Englewood Walk & Wheel Master Plan

September 2, 2015
# Table of Contents

Table of Contents ................................................................. i

A. **Introduction** ................................................................. A-1

B. **State of Walking and Wheeling** ....................................... B-1
   Plan and Study Review ..................................................... B-1
   Existing Infrastructure ..................................................... B-4
   Bicycle Demand Analysis (BDA) ....................................... B-8
   Level of Traffic Stress Analysis ....................................... B-15

C. **Community and Stakeholder Engagement** .......................... C-1
   Englewood Forward Branding and Communications .................. C-1
   Public Meetings .............................................................. C-2
   Focused Outreach ............................................................ C-5
   Walk and Wheel Festival .................................................. C-5

D. **Plan Recommendations** ................................................... D-1
   Areas of Emphasis ............................................................. D-1
   Infrastructure Recommendations ...................................... D-5
   Transformative Projects ................................................... D-7
   Other Key Recommendations ........................................... D-7
   Programmatic Recommendations ...................................... D-13

E. **Implementation** ............................................................... E-1
   Quick Wins ........................................................................ E-1
   Next Steps ......................................................................... E-5

F. **Maintenance Considerations** ............................................. F-1
   Importance of Proper Maintenance ..................................... F-1
   Primary Maintenance Functions ....................................... F-1
   Research Methodology ...................................................... F-2
   Research Findings ............................................................ F-2
   Case Studies – Why Other Communities are Successful .......... F-4

G. **Potential Economic Benefits** .............................................. G-1
   Quantified Benefit Calculation ........................................ G-2
   Health Benefits .................................................................. G-5
   Environmental Benefits .................................................... G-6
   Transportation Benefits ................................................... G-7
   Total Benefits .................................................................... G-8
List of Tables

Table B-1: Data Inputs Information ........................................ B-8
Table B-2: Methods for the Level of Traffic Stress Analysis ...... B-15
Table E-1: Programmatic Recommendations ......................... D-14
Table F-1: Agency Staff Contacted Regarding Bicycle and Pedestrian Facility Maintenance ........................................... F-2
Table F-2: Maintenance Policy and Funding Summary by Agency Interviewed ............................................................... F-3
Table G-1: General Characteristics Comparison of Selected Peer Cities ................................................................. G-3
Table G-2: Estimated Future Walk and bike Mode Split ............ G-4
Table G-3: Annual Health Benefits ........................................ G-6
Table G-4: Annual Environmental Benefits ............................... G-7
Table G-5: Annual Transportation Benefits .............................. G-8
Table G-6: Total Annual Benefits ........................................... G-8

List of Figures

Figure A-1: Planning Process .................................................. A-1
Figure B-1: Map of Current Bicycle Paths/Trails and On-Street Routes ................................................................. B-4
Figure B-2: Bicycle Parking Locations in the City Center, Broadway Corridor, and the Hospital District ......................... B-5
Figure B-3: Bicycle Parking Locations Near the Oxford LRT Station and the Recreation Center ..................................... B-5
Figure B-4: Pedestrian and Bicycle Counts Total ....................... B-6
Figure B-5: Average Number of Bicycle and Pedestrian Counts Per Hour Over All Count Locations ............................... B-8
Figure B-6: Total Bicycle and Pedestrian Volumes at Each Count Location .......................................................... B-6
Figure B-7: Pedestrian and Bicycle Split .................................. B-7
Figure B-8: Bicycle Intersection Preferences ............................. B-7
Figure B-9: Where People Live Census 2010 Block Level Population Density .......................................................... B-9
Figure B-10: Where People Work - Trip Ends for People of Englewood Regardless of Residency ................................. B-10
Figure B-11: Where People Learn - K-12, Community College and University Enrollment .......................................... B-11
Figure B-12: Where People Shop and Play ................................. B-12
Figure B-13: Where People Access Transit ................................. B-13
Figure B-14: Composite Demand ............................................ B-14
Figure B-15: Level of Traffic Stress ........................................... B-16
Figure B-16: Level of Traffic Stress - Connectivity Analysis ......... B-17
Figure D-1: Infrastructure Recommendations for Pedestrians and Bicycles for Englewood ............................................. D-6
Figure E-1: Quick Wins .......................................................... E-2
Figure G-1: Economic Benefits of Bikeways ............................. G-1
Figure G-2: Health and Safety Benefits of Bikeways ................. G-2
A. Introduction

The City of Englewood embarked on three simultaneous studies in 2014-2015 that directly address the City’s transportation network, options for improved multi-modal connectivity and increasing community awareness of biking and walking as a transportation alternative:

- Englewood Comprehensive Plan Update
- Englewood Light Rail Corridor Next Steps Study
- Englewood Walk and Wheel Master Plan and Program

These studies were collaborative in nature and were collectively termed Englewood Forward. Stakeholder and public input was essential to understanding Englewood today, developing a vision of Englewood tomorrow and identifying the recommendations to move Englewood toward that vision.

The Walk and Wheel Master Plan was funded by a grant from Kaiser Permanente and kicked off in September 2014. The plan’s purpose was to evaluate the City’s current walking and bicycling conditions and activity, as well as to develop recommendations for bicycle and pedestrian infrastructure and programs that improve safety, increase connectivity and transportation options, and encourage greater walking and biking among Englewood residents.

The Walk and Wheel Master Plan builds on the previous Bicycle Master Plan completed in 2004 and the Community-Wide Bicycle Route Signage Program implemented in 2012. The planning process, illustrated in Figure A-1, included extensive stakeholder and community engagement throughout the project. Recommendations for the plan were developed through the evaluation of existing conditions data and field assessment, bicycling and walking demand analysis, public input and network connectivity evaluation. The Plan identifies Englewood’s top priority “transformative” projects to the bicycle and pedestrian network, highlights “quick wins” for implementation to begin to enable broader biking and walking and proposes ideas for encouragement and education programming that increase visibility and awareness of these active transportation options.

Figure A-1: Planning Process
Today Englewood has great high capacity transit access with corridor bus service north-south along Broadway and two light rail stations (Oxford Station and Englewood Station at CityCenter Englewood). The City’s street grid creates a strong base for local connectivity and connects employment, shopping, and higher density residential uses that lie within the city core. Trail connections within the City link residents with recreational opportunities. Englewood offers a range of housing options with a strong base of traditional single-family neighborhoods, supported by an improving school system both in terms of programming and facilities. However, Englewood is missing a comprehensive strategy to enable pedestrian and bicycle mobility as an alternative to automobile travel throughout the community. The city lacks dedicated on-street facilities for bicycling and defined pedestrian corridors with enhanced pedestrian facilities and crossings that make walking and biking comfortable, viable options for the majority of residents and visitors. Also of interest is the current and future makeup of Englewood in terms of population and demographic trends. The City has a large population of seniors and is becoming increasingly attractive to the Millennial age group due to its proximity to Denver and lower relative housing costs. Several factors around these demographic groups strongly support the growth of a bike and pedestrian environment in Englewood:

- There has been a significant increase in bicycle use among seniors age 65 plus since 1995
- Baby boomers are looking for alternatives to the car and seeking options to “age in place”
- Millennials exhibit a preference for urban environments that have walkable places, and they are willing to pay a premium and reduce living space to be able to walk to shops and amenities
- 26% of Millennials do not have a driver’s license
- 45% of Millennials report making a conscious effort to replace driving with alternative forms of transportation

Through this study, the City of Englewood is looking to improve community awareness and increase the visibility of bicycle and pedestrian transportation options through the identification and implementation of enhanced bike and pedestrian facilities. The city also hopes to create a community environment that embraces active transportation, attracts new residents and creates a strong vibrant economic base for the City.
B. State of Walking and Wheeling

The state of Walking and Wheeling in Englewood today was assessed through the review of previous planning documentation, an inventory of bike and pedestrian infrastructure, targeted counts of walking and biking activity and an assessment of demand. Today’s conditions present many challenges to bike and pedestrian mobility and identify potential opportunities for improved connections and facilities.

Plan and Study Review

The following City of Englewood Plans and Studies were reviewed for bicycle and pedestrian goals and recommendations.

- Roadmap Englewood: The 2003 Englewood Comprehensive Plan
- Englewood South Broadway Plan
- Englewood Complete Streets Toolbox (2011)
- Englewood Master Bicycle Plan Route Development Study and Implementation Program
- Englewood Downtown and Medical District Small Area Plan
- Englewood Light Rail Corridor Plan
- Englewood Parks and Recreation Master Plan

These documents identify goals and related actions that informed the Plan process and served as a base for overall direction of the Plan. Relevant goals are listed.

ROADMAP ENGLEWOOD: THE 2003 ENGLEWOOD COMPREHENSIVE PLAN

Goal 1: Enhance both the mobility and the accessibility of the transportation system.
Obj. 1-7: Improve directional signage for automobile traffic, pedestrians, and bicyclists.

Goal 2: Improve environmental qualities adversely impacted by automobiles for both local residents and visitors to the community, while also accommodating commuters.
Obj. 2-4: Support educational efforts to increase awareness of automobile traffic, pedestrian, and bicyclist safety issues.

Goal 3: Recognize and enhance the relationships between land use and the transportation system.
Obj. 3-2: Encourage higher-density, pedestrian-oriented, mixed-use development along primary mass transit routes.

Goal 4: Promote a quality of life transportation philosophy that seeks to create an environmentally attractive, pedestrian-friendly community.
Obj. 4-1: Create continuous transit and non-motorized connections between CityCenter and downtown Englewood, as well as the surrounding residential and business community.
Obj. 4-2: Improve bicycle facilities and infrastructure in strategic locations throughout the city.
Obj. 4-3: Design safe, attractive, high-volume pedestrian routes connecting public places that encourage the attention and presence of people at all hours of the day and night.
Urban Design and Amenities Goals

Goal 1: Enhance the Downtown and Medical Center urban streetscape.
Obj. 1-1: Develop wider, safer, handicapped-accessible sidewalks, pedestrian paths, and pedestrian crossings throughout the area, and especially near hospitals and senior facilities.
Obj. 1-5: Enhance streetscapes with urban design features including benches, lighting, planters, banners, street furniture, and bicycle racks.

