavor and council decisions over competing resources are often made for political reasons other than objective and technical evidence. Our position is that the stronger the evidence over the need and the benefits of a particular investment, and the more able planners are to conceive, articulate, and promote investments that address an array of established concerns, the greater the chance that funding will be awarded.

Types of Improvements

The programming tool will be used on non-motorized projects only. It will not address or be relevant to land use, road or transit investment decisions. The types of non-motorized improvements that the TPT could be used to evaluate could include:

- Existing sidewalk widening
- New sidewalk addition
- Road diets or redesigns
- Trails or pathways
- Stairs or ramps
- Elimination of barriers or hazards, such as highways or bridges
- Traffic calming devices, such as traffic circles or speed humps
- Creation of pedestrian walkways through superblocks, cul de sacs, etc.
- Intersection improvements or reconfigurations
- Curb Cuts
- Signalization changes or additions
- Pedestrian-activated signals
- Streetscape Improvements - street furniture, lighting, street trees
- Bicycle lane improvements or additions

II. Developing Criteria Through Current Evidence

Although the research-based criteria take up the bulk of discussion in this section, a number of other considerations are typically used to rank projects. These benefits are not research-based, but based in “on the ground” realities that are no less important, and in most cases, are the core of the process. While the TPT is tasked to examine projects based on research outcomes, it is important to consider how the larger programming processes look at the following:

A) Opportunity

- a. Builds upon already programmed road or transit projects
- b. Available Right-Of-Way

B) Location

- a. Located in one of the “Regional Pedestrian Improvement Zones”
- b. Located in an Urban Center

C) Time to implement

D) Time to achieve results

E) Community support (compatibility with neighborhood, political standing, etc.)

F) Estimated costs or cost-benefit ratio

G) Multimodal Programming Processes

Although some pots of money compare only nonmotorized projects to one another, some compare nonmotorized projects with road or transit projects.

In addition to these criteria, when prioritizing proposed improvements, projects can be compared based on how well they reduce risk and increase benefits. These are the *criteria* by which projects are compared. There are several categories of direct and indirect benefits to any nonmotorized transportation project, some of which are listed below. These lists of benefits are all documented quantitatively in the research.

The mechanisms by which these benefits may be achieved are then enumerated after the benefits are discussed. The mechanisms are the specific characteristics of nonmotorized projects and the surrounding environment that the tool could measure, which would then translate into benefits.

1. Direct Benefits

Nonmotorized improvements create other indirect benefits because they can potentially offset vehicular travel demand and increase safety, or the perception thereof.

A) Transportation. Non-motorized projects have the potential to increase transit and non-motorized mode share and decrease vehicle mode share; and decrease per capita rates of vehicle use (hours/miles/trips/mode share), and increase per capita rates of walking, bicycling, and transit (hours/miles/trips/mode share) (Ewing & Cervero, 2001).

Background: Many studies have shown how aspects of the built environment, individually and in combination, affect travel behavior and associated outcomes (Cervero & Kockelman, 1997; Ewing & Cervero, 2001; Frank et al. 2000; Handy, 1996; Holtzclaw et al., 2002). Others have shown how complex the interrelated factors are (Boarnet & Crane, 2001; Hess et al. 1999; Saelens et al., 2003). The variables developed through

Central Puget Sound research over the past decade, including the LUTAQH phase I research, have proven to be robust as indicators of travel and quality of life outcomes.

B) Safety. Non-motorized projects can slow vehicle traffic (traffic calming), provide vehicle-free pathways, reduce vehicle conflicts with pedestrians (intersection redesign) and increase the number of users, all of which have been shown to reduce risk and/or the perception thereof.

Background: Safety is a more developed area of nonmotorized project evaluation than connectivity. Various measurable elements of infrastructure and traffic patterns have been associated with safety risk, including vehicle speeds and traffic volumes (Stevenson et al. 1995; Daisa & Peers, 1992), number of lanes and separation from traffic (Landis, 2000), and crossing distance. For example, Washington State Department of Transportation provides criteria to local agencies to help guide safety project priorities (see box at right).