Goal 2: Increase park, open space, and trail capacities and service levels, both within Downtown and the Medical Center and beyond.
Obj. 2-1: Create pedestrian-friendly, tree-lined streets and pedestrian paths.
Obj. 2-4: Develop and enhanced pedestrian-bicycle route and trail system connecting neighborhood parks, residential neighborhoods, and commercial areas.

Downtown Sub Area Goals

Downtown Sub Area 2 Goal: Extend the historical Broadway main street character into Sub-area 2.
Obj. 2-2: Enhance area with streetscape improvements and attractive store fronts in order to restore a pedestrian-oriented, main street character.

Downtown Sub Area 3 Goal: Transform the suburban, auto-oriented character of sub-area 3 to a more pedestrian-oriented character, with a stronger business mix.
Obj. 3-4: Explore new street configurations that create a safer and more pleasant pedestrian experience.

ENGLEWOOD SOUTH BROADWAY

Strategies supporting multiple modes of transportation:

1. Support pedestrian-friendly developments with mixed land use of sufficient scale to support neighborhoods and businesses. Reduce vehicle miles traveled (VMT) thus reducing congestion, and indirectly improving air and water quality. Create area on Broadway where people could choose to live without owning a personal vehicle based on excellent access to public transit employment, shopping and recreation. Recognize and enhance the relationships between land use and the transportation system.

1.1 Encourage and support mixed use projects with residential, office and retailing components.
1.2 Enhance pedestrian and bicycle amenities and links to light rail stations, bus stops, shopping and employment centers.
1.3 Enhance the accessibility of the transportation system.
1.4 Support and develop a balanced, multi-modal transportation system that includes rapid transit, regional bus service, bike and pedestrian facilities, and improvements to the existing roadway systems.
1.5 Provide safe and direct crosswalk movements along Broadway.
Additional plans served as a base for evaluating the bike and pedestrian network, and identifying future on and off-street bike facilities by location and type. The City’s Parks and Recreation Master Plan identifies primary connections and an expansive off-street trail network that fundamentally supports future on-street bike and pedestrian improvements. The Bicycle Plan Route Development Study and Implementation Program resulted in a signed network of bike routes that are the base network in the City today. The Light Rail Corridor Plan identified key projects for enhanced bike facilities and connections that were further studied in the Next Steps Study. The City’s Complete Street Toolbox also informs facility types and pedestrian facility recommendations within the city.
Existing Infrastructure

The City of Englewood’s bicycle transportation network today is made up of locally signed bicycle routes and regionally signed bicycle routes connecting Englewood to Denver, Littleton, Cherry Hills and Sheridan. The off-street facilities consist primarily of bike and pedestrian paths through city parks and Mary Carter Greenway, and link Englewood to the broader trail network in Denver and Littleton. There are currently 91 miles of bicycle paths/trails and 42.6 miles of on-street bicycle routes as shown Figure B-1.

Englewood’s street grid is uniform throughout the core of the city with some variances in street pattern to the west and south, at the edges with Littleton. This street configuration is the base of a uniform pedestrian network with the majority of local or neighborhood streets containing 3’ sidewalks along both sides of the street. The city is bisected by Broadway north-south and Hampden Ave. east-west. These busy arterials are barriers to easy bike and pedestrian movement between sections of the city and between residential uses and retail/commercial development. Traffic signals along Broadway and Hampden provide crossings but high traffic volumes, driveway access and turning movements along the length of these arterials make for an uncomfortable walking and biking environment through the core of the city, and inhibit connectivity between destinations.
Bicycle Parking

Today, the City of Englewood has over 45 bicycle parking racks in place within the community. The majority of these facilities are located in high activity, high volume areas and include the Broadway corridor from Yale Avenue south to Hamden Blvd., the Hospital District and the Oxford and Civic Center LRT stations. The innovatory of bicycle parking performed as part of the Walk and Wheel Study identified current locations as illustrated in Figures B-2 and B-3. Additionally, several bikes were observed in the northwest area of the Hospital District locked to signposts or trees, and are indicated on the maps in black. RTD bike lockers are available at the Civic Center station for rental through RTD, but community concerns over capacity of these lockers and availability indicate a need for a different bike parking solution at this station.

Figure B-2: Bicycle Parking Locations in the City Center, Broadway Corridor, and the Hospital District

Figure B-3: Bicycle Parking Locations Near the Oxford LRT Station and the Recreation Center
Pedestrian and Bicycle Counts

Counts of pedestrian and bicycle activity were performed at eleven locations around the City from 7-10 am, 11am-1pm, and 4-6pm to determine the current level of pedestrian and bicycle activity. The counts were performed in late October and early November 2014 during periods of nice weather. The locations were:

- Dartmouth at Broadway
- Floyd at Broadway
- Oxford at Broadway
- Oxford at Navajo
- Clarkson at Old Hampden
- Inca at US 285
- Inca at Englewood Parkway
- Elati at US 285
- Sherman/Little Dry Creek Trail/
- Sherman at US 285
- Belleview at Delaware
Bicycle Travel Demand and Level of Traffic Stress

The Bicycle Suitability Index (BSI) model utilizes existing infrastructure (in a Geographic Information System (GIS) form) to develop composite demand-side (where resident trips would typically originate from and travel to) and supply-side (what physical infrastructure exists) models of Englewood. Objective tools such as this are utilized during the planning process to complement the more subjective input received during public input sessions and project team network evaluation exercises, as both are critical components to developing a well-rounded data and input-driven plan.

Following is a description of the methods and results of Bicycle Demand Analysis (demand side) and the Bicycle Level of Traffic Stress Analysis (supply side). The analytical methods within provide an objective, data-driven process of identifying network gaps as potential projects and identifying areas of high existing or potential bicycle and pedestrian activity. The resulting Supply and Demand Typologies Model presents an array of potential bicycle and improvement opportunities for Englewood.

Data Sources

The following data inputs were incorporated into the analysis. The table below displays variables, its sources, and notes on limitations of available data and assumptions made.

<table>
<thead>
<tr>
<th>Model Input</th>
<th>Source</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Enrollment</td>
<td>Englewood School District</td>
<td>Various school web pages and discussions with school personnel.</td>
</tr>
<tr>
<td>Transit Service</td>
<td>RTD Boarding and Alighting Data</td>
<td>LRT rail activity was estimated</td>
</tr>
<tr>
<td>Traffic Signal/Control</td>
<td>Englewood</td>
<td>GIS data</td>
</tr>
</tbody>
</table>

Bicycle Demand Analysis (BDA)

Models serve as an effective means to understand how factors in a complex system interact by providing a simplified version of the system for study. However, by definition, models are representations of reality and are constrained by the quality of available data and the complexity of the system under consideration. Throughout the modeling process, significant effort was made to collect the best data possible for input to the model and field verify data as necessary and possible.

BSI provides a general understanding of expected activity in the pedestrian environment by combining categories representative of where people live, work, play, access public transit and go to school into a composite sketch of demand.

Generally speaking, the scoring method is a function of density and proximity. Scores reflect relative impact on walking or bicycling to and from census block corners that are located adjacent to the features used in the analysis. As such, scores are represented as density patterns of points within a ¼ mile of each other. Subsequently, the scores are effectively a result of two complementing forces: distance decay – the effect of distance on spatial interactions yields lower scores for features over ¼ mile away from other features; and spatial density – the effect of closely...
Clustered features yields higher scores. Scores will increase in high feature density areas and if those features are close together. Scores will decrease in low feature density areas and if features are further apart. In essence, the score is the intersection of distance and density. Thus, on the maps shown below, the highest density/usage/activity locations (shown in red) do not represent specific physical facilities, but rather represent relative higher use zones as calculated above.

Categories are scored on a scale of 1 - 5 based on density and proximity and then assigned weighted multipliers to reflect the relative influence categories have on pedestrian and bicycle activity. The feature weighting method is discussed in the following section.

**Where people live** includes 2010 census block level population density information. These locations represent potential trip origin locations. More trips can be made in areas with higher population density if conditions are right. “Live” trip hot spots include areas in the residential western-most arm of town, the northern end of town along Floyd Street, and the larger areas east and west of Broadway south of Hampden.
Where people work mainly represents trip ends, for people working in Englewood regardless of residency. Its basis is 2010 total employment by census block. Depending on the type of job, this category can represent both trip attractors (i.e., retail stores or cafes) and trip generators (i.e., office parks and office buildings) in terms of base employment population. It is therefore also used in the “where people play” category by overlaying with specific job types, such as retail. Hot spots for the “work” analysis include the area’s shopping centers along Englewood Parkway/Girard Avenue and south across Hampden, the Swedish Medical Center hospital, and the newly redeveloped shopping center just east of University Boulevard. The Broadway corridor is represented by moderate employee density because employment is spread out along the corridor, rather than clustered in a commercial shopping center.
Where people learn represents where students K-12, at community college, or at university go to school. Its basis is enrollment data from the Englewood Public School District individual school websites and information provided by district staff. As shown on Figure B-11, Englewood Middle and High School Campus has the greatest concentration of students and associated activity. In the southern portion of town the proximity of four schools increases the relative intensity of activity. Higher order streets, like Broadway are likely to act as barriers and reduce actual observed activity.
Where people shop and play is a combination of varied land use types and destinations. Overlays such as retail destinations, regional trails and parks contribute to this category. Regional trails travelling through Englewood were considered as parks in this analysis due to their recreational draw. Specific trailhead connections and locations will be strongly considered in the network recommendations due to public emphasis on trail connection desirability. These destinations are important and have higher activity due to the shorter term nature of these visits (typical duration of these visits is less than one half a day) and because they are likely to attract a wide variety of people who are likely to visit multiple destinations in close proximity. “Play and shop” hotspots identified in this analysis include retail in the Englewood Plaza/Englewood Marketplace area, retail and entertainment along Broadway and shopping centers along Hampden Avenue, as well as parks like Bellevue Park and trails along the South Platte River.
Where people access transit is assessed by location of bus stops and light rail stops. Stops with greater observed activity were weighted more heavily utilizing boarding data from the Regional Transit District (RTD). Use data was not available for the light rail stations and so an activity estimate was made based on a portion of adjacent bus boarding volumes. It is important to understand that, because potential bicycle and pedestrian destinations consider adjacencies and density of destinations (in this case, locations such as bus stops), this analysis considers not only the relative use (boarding data) for each stop, but analyzes each stop’s proximity to other stops and other lines, creating hot spots based on both proximity and use. In this case, the Broadway/Civic Center core, light rail stations, and Hampden Avenue are identified as “hot spots.”
Composite Demand. Figure B-14 shows the potential composite demand analysis for Englewood, which was developed by overlaying the factor maps and applying standard weights to each factor. This analysis shows that the highest potential for bicycle travel demand is along the Broadway Corridor, Hampden Avenue/Englewood Parkway/Girard Avenue corridor, areas near the light rail stations and the cluster of schools in southeast Englewood. It is also important that future bicycle and pedestrian improvements consider connectivity between the hot spots shown on this composite map.
Level of Traffic Stress Analysis

The methods used for the Level of Traffic Stress Analysis were adapted from the 2012 Mineta Transportation Institute (MTI) Report 11-19: Low-Stress Bicycling and Network Connectivity. The approach outlined in the MTI report uses roadway network data, including posted speed limit, the number of travel lanes, and the presence and character of bicycle lanes, as a proxy for bicyclist comfort level. Road segments are classified into one of four levels of traffic stress (LTS) based on these factors. The lowest level of traffic stress, LTS 1, is assigned to roads that would be tolerable for most children to ride, and could also be applied to multi-use paths that are separated from motorized traffic (not shown in this analysis); LTS 2 roads are those that could be comfortably ridden by the mainstream adult population; LTS 3 is the level assigned to roads that would be acceptable to current “enthusied and confident" bicyclists; and LTS 4 is assigned to segments that are only acceptable to “strong and fearless” bicyclists, who will tolerate riding on roadways with higher motorized traffic volumes and speeds.

A bicycle network is likely to attract a large portion of the population if its fundamental attribute is low stress connectivity. In other words, a network should provide direct routes between origins and destinations that do not include links that exceed one’s tolerance for traffic stress. The ESI is an objective, data-driven evaluation model which identifies high traffic stress links, bicycle network gaps and gaps between “low stress” links, and a score assessing the relative user comfort or level of stress a user may experience on each link is mapped. Each user is different and will tolerate different levels of stress in their journey so these maps should be used as a general guide rather than an absolute truth.

Table B-2: Methods for the Level of Traffic Stress Analysis

<table>
<thead>
<tr>
<th>Levels</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTS 1</td>
<td>Presenting little traffic stress and demanding little attention from cyclists, and attractive enough for a relaxing bike ride. Suitable for almost all cyclists, including children trained to safely cross intersections. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a slow traffic stream with no more than one lane per direction, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where cyclists ride alongside a parking lane, they have ample operating space outside the zone into which car doors are opened. Intersections are easy to approach and cross.</td>
</tr>
<tr>
<td>LTS 2</td>
<td>Presenting little traffic stress and therefore suitable to most adult cyclists but demanding more attention than might be expected from children. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a well-confined traffic stream with adequate clearance from a parking lane, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where a bike lane lies between a through lane and a right-turn lane, it is configured to give cyclists unambiguous priority where cars cross the bike lane and to keep car speed in the right-turn lane comparable to bicycling speeds. Crossings are not difficult for most adults.</td>
</tr>
<tr>
<td>LTS 3</td>
<td>More traffic stress than LTS 2, yet markedly less than the stress of integrating with multilane traffic, and therefore welcome to many people currently riding bikes in American cities. Offering cyclists either an exclusive riding zone (lane) next to moderate-speed traffic or shared lanes on streets that are not multilane and have moderately low speed. Crossings may be longer or across higher-speed roads than allowed by LTS 2, but are still considered acceptably safe to most adult pedestrians.</td>
</tr>
<tr>
<td>LTS 4</td>
<td>A level of stress beyond LTS 3.</td>
</tr>
</tbody>
</table>

Source: Mineta Transportation Institute Report 11-19
Bicycle Level of Traffic Stress (LTS) Analysis Results

Segment Analysis

The results of the segment-based LTS are shown below. Much of the network consists of disconnected clusters of low-stress (LTS 1 to 2) streets, shown in green and yellow. Individually, these islands of low-stress streets are comfortable to ride for most adults, but they are isolated from one another by larger roads with higher traffic speeds that disrupt bicycle mobility. Higher order roadways like Hampden Avenue, Broadway, and Santa Fe act as barriers to bicyclists.

Figure B-15: Level of Traffic Stress
While major roadways act as barriers along the roadways and at unsignalized crossings, signals provide a connection for cyclists to move between low-stress neighborhood roadways. Outside of this central core, however, low-stress roads have been built without connectivity across major roadways, making travel between neighborhoods inaccessible to most adults. This display makes apparent the gaps in the bicycle network that could be targeted for improvements to create connected bicycling routes that are comfortable for the mainstream adult population. Along with improvements along high-stress corridors, safe crossing opportunities across those corridors will greatly increase bicycling mobility.
**Bicycle Suitability Index Conclusions**

BSI provided a picture of several phenomena:

1. Geographic variation in demand - potential activity levels at different Census block corners
2. Geographic variation in supply - the quality of the physical pedestrian and bicycle network

Variation in demand and supply are combined into the Composite BSI models. A list of possible bicycle and improvement options is summarized below.

Areas with high demand for bicycling and high supply of suitable infrastructure can benefit from innovative programs and capital projects that further support bicycling, closure of key gaps, and should be considered showcase areas where best practices can be modeled for the region. These areas provide cost-effective opportunities for improvements and should be high priority for investment.

Areas with high demand and low supply of suitable infrastructure can benefit from infrastructure improvements to improve bicycling conditions. These areas may require bicycle facilities or intersection improvements to accommodate high level of demand. They should also be high priority for investment.

Areas with low demand for bicycling and high supply of suitable infrastructure can benefit from programs to encourage bicycling and land use changes or development to increase the density of attractors and generators. These areas should be medium priority for investment.

Areas with low demand for bicycling and low supply of suitable infrastructure can benefit from basic infrastructure improvements. These areas should be low-priority for investments.

Overall the areas of highest demand for bicycling are centered on Broadway Corridor, Hampden Avenue/Englewood Parkway/Girard Avenue, areas near the light rail stations and the cluster of schools in southeast Englewood. Other areas of Englewood are characterized by more modest potential demand.

Most adult cyclists can circulate comfortably on local and minor collector roadways. Higher order roadways, with speeds exceeding 30 miles per hour, such as Hampden and Federal, typically act as barriers to bicycling when appropriate bicycle facilities are not provided. Bike lanes can decrease the level of traffic stress on several of Englewood’s roadways, but enhancing the facilities with bike lane buffers or vertical separation from traffic while also providing a continuous dedicated facility on higher speed or higher volume roadways will further enhance the bicycling experience for all users. Within Englewood, islands of connected facilities exist. Concentrating short term facility construction on gap closure between these islands can significantly increase bicycling access within Englewood and help the city realize the full potential of a safe, continuous and connected bicycling network.
C. Community and Stakeholder Engagement

Open and transparent community engagement and public participation were key elements in the process of developing the Plan. The goal of the community engagement and outreach process was to increase public awareness of biking and walking in Englewood and to promote community participation in the study process. Public input was solicited throughout the entire study process, and in coordination with the other concurrent planning studies; the Comprehensive Plan update and the Next Steps Study. Project management team meetings were held on a regular basis and coordination between the three planning processes was essential to success.

The public process for the Walk and Wheel Master Plan included two community workshops; stakeholder focus group and interviews; website, e-newsletter and email blasts; online questionnaire; meetings with school district; and participation in the comprehensive plan coordinated outreach.

Englewood Forward Branding and Communications

Brand/Logo/Templates: An overall project brand with logos and templates were produced to give a similar look and feel between online and print materials across all projects.

Website: Project materials, meeting notes, public meeting announcements and materials, and general project information was available through the project website at: www.englewoodforward.org.

Contact Database (Stakeholder/Public): A contact database was developed for Englewood Forward as a whole with specific bike and pedestrian contacts updated on an ongoing basis.
Public Meetings

Two public meetings were held to garner support for the planning process and gain public perspective on the vision of the plan, community choices and review of the final plan. At each of the public meetings, attendees read informational boards exhibiting recent analysis for future demand for walking and biking in Englewood; and learned about potential pedestrian and bicycle facility types and engaged in discussion over a large scale map of the city, noting their particular interests or concerns. The project team gathered key information on the improvements or changes in facilities that would make biking or walking more comfortable and encourage a greater number of residents to do so.

The Public Meetings Included:

Vision Workshop / Initial Project Kick-off Meeting | November 12, 2014
Community Choices Workshop – held in conjunction with the two concurrent planning projects | February 11, 2015

Public meetings were advertised through the sources listed below to ensure input was gained from a broad range of community leaders, agencies, elected officials, citizens and organizations that have an interest in the outcome of the studies:

- Englewood Citizen
- E-Notifier sent out by City
- Postcard mailers
- Press Releases
- Quarterly Englewood Forward E-Newsletters
- Facebook
- Englewood Herald
- Your Hub weekly
- Chamber of Commerce
- Next Door
- Flyers at bike organizations, bike shops, library, coffee shops, etc.
Key Themes

60% of Englewood Public Meeting Attendees Would Walk or Bike More Frequently if Facilities Were Improved

Use new bike facilities to reinvigorate Downtown Englewood and pull people from south Denver neighborhoods into this retail/restaurant/entertainment core

Establish East-West Bicycle and Pedestrian Connections from LRT Stations to Commercial and Residential Areas

Link City Center LRT Station to the Broadway/Downtown Area with a Strong Bicycle and Pedestrian Spine

Improve Pedestrian Access Along and Across Broadway and in the Medical District

Link Areas West of Santa Fe and Railroad Tracks to Core Community

Ensure Safe Bicycle and Pedestrian Access to Schools

Improve Off-Street Trail System and Connections to Trails

Connectivity

Establish east-west bicycle and pedestrian connections from LRT stations to commercial and residential areas; north-south bicycle and pedestrian connections along Broadway

Link City Center LRT Station to Broadway/Downtown Area with a Strong Bicycle and Pedestrian Spine