2. Indirect Benefits

A number of indirect benefits stem from the direct benefits to travel demand and safety. Each of the benefits listed below has been documented in research as associated with changes in travel behavior and safety.

A). Environmental Benefits

Non-motorized projects shift travel from polluting modes (vehicular) to those that have less or no health-damaging air pollutant emissions (NO_x, CO₂, VOCs, and hydrocarbons) and dramatically lower carbon dioxide and greenhouse gas releases. Moreover, the vehicle trips replaced are largely short trips, which are more frequently higher-polluting 'cold starts' (WSDOT, 2005 and LUTAQH, 2005).

B) Economic Benefits

Our economy benefits from more efficient, productive use of energy. Non-motorized travel is highly energy efficient, and increases as walkability increases (Frank et al. 2006). The increased physical activity is efficiently accomplished as part of daily routine trips to both work and non-work destinations. Moreover, the reduction in health care costs, as a result of facility improvements inducing physical activity, can be quantified (TRB, 2006).

C) Equity Benefits

Depending on where a project is located (close to a school, for example) it can improve access for sensitive populations or those who are less reliant on vehicle travel (for example, low income, youth and elderly).

WSDOT safety criteria:

- Pedestrian exposure to vehicles
- Current ADT
- Posted Travel Speed
- Prior vehicle-pedestrian crashes at location within past three years
- Width of Roadway
- Horizontal and/or Vertical Stopping Sight Distance

D) Health Benefits

As noted above, non-motorized transportation projects generate more walking and bicycling travel. Such physical activity, whether for the purpose recreation or transportation, is associated with higher rates of physical activity, and lower rates of obesity and other chronic diseases (LUTAQH, 2005; McGinnis, 2002).

3. Mechanisms

Nonmotorized projects create benefits because of changes to the following aspects of the urban environment. These are the mechanisms, or the measures that could be used to define the relative benefits (criteria).

A) Increased Route Directness (Connectivity).

Nonmotorized projects can create more direct routes between destinations for cyclists and pedestrians.

Background: Dill (2005) provides a summary of all the measures used for connectivity measurement in bicycle and pedestrian planning, finding among these that some are quite commonly used:

- block size,
- intersection density, and
- link-to-node ratio.

Ultimately connectivity measures the degree of route directness between destinations. Geographic Information Systems in place at most local governments in King County have the capacity to evaluate the relative route directness that results from different types of transportation investments. Directly measuring the change in route directness between two destinations that results from a given investment (e.g. the ratio between proposed distances between two destinations) offers a more robust indication of the effects of connectivity on travel. Route directness is a simple concept and can be measured on the network by travel mode for origin-destination pairs (the basis for trip generation modeling). This kind of measurement involves more intensive data collection and processing than grid based analyses of connectivity (e.g. intersection density). However, a specific project will not likely impact intersection density very much in an overall area but will have a significant impact in terms of its ability to connect specific destinations. Measurement of the effective travel distance between two destinations may be a more powerful outcome than minor changes to the overall network unless major sets of improvements are proposed for a given area.

Identification of best measures of connectivity for non-motorized transportation is ongoing. Bruce Landis, a well noted non-motorized transportation planner, notes that connectivity is a less-reliable measure if it is simply used to identify where an improvement adds to an existing facility.¹ Therefore, improvements to connectivity are most effective where a case can be made that there is significant latent demand for movement on foot or bike between two locations. This requires combining land use/urban form data (e.g. concentrations of people, jobs, services across space) with

¹ Sprinkle Consulting. LUTAQH communication.

relative distances between complementary uses resulting from distinct investments. Improvements that provide only non-motorized access between currently disconnected destinations (e.g. a cul-de-sac and a nearby commercial node) offer considerable potential to increase the relative utility or benefit of walking or biking compared to driving. Simply put, driving around the block and parking may take up to 15 minutes while walking may only take 10 minutes where direct connections are provided.

LUTAQH found that changes in degree of walkability (measured through an index of land use and connectivity measures) are associated with lower vehicles miles of travel (VMT) and higher levels of active transportation (walking and bicycling). LUTAQH used intersection density to measure connectivity and found that a quartile increase in number of intersections per acre corresponded to a 14% increase in likelihood of walking.