Link Areas West of Santa Fe and Railroad Tracks to Core Community

Improve Off-Street Trail System and Connections to Trails

Improve connectivity at Oxford

Improved route to the Platte Park area and to Denver

Improving bike facilities along Bates would capture the Denver audience - excellent and safe alternative to riding on Dartmouth; connects east-west to Galapago and ties over to the Greenway connection at Dartmouth

Franklin Street has always worked well as a connection from the east

Eastman is a better bike path with less traffic and it connects to Cushing Park, unlike Floyd

Tejon or Zuni should be a north-south bikeway in the northwest area of Englewood

Southwest Greenbelt needs to connect through Rotolo Park and Jason Park up to a facility on Oxford or a pedestrian crossing on Oxford up to the Oxford Station to link the southern part of Englewood safely to LRT

Regional connections with Littleton and Denver are important to making biking successful in Englewood

Infrastructure and Wayfinding

Add more bike racks, bike boxes at Oxford station – Boulder and Rino models for bike security

Bike facility on Oxford: Increase width or separate bike lane on Oxford; Protected bikeway along Oxford to get cyclists to the Platte River Trail; Two-way bike path on north side of Oxford tied to the Rec Center

Bike facility on Dartmouth: replace on-street parking with bike lanes

Logan better location for advanced bike facility than Clarkson

On-street bike facility on Bates and Galapago to compliment pending rezoning of the properties at Galapago and new General Iron Works Trail

Iconic pedestrian bridge like Downtown Denver to link Civic Center Station to west side of Santa Fe

Raised crossing over Oxford to connect to the light rail platform

Improved pedestrian facilities along Broadway with improved land uses to make it a destination

Improve Southwest Greenbelt trail

Build the Englewood Rail Trail!

Signage on Little Dry Creek system, to LRT Station and within downtown - signage or painted lanes to show continuous connection of trail and street and General Iron Works Trail and Dartmouth link

Signage or bike lanes along Floyd to access the LRT station
Better pedestrian way-finding and signage in Downtown and increased visibility of the downtown area
Additional way-finding signage should be developed with more descriptive detail – no one knows what E-9a is
Maps or kiosks with signage and directions to destinations and trail intersections
Recreational path on one side/commuter path on the other side of Mary Carter bike path

**Safety and Access**

Improve pedestrian access: along and across Broadway and in the Medical District - more visible crosswalks; improve crossing at Broadway and 285; green paint or bike box at Floyd and Broadway to avoid conflicts between right-turning cars from west-bound Floyd and bikers; safer connection at Inca/Dartmouth, 285/Santa Fe; Jason/Mansfield needs an RRFB light; ped. crossing Santa Fe/Oxford; ped. crossing Santa Fe/Dartmouth; safer crossing at Oxford to the Rec Center; better ped. crossing on Bates/Logan for safer access to Bates Park
Ensure safe bicycle and pedestrian access to schools
Improve the three underpasses of Little Dry Creek Trail with lighting and natural feel elements
Improve the crossing at Englewood Parkway and Cherokee Crossing Hampden is hard to impossible on a bike unless you are at a major street – model what Glendale did with Birch Street
Traffic light needed at Kenyon/Jason
Increase cycling’s visibility in Englewood through education and events
Observance of traffic laws leads to safety and respect for both user types
Host bike event in Englewood like a Criterium race or a Cyclovia
Consistent removal of debris on roadways and from snow removal
Focused Outreach

**Senior Center Community Holiday Bazaar** | The Walk and Wheel Master Plan was represented during the Englewood Holiday Bazaar at the O’Malley Senior Center to engage the senior population and gather input and opinions on key issues. The attendees viewed project maps and displays and discussed the project with the team.

**Stakeholder Interviews** | In-depth interviews were conducted with key stakeholders to gain understanding of stakeholder perceptions, key issues and opportunities. Stakeholders interviewed:

Englewood School District, South Broadway Businesses, Englewood Transportation Advisory Committee.

**Englewood Walking and Wheeling Citizen Focus Group** | City Staff and the Project Team Consultants identified a select group of Englewood Wheeling and Walking Enthusiasts based on board service, meeting attendance, career vocation, and advocacy work. The citizen focus group consisted of South Broadway business owners, Englewood city staff and community residents. The purpose of the Focus Group was to introduce the preliminary study findings, and to solicit input on identifying and prioritizing preferences for implementation of bicycle and pedestrian infrastructure projects.

Walk and Wheel Festival

The Walk and Wheel Festival was held on Saturday, June 23rd from 1:00-5:00 pm. The festival served as both a public meeting to present the final Walk and Wheel Master Plan network to the community, as well as a community celebration providing education and awareness of health and well-being in Englewood. The following agencies, organizations and businesses participated in the event:

- Kaiser Permanente
- Englewood School District
- Museum of Outdoor Art
- Brew on Broadway
- Brewpub
- Bicycle Colorado
- Englewood Police Department
- Englewood Wastewater
- Keep Englewood Beautiful
- Englewood Library
- Lifetime Fitness
- Yoga Tree/East West Professionals
- Swedish Hospital

The Walk and Wheel Festival included numerous outreach, educational programming and awareness activities, including: a bicycle facility demonstration to enable residents to test new facility types recommended in the plan such as protected bike lanes and sharrows; a bike rodeo to demonstrate bike safety, facilitated by Bicycle Colorado; gardening and fitness demonstrations; free chair massages; and health information from Kaiser Permanente. In addition, both the Next Steps and Englewood Comprehensive Plan teams were present to discuss updates and progress for each of the plans.
Outreach Activities at Walk and Wheel Festival

Education and Programming
Bike Facilities and Demonstration
D. Plan Recommendations

The framework for plan recommendations is built on the findings of the conditions and demand assessment and the input of the Englewood community and stakeholders. The framework emphasizes a primary bike and pedestrian connection east-west from Englewood Civic Center LRT Station to the Broadway retail/commercial corridor and east to the hospital district; east-west crossings of Broadway to link destinations especially within the core of the community; enhancements along Broadway and perpendicular local streets to enable comfortable pedestrian movement from residential areas to commercial uses; linkages to south Denver; linkages between the rail stations and connections west to trails and recreational uses at Dartmouth, Oxford and potentially near Civic Center.

Areas of Emphasis

The key emphasis of the recommendations is to encourage additional walking and biking trips in Englewood through the creation of a low stress travel network for bicycling, and the provision of enhanced pedestrian facilities and way finding signage for comfortable pedestrian mobility. The implementation of greater pedestrian visibility, street markings and dedicated space, coupled with way-finding signage is fundamental to establishing a stronger pedestrian environment within the community. Improved bike facilities such as bike boulevards and protected bike lanes are identified as means of increasing ridership and encouraging the 60% of Englewood riders who would be inclined to cycle if more comfortable facilities were developed. Examples of these types of improvements are described below.
Pedestrian Facility Typologies

**Improved Pedestrian Corridor** | This facility type is characterized by the presence of 5’ or wider sidewalks on both sides of the street, improved crossings of major streets with bulbouts, enhanced crosswalks, or other signing devices as necessary, and local destination way finding signage. They provide primary corridors for pedestrian mobility around the City.

**Priority Pedestrian Corridor** | This facility type is intended to be used in high pedestrian traffic areas in more commercial and retail areas of the City. It is characterized by enhanced intersection treatments such as colored crosswalks, bulbouts, special pedestrian signalization and timing, the installation of medians and mid-block crosswalks, and sidewalks of at least 8’ in width on both sides of the road. Sidewalk areas would preferably be 13’-16’ wide to accommodate a wide sidewalk, and an amenity zone.
Bicycle Facility Typologies

**Bikeway** | A bikeway is a roadway that has some form of markings and signage installed to indicate to drivers and cyclists how to interact and that bikes are to be expected here. Bikeways can include shared lane markings, bike lanes, or buffered bike lanes as space allows and traffic volumes and speeds dictate.

**Protected Bikeway** | A protected bikeway is characterized by the addition of some form of raised vertical element between the cyclists travel area and the vehicular travel area and they are restricted to bicycle use only so a separate pedestrian facility is provided as well. Examples of vertical elements are flexible posts, roadside planters, vertical curbs, and parked vehicles, among others. Studies have shown that cyclists feel more comfortable on a protected bikeway than a non-protected bikeway and this encourages more people to ride their bikes.

**Bike Boulevard** | A bike boulevard is a low volume, low speed street where bicycle travel is emphasized over automobile travel. Traffic calming elements are often installed on bike boulevards including diverters, chicanes, and bulb outs. The idea is to encourage automobile drivers to use the street only for local access and to allow for uninterrupted through movements for bicycles thus encouraging bicycle use and creating a safe and bicycle friendly environment. Bike boulevards also have improved way finding signage listing destinations and the distances and travel times to reach them by bike or by walking. Bike boulevard corridors are also good places for implementing Improved Pedestrian Corridors as described on the previous page.
Bicycle Parking

Throughout the planning process, Englewood residents expressed frustration over the bike lockers found today at the Civic Center LRT station. The rental of the lockers limits availability of bike storage at the station, and turnover is extremely low. Consideration should be given to a higher capacity secure bicycle parking facility at both the Civic Center and Oxford Stations.

Secure bicycle parking, which is a locked structure that is protected from the elements, is a growing trend across the country and transit agencies are beginning to incorporate secure bicycle parking facilities into station area plans. Secured bicycle parking facilities at Civic Center and/or Oxford Stations would work in conjunction with recommended bicycle facility improvements to Oxford Ave. and Floyd Ave, and would increase visibility and accessibility of bike parking.

Providing secure bike parking at light rail stations encourages greater use of bicycles as a means of transportation and serves to activate commercial and retail spaces surrounding station areas. In addition, secured bike parking facilities reduce the fear of theft and deter cyclists from locking bikes in undesired locations. Prefabricated bike cages are modular, which would allow Englewood to add additional facilities over time as demand increases.
Infrastructure Recommendations

Figure D-1 (next page) shows the infrastructure recommendations for pedestrians and bicycles for the entire City of Englewood. They are based on public and stakeholder comment, the existing condition assessment, and the level of traffic stress and bicycle demand analyses as well as looking at continuity with facilities in adjacent jurisdictions.