Increased connectivity may also be measured by a decrease in the travel time it takes to access a destination by foot or bicycle. In the case of street crossing improvements or changes in signalization, although distance may not change, the time it takes to make a trip may decrease substantially. Decreases in travel time have been shown to be one of the most highly associated variables with mode choice, and can induce shifts from driving to walking, bicycling, and transit (WSDOT 2005).

B) Connections to Transit

Although it is related to connectivity, access to transit is important to measure outside of the other connectivity measures. Transportation benefits are not exclusive to bicycling and walking - transit ridership is dependent on good access by nonmotorized modes. In the LUTAQH study, a measure of transit inaccessibility (distance from home to nearest bus stop) was found to be positively related to VMT, and each ¼ mile increase in distance to transit reduced the odds of someone reporting a transit trip to work by 16%. Another Puget Sound region study for WSDOT (2005) found each mile to a bus stop was associated with a 5% increase in VMT, and just over 4% increase in VHT.

C) Reduced Conflicts With Vehicular Modes

The various non-motorized level of service tools use measures like vehicle speeds, traffic volumes, number of lanes or roadway width, and separation from traffic, and crossing distance to score the safety/comfort conditions, many of which are statistically associated either with lower rates of collision or perception of reduced risk.

D) Size and Characteristics of Impacted Population

The size of the surrounding population – the ‘travelshed’ of the improvement - acts as a multiplier to the other benefits. Certain locations, such as those that have a high density or many destinations, may be more ‘ripe’ for nonmotorized transportation improvements. This is, essentially, the concept of latent demand for nonmotorized improvements. Demographics of the impacted population may also change the equity benefits.

IV. Conclusion

There are several key points that emerge from LUTAQH's research to date for the development of the Transportation Programming Tool:

- *Achievement of the region's land use and transportation vision can be helped by objectively measuring goal-based criteria transportation programming at the local level.*
- *Non-motorized transportation programming needs to consider a broader set of benefits than safety and local environment improvements. Neighborhood characteristics are significant to the likelihood of walking.*
- *The criteria for measuring multiple benefits that are suggested by the literature and best practices appear to align well with the national funding objectives, desired regional and local outcomes, and current practices. The groundwork is in place for an enhanced method of prioritization.*
- *There are opportunities emerging in King County, as local governments revise and update their bicycle and pedestrian plans, conduct inventories of bike/ped facilities, and seek new ways of creating enhanced active transportation.*

Tool Development - Next Steps

The development of a non-motorized transportation programming tool that is at once responsive to local needs and the opportunities to benefit the health and quality of life for King County residents and to the regional transportation planning process is an iterative one. We are eager to gather the best knowledge from local practitioners, other experts, and models from other regions. Please join this effort and assist us in creating the optimal tool for use by King County's communities. Among the remaining questions we would like you to consider and respond to are:

- Can we achieve the objectives for this tool (i.e. do you think the tool would be helpful to you in your local bike/ped planning)?
- Which of the research-based criteria will you be able to make use of in your local planning process?

LUTAQH will gather more information on how to fit the research-based prioritization criteria to the process for planning non-motorized projects in the region, through surveying local practitioners and hosting a workshop, Dec. 5, 2006. Tool development will proceed through the following stages:

- 1. Survey:** The nonmotorized programming survey will help to define how the TPT interacts with existing tools, processes and criteria (in process).
- 2. Workshop:** The workshop will provide further input on what the criteria priorities should be, the intersection between the TPT criteria and those existing processes.
- 3. Criteria Development:** Research from the first phase of LUTAQH and other sources will form the basis of much of the criteria (final list of criteria in early 2007).
- 4. Tool Development:** Based on the first three steps, the consultant team will develop a preliminary version of the TPT (spring 2007).
- 5. Testing:** The preliminary version of the TPT will be subjected to testing and refinement based on feedback from a small, expert "focus group" (spring 2007).
- 6. Project List Development:** An actual list of proposed nonmotorized projects will be scored and ranked using the TPT (summer and fall 2007).
- 7. Training:** Training in use of the TPT will be held for King County staff and staff from other interested local jurisdictions (early 2008).