The map in Figure D-1 has several key improvements for pedestrian and bicycle travel in the City and are listed in the following section.
Figure D-1: Infrastructure Recommendations for Pedestrians and Bicycles for Englewood
Transformative Projects

The following projects are anticipated to have a transformative effect on Englewood’s pedestrian and bicycle system and are anticipated to catalyze other improvements in the City.

Transformative Pedestrian Improvements

Broadway corridor from US 285 to Dartmouth: this corridor is identified as a Priority Pedestrian Corridor in the Plan. Key connectivity improvements include installing pedestrian-scale way finding signage, strengthening the connections between Broadway and the adjacent neighborhoods, installing mid-block crossings between Hampden and Girard at the mid-block pedestrian paseos and between Floyd and Eastman at the Gothic Theatre.

Enhance pedestrian scale way finding signage between City Center LRT Station and the hospital district: signage that identifies key local destinations and guides pedestrians between the LRT station and the hospital district with expected travel time and distances will reinforce the active transportation links in this corridor and encourage more people to walk in this area.

Improved pedestrian corridors along Kenyon, Sherman, and Bannock: these corridors are intended to provide low stress connections between neighborhoods and schools, commercial districts, and civic uses to encourage walking trips.

Transformative Bicycle Improvements

Protected bikeway loop: located along Oxford, Sherman/Clarkson, and Floyd this facility will provide a low stress connection through the heart of Englewood and is anticipated to attract significantly more users and be a key community asset once in place. The City of Sheridan is also planning on making improvements to Oxford west of Santa Fe to allow for a continuous protected bikeway connection between the two cities.

Bicycle improvements to Dartmouth: Dartmouth currently has the highest level of bicycling activity of locations observed in the City and primarily serves bicycle commuters. It also traverses the entire City from east to west making it an important connection for Englewood. Dartmouth west of the Platte River is envisioned as an off street or protected bikeway facility linking west Englewood to the Mary Carter Greenway and the Little Dry Creek Trail that extends east to Inca. East of the Platte River Dartmouth is envisioned to be an on-street facility to serve bicycle commuters and to communicate to automobile drivers and bicyclists that they should expect each other on the road in this area. The parallel protected bikeway facility on Floyd east of Inca is intended to serve a wider cross section of bicyclists and is intended to complement the Dartmouth improvements and to provide a low stress connection to Inca and the Little Dry Creek Trail.

Rail Trail along LRT line: This facility provides an off street experience for pedestrians and bicyclists to travel the length of Englewood and to connect to key destinations. The first portion of this trail being evaluated for implementation is the section from the Big Dry Creek Trail to Oxford Station.

Other Key Recommendations

In order to better illustrate the infrastructure recommendations, we have divided the City into 4 quadrants for better map visibility in this document. A discussion of the key recommendations in each quadrant is included.
Key pedestrian recommendations:

Improve the existing Harvard Gulch Trail segment in Englewood by replacing the current asphalt pavement with concrete pavement and creating a parallel soft surface trail for walkers and joggers.
Add continuous sidewalk of at least 5' in width along Dartmouth Ave to provide for a connection to the Mary Carter Greenway and the Little Dry Creek Trail.

Key bicycle recommendations:

Create a north-south bikeway on Zuni St connecting west Englewood with Denver, Sheridan, the Mary Carter Greenway near River Point, and proposed improved bike facilities on Dartmouth Ave.
Dartmouth Ave protected bikeway improvements west of Santa Fe Dr. to connect neighborhoods in the northwest area to the Mary Carter Greenway, to downtown Englewood and east to commercial/retail along Broadway.
A future bikeway along Wesley Ave to connect to the Mary Carter Greenway and planned Denver improvements near the Evans LRT station.
A new Mary Center Trail segment on the east side of the Platte River between Oxford Ave and Iliff Ave.
Key pedestrian recommendations:

- Implement an improved pedestrian corridor along Irving St in conjunction with the City of Sheridan and the City of Denver.
- Implement an improved pedestrian corridor along Federal Blvd in conjunction with the City of Sheridan and the City of Denver.
- Work cooperatively with the City of Sheridan to extend the existing Quincy Ave trail from Federal Blvd to Centennial Park.

Key bicycle recommendations:

- Create a bikeway connection along Lowell Blvd. that enables residents of the Cities of Sheridan and Englewood to access City of Sheridan improvements along Oxford Ave.
- Add a parallel trail to the Mary Carter Greenway on the east side of the Platte River from Union Ave to north of Oxford Ave.
- Improve bikeway elements along Irving/Union to connect the western part of Englewood to the Mary Carter Greenway and the Big Dry Creek Trail.
Key pedestrian recommendations:

Broadway corridor pedestrian improvements such as way finding signage and enhanced crosswalks.
Mid block crossings of Broadway between Hampden and Girard and between Floyd and Eastman.
Pedestrian improvements including intersection bulb outs along Kenyon Ave to improve connections between neighborhoods and the High School and Middle School.
Pedestrian scale way finding signage between the City Center LRT station and the hospital district.
Improved wayfinding signage for the Little Dry Creek Trail sidewalk connections between the Inca/Dartmouth intersection and the Cherokee/US 285 intersection.
Pedestrian improvements along Bannock to better connect neighborhoods with the downtown area and to reinforce neighborhood connections to Broadway.
Improved pedestrian corridor along Fox and Elati to provide a low stress experience in the center of the City.

Key bicycle recommendations:

Protected bikeway and bikeway improvement along Dartmouth Ave to serve bicycle commuters.
Protected bikeway improvements on Floyd Ave from Inca St to Sherman St and bikeway improvements from Sherman St to University Blvd to connect to the protected bikeway loop.
Bicycle boulevard improvements along Sherman St coupled with improved pedestrian corridor elements to create a unique and attractive multi-modal travel corridor in the City.
Rail trail along the LRT line between Oxford Ave, City Center LRT station, and Bates Ave to provide a low stress travel environment between major destinations in Englewood. This includes overpasses of Oxford Ave, US 285, and Dartmouth Ave.
Key pedestrian recommendations:

Pedestrian improvements along the Broadway corridor such as intersection curb bulbouts and sidewalk amenity improvements. Pedestrian improvements along Bannock including an improved crossing of Oxford and improved connections to Broadway to encourage more walking trips. Fox St, Sherman St, Bannock St, Chenango Ave, and Tufts Ave. improved pedestrian corridors with enhanced crossings at busy intersections and wider sidewalks.

Key bicycle recommendations:

Protected Bikeway improvements to Oxford Ave to serve a wider cross section of users and encourage more bicycle trips and leverage investments in the protected bikeway loop. This improvement connects to planned improvements by the City of Sheridan west of Santa Fe Dr. Bikeway improvements on Chenango, Fox, and Tufts to connect neighborhoods to schools. Extension of the Sherman St bicycle boulevard from Oxford Ave south to Belleview Ave. Extension of the Clarkson St bikeway improvements from Oxford Ave to Belleview Ave. Bikeway enhancements to Fox St.
Programmatic Recommendations

It is important to implement programmatic elements to complement physical infrastructure improvements to leverage those investments. Programmatic elements can be effective at improving the acceptance of walking and biking as a regular part of daily transportation activities as well as provide transparency and support for City decision making processes regarding walking and biking improvements. The following programmatic elements should be considered for implementation:

- Establish a sub-committee or special citizen group to be the voice of walking & biking in Englewood and continue the dialogue between citizens and policy makers;
- Seek community partners to promote increased walking and biking within the community;
- Increase visibility of walking and biking through events, programming and educational opportunities;
- Encourage the “interested but concerned” through the addition of new facilities
Table D-1: Programmatic Recommendations

| Bicycle Rodeos/ Safe Routes to Schools (SRTS) Educational Activities | By offering bicycle rodeos and other youth educational activities, the City of Englewood can provide children with opportunities to practice bicycling (or walking) in safe learning environments. These events also give children the safety knowledge they need to continue riding as they mature.

  - Bicycle rodeos are set up as bicycle or street skills courses and use cones, signs, and striping to mimic actual on-street traffic scenarios.
  - Trained instructors use the course to teach children skills including signaling, stopping, yielding, and turning.
  - Rodeos can range from small and informal gatherings to large-scale events.
  - Rodeos can also be coupled with activities such as helmet-fitting instruction, reward raffles, and bicycle registration.

  Regardless of size, bicycle rodeos require forethought and planning. A course design that addresses a variety of traffic situations must be considered and required supplies must be assessed. To promote the rodeo and engage more participants, consider hosting it as part of an existing community and school event. |

| Group Walks or Rides | Group walks and bicycle rides are fun ways to engage community members from a variety of ages and backgrounds. These group activities can range in focus from a guided walking tour of local gardens or public art to a ride to a local concert series or farmers market, often highlighting local destinations, community assets, or special features. The focus of each walk or ride should creatively portray walking or bicycling as a positive and normal mode of transportation.

  After the activity, residents may be surprised to learn that they traveled five miles by bike or one mile by foot—organizers should take advantage of this opportunity to drive home the point that bicycling and walking for everyday trips are possible. |

| Walk/Wheel to Work Day or Week - Employer Involvement | Employer involvement in a Walk/Wheel to Work day or week encourages employees to try walking or bicycling to work through fun activities, incentives, and peer-to-peer encouragement. Participants can report their bike and walk commute trips to a team captain or human resources representative to confirm their participation.

  Encouragement activities for employees can include free breakfasts or lunches, gift card drawings, group walks or rides, happy hours, or an early release day.

  Organizers and/or employers may consider hosting a bicycle safety overview for employees prior to the event. Messaging to encourage employees to continue bicycling and walking to work after the event is recommended. |

| Walk/Wheel Rewards Program | Walk or wheel rewards programs support community health goals by incentivizing shoppers to visit stores by foot or bike with discounts, free gifts, or rewards points for redemption. Rewards programs also benefit businesses and support economic vitality by opening parking spaces for other customers and encouraging more foot traffic around store fronts.

  Organizers and participating businesses can promote the program through window decals, posters, mailers, or traditional advertising.

  The program may require some type of system for identifying eligible patrons, such as showing one’s helmet or a membership card, or it may be based on the honor system.

  Reasons2Ride is a program/app being developed by a local champion (Joel Phillips) that provides a platform for a rewards program. The program/app would be activated on a smart phone using QR codes on signs installed on area bikeways. The smartphone would then show a) where the rider is within the existing bike network, and b) nearby businesses that provide discounts to those riding bicycles. The Reasons2Ride organization would like to kick the program/app off in Englewood in association with the Walk and Wheel Plan. |
Making the Plan recommendations a reality is an important step in transforming Englewood and encouraging walking, biking, and transit trips in the City. This section focuses on two areas of implementation; Quick Wins and Next Steps.

Quick Wins

A key focus of the Plan development process was to identify early action opportunities that were realistically achievable by Englewood in the near term. Analysis, discussions with stakeholders and citizens, and conversations with City staff led to the identification of the following projects as early action opportunities. They are listed below and shown in a figure on the following page.

- Dartmouth Avenue Shared Bicycle/Parking Lane
- Floyd Avenue Bikeway (Bike Lanes/Sharrows)
- Oxford Avenue Bikeway (Sharrows/Bike Lane/Signage)
- Sherman Street Bike Boulevard (Sharrows/Signage)
- Clarkson Street Bikeway (Sharrows/Signage)
- Irving St/Union Ave Bikeway (Sharrows/Signage)
- City Center/Broadway/Medical District Pedestrian Wayfinding Signage
- Little Dry Creek Trail Enhanced Wayfinding Signage
Of the Quick Win projects, the following projects were identified through the planning process and discussions with City staff as immediate implementation priorities for Englewood. More information about each project is presented on the following pages.

Dartmouth Avenue: Inca to Downing
Oxford Avenue: Broadway to Clarkson
Oxford Avenue: Navajo to Broadway
Clarkson Street: Belleview to Little Dry Creek Trail
Sherman Street: Oxford to Dartmouth
Floyd Avenue: Elati to University (Conceptual Design)
**Description** | Shared parking/bicycle lane of 10’ in width with vehicular lanes reduced to 11’

**Implementation Cost** | $85,000

**Note** | This improvement is expected to help automobiles and bicyclists share this corridor more effectively by defining the vehicular operating space. On-street parking levels are low in most areas of the corridor, which will limit bicycle/parked vehicle conflicts. Other safety benefits are expected on the hill at Sherman St by providing positive guidance to drivers. The intersection of Dartmouth/Broadway requires further study to determine the best configuration and it may require removal of on street parking for ½ to 1 block on either side of Broadway.

**Description** | Shared travel lanes of 14’ in width marked with shared lane markings

**Implementation Cost** | $26,000

**Notes** | This improvement will emphasize the multi-modal nature of this corridor and provide positive guidance to bicyclists as to where to position themselves in the travel lane to maximize safety of travel. It will also provide visual information to automobile drivers that they should expect bicyclists on the road and are required to share the space with them. This section of Oxford Ave has lower traffic volumes than there are west of Broadway that lends itself to this type of improvement.
**Description** | 6’ wide striped bicycle lane next to 7’ wide parking lane

**Implementation Cost** | $50,000

**Notes** | This section of Oxford has higher traffic volumes and speeds requiring a higher design treatment than shared lane markings. There are currently raised medians installed on portions of this corridor as traffic calming devices that would need to be removed to implement this improvement. This is an important corridor that connects neighborhoods to the Oxford Ave LRT Station as well as to the Sherman and Clarkson bicycle facilities.

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**Description** | Shared lane markings in 15’ travel lanes

**Implementation Cost** | $50,000

**Notes** | Clarkson St in this area is the boundary between Cherry Hills Village and Englewood. The boundary line varies in relation to the centerline of the street throughout this area resulting in the need for a joint project between Cherry Hills Village and Englewood. Traffic volumes and speeds in this section are commensurate with the installation of shared lane markings. The actual width of the pavement varies slightly due to the fact that the east side of the street has no curb or gutter. The current plan is to install painted shared lane markings here in the immediate terms and to install more permanent thermoplastic shared lane markings once the planned pavement overlay project for this roadway is completed in 2016.
**Sherman Street: Oxford to Dartmouth**

**Description** | Bike boulevard consisting of shared lane markings in 11' lanes and enhanced wayfinding signage

**Implementation Cost** | $35,000

**Notes** | This section of Sherman St connects the improvements planned for Dartmouth and Oxford on a low volume neighborhood street that runs the entire length of the City. Although it has a narrow cross section in this area, the traffic speeds and volumes are low enough to justify this type of treatment. Bicycle and pedestrian scale wayfinding signage directing users to connecting routes and local destinations should be installed in this corridor to enhance its’ status as an important bicycle and pedestrian connector.

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**Next Steps**

In addition, important projects that would cost more to implement and have bigger construction impacts were identified as high priorities. These projects would be the “Next Steps” projects to undertake to improve walking and biking in Englewood.

- Rail trail segment 1 from Big Dry Creek Trail to the Oxford LRT Station
- Rail trail segment 2 from City Center LRT Station to Bates Ave
- Protected bikeway on Floyd Ave from Inca St to Sherman St
- Protected bikeway on Oxford Ave between Navajo St and Broadway
- Priority pedestrian corridor improvements along Broadway from Hampden Ave to Dartmouth Ave
- Mid-block pedestrian crossing of Broadway at the Gothic Theater between Floyd Ave and Eastman Ave. A detailed engineering design for this improvement is already complete.
- Mid-block pedestrian crossing at the pedestrian paseos between Hampden Ave and Girard Ave.
F. Maintenance Considerations

The City of Englewood is considering investing further in the construction of bicycle and pedestrian facilities such as on-street bikeways, multi-use pathways and sidewalks, all of which provide significant, valuable recreational and transportation benefits to local residents and visitors. However, ongoing maintenance of these facilities, and in particular, funding sources to support maintenance must also be addressed.

This section summarizes existing maintenance activities in a number of peer cities to Englewood, based on interviews with staff of local agencies, and identifies challenges to maintaining on-street bike facilities, sidewalks and multi-use paths. It includes a description of components of successful maintenance programs in comparable communities.

Importance of Proper Maintenance

Maintaining on-street bike facilities, sidewalks and multi-use paths to a high standard is important for a variety of reasons.

**Safety**: Public agencies have a duty to protect the public welfare by maintaining facilities to a level that reduces potential safety hazards. This includes repairing damage on paths and sidewalks that may pose a tripping hazard, clearing snow in a timely manner, and preventing ice from forming.

**Universal Access**: Public agencies are required by federal law to maintain public facilities so that they are accessible to people with disabilities. Small but abrupt vertical changes in level along a path or sidewalk may not pose a safety hazard to able-bodied pedestrians, but may present an obstacle to people who are using wheelchairs or other mobility-assistive devices.

**Attracting Use**: Well-maintained facilities, with smooth surfaces, well-kept vegetation, and up-to-date signage will attract and sustain use, increasing the livability of the areas served by the network.

**Liability**: Allowing hazardous conditions to exist along a path or sidewalk exposes a local agency to potential lawsuits.

**Protecting the Public Investment**: Regular preventative maintenance on an on-street bike facility, path or sidewalk (e.g. periodic overlays on multi-use paths) can extend the lifetime of the existing facility and delay the need for more expensive repairs.

Primary Maintenance Functions

Primary functions of maintaining on-street bike facilities, sidewalks and multi-use paths include:

- Maintaining pavement quality through spot repairs, regular overlays and longer-term repaving
- Maintaining trails and sidewalks to ADA standards
- Sweeping and removal of garbage and debris on a regular basis
- Vegetation trimming to provide clear access on a monthly basis
- Snow removal after storms
- Restripping paths as needed, usually annually
- Landscaping maintenance on a weekly or monthly basis, including irrigation costs
- Lighting feature maintenance, including electricity costs
- Repair of damage due to storms, floods, collisions and other unforeseen events
- Repair and replacement of wayfinding or other signage
Research Methodology

The project team used the following strategies to research this topic and identify regional successes and struggles for reference.

- Interviews with Englewood staff
- Interviews with peer city staff
- National research on maintenance issues

Staff from Englewood and other peer communities were contacted and asked to share information about maintenance activities in their agency. Staff contacts are listed in Table F-1.

Table F-1: Agency Staff Contacted Regarding Bicycle and Pedestrian Facility Maintenance

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Most Recent Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlie Blosten</td>
<td>City of Littleton</td>
<td>Spoke on 1/29/2015</td>
</tr>
<tr>
<td>Dave Bakett/John Padon</td>
<td>City of Lakewood</td>
<td>Email on 2/3/2015</td>
</tr>
<tr>
<td>Dave Lee</td>
<td>City of Englewood</td>
<td>Spoke on 2/11/2015</td>
</tr>
<tr>
<td>Previous Research Contacts</td>
<td>City of Madison, WI</td>
<td>Previous Research</td>
</tr>
<tr>
<td>Dan Raine/Emily Snyder</td>
<td>City and County of Denver</td>
<td>Spoke in August 2015</td>
</tr>
</tbody>
</table>

Research Findings

Maintenance policies and procedures varied among the communities contacted. Of the agencies contacted, none had specific money/funding budgeted for bicycle and pedestrian facility maintenance, and none regularly require additional maintenance funding to be provided or allocated when a new bike facility was built. Most agencies stated that bicycle and pedestrian facility maintenance was completed not by one department in particular, but was a cross-department collaboration, often without pre-defined assignments or agreements. Table F-2 shows a summary of agency responses to questions relating to bicycle and pedestrian facility maintenance.
### Table F-2: Maintenance Policy and Funding Summary by Agency Interviewed

<table>
<thead>
<tr>
<th>City</th>
<th>Existing Maintenance Budget for Bike/Ped from Capital Budget?</th>
<th>Allocation for Bike/Ped?</th>
<th>Add funding to Maintenance Budget when new bike facilities are built?</th>
<th>Funding Sources Used</th>
<th>Maintenance Staff</th>
<th>Maintenance Prioritization</th>
<th>Citizen Reporting?</th>
<th>Existing Maintenance Programs</th>
<th>Maintenance Budget 2015</th>
<th>Current Capital Budget</th>
<th>Capital Budget Include Bike/ Ped Improvements?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Littleton</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>General fund and then open space fund (20% of open space fund)</td>
<td>Grounds maintenance, streets</td>
<td>As needed. Funding is added incrementally throughout the years. Some scheduled (graffiti), but many as needed.</td>
<td>Pothole reporting app</td>
<td>Adopt a Trail, Adopt a Street</td>
<td>$1,950,000 (resurfacing)</td>
<td>$8.2 million</td>
<td>Sometimes, but not this year because of recent completions</td>
</tr>
<tr>
<td>Lakewood</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Operational budget and General fund for street resurfacing</td>
<td>PW and Community Resources</td>
<td>As needed. Funding is just absorbed into the highest-risk areas addressed first. Unwritten - sweep trails once a month.</td>
<td>Yes and is highly used</td>
<td>Adopt a Street</td>
<td>$11,287,230 (PW only)</td>
<td>$22 million</td>
<td>$300,000 (plus one-time $2,000,000)</td>
</tr>
<tr>
<td>Englewood</td>
<td>Overall Open Space maintenance budget that is $2,137,252 for all Open Space facilities</td>
<td>No</td>
<td>No</td>
<td>Arapahoe Co Shareback funds</td>
<td>Open Space, Public Works, and SSDP</td>
<td>Safety first, then as needed; Vegetation and trash, scheduled</td>
<td>Generic form on the website for citizens to ask questions. Or phone call or email to the department.</td>
<td>None</td>
<td>$120,000 annually from Arapahoe Co sales tax in combination with overall Open Space budget</td>
<td>None anymore - years ago there was for open space projects. ($600,000 annually from Arapahoe County)</td>
<td></td>
</tr>
<tr>
<td>Madison</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Among others, sidewalks - Property Owner Assessment</td>
<td>Crosses departments (parks and City engineering). Added 1 FTE - 1/2 year striping and 1/2 year bus stop snow removal</td>
<td>Prioritizes higher-use trails. Documents for maintenance practices. (among others) City owned sidewalks and school/handicap crosswalks are maintained during regular business hours during a storm. Main bike routes are maintained starting at 4AM on weekdays in order to be traversable on morning commute.</td>
<td>Website reporting</td>
<td>None</td>
<td>$500,000 for bikeways program (capital budget); includes some resurfacing, etc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: All information provided for Littleton, Lakewood, and Englewood is for FY 2015.*
Obstacles to Proper Maintenance

There are three main obstacles to successful bicycle and pedestrian facility maintenance programs, according to the peer city interviews completed for this and other projects:

1. The first, and most common issue in the cities examined, is a lack of dedicated funding. There are fewer grants available for maintenance activities than are available for construction of new facilities.

2. Second, proper equipment, trained, or allocated personnel may not be available. For example, shared-use trails require narrow snow-blowers for snow removal, but these machines may not be owned by the jurisdiction.

3. Third, there may be too little or too much coordination between different departments regarding whose responsibility it is to maintain bicycle and pedestrian facilities, and the exact duties that are required of the responsible party.

4. Most Cities “Make it Work”

Each of the communities that were surveyed (and many other communities that have been contacted through other studies) take an enthusiastic “make it work” approach to maintenance of bicycle and pedestrian facilities because the benefits of improved livability and desirability outweigh the additional money/time these facilities may require. It is worth noting that both Lakewood and Littleton have significantly higher lane miles of on-street and off-street bicycle facilities than Englewood, and they have continued to maintain them as necessary through alternate, combined, and shared funding and responsible agencies.

Case Studies - Why Other Communities are Successful

Additional information was gathered from case study cities (cities with readily available maintenance information) with successful maintenance programs or policies to aid in comparing with Englewood’s current policies and concerns. These case study cities (as well as peer cities) build and maintain bicycling and walking facilities because they are a priority for the community. As a result, they are privy to the economic benefits and quality of life benefits these types of facilities bestow on the community. A few examples of information provided by these cities to describe approach to maintenance or reasoning for providing bicycle and pedestrian facilities with continuing maintenance are listed below:

Madison - “We treat bicycling infrastructure no different from other infrastructure we have. We don’t ask that [about maintenance cost concerns] about other development. We don’t stop building housing because of the cost of trash pick-up and sewers.”

A study of Maryland’s Northern Central Rail Trail found that the state received $303,000 per year in trail related tax income while paying $192,000 per year in maintenance.

Dayton and Miami Valley - the trail system, which cost approximately $50 million over 30 years, has an annual positive economic impact of nearly $15 million.
G. Potential Economic Benefits

There are two categories of potential economic benefits related to improving pedestrian and bicycle facilities in Englewood. The first category, labeled Qualitative Benefits, is related to improving the attractiveness of Englewood to new residents and supporting current residents desires to stay in the community. These benefits are hard to quantify and consist of quality of life improvements, property value increases, sales tax receipt impacts, and other more intangible benefits. The second are more quantifiable and measurable benefits related to lower transportation costs, improved community health and improved environmental characteristics.

Figure G-1 illustrates qualitative benefits of improving bicycle and pedestrian systems.
Additionally there are qualitative benefits for health and safety shown in Figure G-2.

**Figure G-2: Health and Safety Benefits of Bikeways**

Quantified Benefit Calculation

This section contains an analysis of the quantified benefits that might occur as the result of implementing the recommended projects in the Englewood Walk and Wheel Master Plan. The analysis estimates the number of bicycle and pedestrian trips that would directly result from the implementation of the project list, approximates the corresponding reduction in vehicle trips and vehicle miles travelled (VMT), and assesses the potential health-, environmental-, and transportation-related benefits.

The impact analysis utilizes a standard methodology for calculating health-, environmental-, and transportation-related benefits. All projections are based on five-year estimates from the U.S. Census Bureau, which are then extrapolated through the use of various multipliers derived from national studies and quantified in terms of monetary value where appropriate. The estimated monetary values are then calibrated to baseline values and compared to bicycling and pedestrian mode splits of peer cities that recently have implemented similar projects.

**Selecting Peer Cities**

The consultant team examined levels of bicycling and walking in municipalities with similar infrastructure already in place, called peer cities. Selection factors in choosing these municipalities included the existing street network, geographic location, climate, topography, socio-demographic data, and the completeness of the city’s bicycle and pedestrian network.
### Table G-1: General Characteristics Comparison of Selected Peer Cities

<table>
<thead>
<tr>
<th></th>
<th>Englewood</th>
<th>Littleton, CO</th>
<th>Oak Park, IL</th>
<th>Claremont, CA</th>
<th>Jackson, WY</th>
<th>Park City, UT</th>
<th>Helena, MT</th>
<th>Bozeman, MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street Network</td>
<td>Tight Grid</td>
<td>Loose Grid</td>
<td>Large Grid</td>
<td>Large Grid</td>
<td>Large Grid</td>
<td>Linear</td>
<td>Tight Grid</td>
<td>Tight Grid</td>
</tr>
<tr>
<td>Region</td>
<td>Mountain West</td>
<td>Mountain West</td>
<td>Midwest</td>
<td>Mountain West</td>
<td>Mountain West</td>
<td>Mountain West</td>
<td>Mountain West</td>
<td>Mountain West</td>
</tr>
<tr>
<td>Climate</td>
<td>Semi-Arid</td>
<td>Semi-arid</td>
<td>Humid Continental</td>
<td>Mediterranean</td>
<td>Continental</td>
<td>Semi-arid</td>
<td>Semi-arid</td>
<td>Continental</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>5,371</td>
<td>5,351</td>
<td>594</td>
<td>1,168</td>
<td>6,237</td>
<td>7,000</td>
<td>3,875</td>
<td>4,820</td>
</tr>
<tr>
<td>Population</td>
<td>30,840</td>
<td>41,737</td>
<td>51,878</td>
<td>34,926</td>
<td>9,577</td>
<td>7,873</td>
<td>28,190</td>
<td>37,280</td>
</tr>
<tr>
<td>Population Density per Square Mile</td>
<td>4,844</td>
<td>2,902</td>
<td>11,038</td>
<td>2,600</td>
<td>3,291</td>
<td>4,430</td>
<td>1,724</td>
<td>1,950</td>
</tr>
<tr>
<td>Percent Minority Population</td>
<td>28.2%</td>
<td>8.2%</td>
<td>32.3%</td>
<td>29.4%</td>
<td>20.2%</td>
<td>19.0%</td>
<td>6.7%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Bicycle Friendly Community Award Level</td>
<td>None</td>
<td>None</td>
<td>Bronze</td>
<td>Silver</td>
<td>Gold</td>
<td>Silver</td>
<td>Bronze</td>
<td>Silver</td>
</tr>
<tr>
<td>Walk Friendly Community Award Level</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Bozeman, Claremont, Helena, Jackson, Littleton, Oak Park, and Park City were chosen by the consultant team as peer cities because they have similar design, geographic, and demographic characteristics to Englewood, and because each city except for Littleton has achieved a Bronze Level League of American Bicyclist’s Bicycle Friendly Community® award designation or higher. After the identification of peer cities based on general characteristics, the consultant team analyzed the bicycle and pedestrian commute data from each city. Compared to selected peer cities, Englewood has the second lowest bicycle commute mode share (1.55%) and third lowest pedestrian commute mode share (2.75%) according to five-year American Community Survey data from 2009 to 2013.
Table G-2: Estimated Future Walk and bike Mode Split

<table>
<thead>
<tr>
<th></th>
<th>Englewood</th>
<th>Littleton, CO</th>
<th>Oak Park, IL</th>
<th>Claremont, CA</th>
<th>Jackson, WY</th>
<th>Park City, UT</th>
<th>Helena, MT</th>
<th>Bozeman, MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed Population¹</td>
<td>16,606</td>
<td>21,011</td>
<td>26,792</td>
<td>14,493</td>
<td>6,224</td>
<td>4,262</td>
<td>15,122</td>
<td>21,050</td>
</tr>
<tr>
<td>Daily Bicycle Commute Trips¹</td>
<td>257</td>
<td>131</td>
<td>445</td>
<td>270</td>
<td>171</td>
<td>119</td>
<td>482</td>
<td>1,227</td>
</tr>
<tr>
<td>Bicycle Commute Mode Share¹</td>
<td>1.55%</td>
<td>0.62%</td>
<td>1.66%</td>
<td>1.86%</td>
<td>2.75%</td>
<td>2.79%</td>
<td>3.19%</td>
<td>5.83%</td>
</tr>
<tr>
<td>Scenario 1 Future Bicycle Commute Mode Share*</td>
<td>1.76%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 2 Future Bicycle Commute Mode Share**</td>
<td>2.75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 3 Future Bicycle Commute Mode Share***</td>
<td>4.24%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily Walk Commute Trips¹</td>
<td>456</td>
<td>497</td>
<td>967</td>
<td>1,392</td>
<td>608</td>
<td>77</td>
<td>1,187</td>
<td>2,055</td>
</tr>
<tr>
<td>Walk Commute Mode Share³</td>
<td>2.75%</td>
<td>2.37%</td>
<td>3.61%</td>
<td>9.60%</td>
<td>9.77%</td>
<td>1.81%</td>
<td>7.85%</td>
<td>9.76%</td>
</tr>
<tr>
<td>Scenario 1 Future Walk Commute Mode Share*</td>
<td>2.99%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 2 Future Walk Commute Mode Share**</td>
<td>7.85%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 3 Future Walk Commute Mode Share***</td>
<td>9.76%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Based on the difference between Englewood's existing bicycle and walk commute mode share and the 25th percentile bicycle and walk mode share of peer cities.
**Based on the difference between Englewood's existing bicycle and walk commute mode share and the 50th percentile bicycle and walk mode share of peer cities.
***Based on the difference between Englewood's existing bicycle and walk commute mode share and the 90th percentile bicycle and walk mode share of peer cities.
Multipliers

Multipliers were developed through an analysis of the relationship between two or more model inputs (such as the number of vehicle-miles reduced) and associated model outputs (such as the cost of road maintenance per every vehicle-mile travelled). The model used for this study utilizes over 50 multipliers in order to extrapolate daily, monthly, and annual trip rates, trip distance, vehicle trips replaced, emission rates, physical activity rates, and other externalities linked to an increase in bicycling and walking trips and to a decrease in motor vehicle trips. Individual multipliers of note are covered in more detail in the sections that follow.

Limitations

The primary purpose of the analysis is to enable a more informed policy discussion on whether and how best to invest in a bicycle and pedestrian network in Englewood. Even with extensive primary and secondary research incorporated into the impact analysis model, it is impossible to accurately predict the exact impacts of various factors. Accordingly, all estimated benefit values are rounded and should be considered order of magnitude estimates, rather than exact amounts.

Health Benefits

The implementation of a well-designed, connected bicycle and pedestrian network across Englewood will encourage a shift from energy-intensive modes of transportation such as cars and trucks to active modes of transportation such as bicycling and walking. The impact analysis model evaluates and quantifies the estimated increase in bicycling and walking trips, the estimated increase in hours of physical activity, and the annual savings resulting from reduced healthcare costs. In order to evaluate these health factors, the consultant team analyzed readily-available data inputs.

Health Calculations

The primary inputs into the health component of the impact analysis model come from five-year estimates of commute trip data from the U.S. Census Bureau. Five-year estimates were chosen because they are the most reliable dataset available from the U.S. Census Bureau between the 10-year censuses and because they allow for analysis at the individual census tract level.

After extrapolating the commute trip data to recreational trips and to estimate daily, monthly, and annual trip values, the consultant team used a series of multipliers and assumptions to calculate the various health factors. Englewood currently experiences 977,000 bicycle trips and 1,593,000 walk trips per year. If the City implements the recommended projects under Scenario 1, Englewood could experience 135,000 additional bicycling trips and 204,000 additional walking trips per year. If the recommended projects under Scenario 2 are implemented, the City could experience 757,000 additional bicycling trips and 4,311,000 additional walking trips per year. If the City implements the recommended projects under Scenario 3, Englewood could experience 1,702,000 additional bicycling trips and 5,929,000 additional walking trips per year. Using trip distance multipliers derived the National Household Travel Survey (NHTS) and annual vehicle trip replacement factors derived from a combination of US Census data, NHTS data, and historic Safe Routes to School data, the estimated increase in distance bicycled is 187,000, 1,048,000, and 2,357,000 miles per year for Scenario 1, 2, and 3, respectively. The estimated increase in distance walked is 61,000, 1,293,000, and 1,779,000 miles per year for the Scenario 1, 2, and 3, respectively. The combined bicycle and walk trips for Scenario 3 would result in 3,441,000 fewer vehicle-miles travelled (VMT) annually.

These annual distance estimates and VMT reduction estimates were used to calculate changes in physical activity rates among residents in Englewood. Implementation of the recommended projects for
Scenario 1 could result in 39,000 more hours of physical activity per year among Englewood residents, and 536,000 and 829,000 for Scenarios 2 and 3, respectively. This increase in physical activity means that no more residents will be meeting the Centers for Disease Control and Prevention (CDC) minimum number of hours of physical activity per day under Scenario 1, 4,000 under Scenario 2, and 6,000 under Scenario 3. This is equal to a jump from approximately 18.83 percent of the regional physical activity need being met at current baseline levels to 36.59 percent of the regional physical activity need being met under Scenario 3 – an increase of 17.76 percent. This growth in the percent of people within the City exercising also equates to a $238,000 reduction in healthcare expenses per year under Scenario 3.

### Table G-3: Annual Health Benefits

<table>
<thead>
<tr>
<th>Englewood</th>
<th>Baseline</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Bicycle Trips</td>
<td>977,000</td>
<td>1,112,000</td>
<td>1,734,000</td>
<td>2,679,000</td>
</tr>
<tr>
<td>Annual Miles Bicyced</td>
<td>2,240,000</td>
<td>2,427,000</td>
<td>3,288,000</td>
<td>4,597,000</td>
</tr>
<tr>
<td>Annual Walk Trips</td>
<td>2,319,000</td>
<td>2,523,000</td>
<td>6,630,000</td>
<td>8,248,000</td>
</tr>
<tr>
<td>Annual Miles Walked</td>
<td>1,593,000</td>
<td>1,654,000</td>
<td>2,886,000</td>
<td>3,372,000</td>
</tr>
<tr>
<td>Annual Hours of Physical Activity</td>
<td>755,000</td>
<td>794,000</td>
<td>1,291,000</td>
<td>1,467,000</td>
</tr>
<tr>
<td>Number of Resident Meeting CDC Recommended Number of Hours of Physical Activity</td>
<td>6,000</td>
<td>6,000</td>
<td>10,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Physical Activity Need Met</td>
<td>18.83%</td>
<td>19.80%</td>
<td>32.20%</td>
<td>39.51%</td>
</tr>
<tr>
<td>Annual Healthcare Cost Savings</td>
<td>$105,000</td>
<td>$115,000</td>
<td>$262,000</td>
<td>$343,000</td>
</tr>
</tbody>
</table>

### Environmental Benefits

While the causes of physical inactivity and pollution stem from many sources, the implementation of the recommended bicycle and pedestrian projects in Englewood will contribute to a shift from energy-intensive modes of transportation such as cars and trucks to active modes of transportation such as bicycling and walking. The impact analysis model evaluates and quantifies the estimated increase in bicycling and walking trips and the annual savings from reduced vehicle emissions. In order to evaluate these environmental factors, a number of readily-available data inputs were analyzed.

### Environmental Calculations

The primary inputs into the environmental component of the impact analysis model come from five-year estimates of commute trip data from the U.S. Census Bureau. Using the same estimates of VMT reduction calculated in the health benefits analysis, changes in hydrocarbon, particulate matter, nitrous oxides, carbon monoxide, and carbon dioxide were analyzed. In total, the replacement of motor vehicle trips with active transportation trips may result in an estimated 302,000, 3,509,000, and 5,726,000 fewer pounds of CO2 emissions per year under Scenario 1, 2, and 3, respectively, and 7,000, 67,000, and 111,000 fewer pounds of other vehicle emissions under Scenario 1, 2, and 3, respectively. Based on a review of air emissions studies, each pound of emissions were assigned an equivalent dollar amount based on how much it would cost to clean up the pollutant or the cost equivalent of how much damage the pollutant causes the environment. The total reduction in vehicle emissions is equal to a savings of $115,000 in related environmental damage or clean-up per year under Scenario 3. Other potential ecological services associated with the bicycle projects such as water regulation, carbon sequestration, carbon storage, and waste treatment exist, but the quantifiable value of these services are negligible on the overall impact of the recommended project list.
Table G-4: Annual Environmental Benefits

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in CO2 Emissions (lbs)</td>
<td>2,664,000</td>
<td>2,966,000</td>
<td>6,173,000</td>
<td>8,390,000</td>
</tr>
<tr>
<td>Reduction in CO2 Emissions (lbs) (beyond baseline scenario)</td>
<td></td>
<td>302,000</td>
<td>3,509,000</td>
<td>5,726,000</td>
</tr>
<tr>
<td>Reduction in Other Vehicles Emissions (lbs)</td>
<td>53,000</td>
<td>60,000</td>
<td>120,000</td>
<td>164,000</td>
</tr>
<tr>
<td>Reduction in Other Vehicles Emissions (lbs) (beyond baseline scenario)</td>
<td></td>
<td>7,000</td>
<td>67,000</td>
<td>111,000</td>
</tr>
<tr>
<td>Total Vehicle Emission Cost Savings</td>
<td>$55,000</td>
<td>$61,000</td>
<td>$123,000</td>
<td>$170,000</td>
</tr>
<tr>
<td>Total Vehicle Emission Cost Savings (beyond baseline scenario)</td>
<td></td>
<td>$6,000</td>
<td>$68,000</td>
<td>$115,000</td>
</tr>
</tbody>
</table>

Transportation Benefits

The most readily identifiable benefits of the recommended project list derive from their use as a connection between activity centers and residences. While no money may change hands, real savings can be estimated from the reduction costs associated with congestion, vehicle crashes, road maintenance, and household vehicle operations.

**Transportation Calculations**

The primary inputs into the health component of the impact analysis model come from five-year estimates of commute trip data from the U.S. Census Bureau.

Utilizing the same calculations for estimated increase in annual bicycle and walk trips and annual VMT reductions used in the health and environmental components, transportation-related cost savings can be calculated. By multiplying the amount of VMT reduced by established multipliers for traffic congestion, vehicle collisions, road maintenance, and vehicle operating costs, monetary values can be assigned to the transportation-related benefits. In total, an annual cost savings of $245,000, $2,648,000, and $4,438,000 is estimated for the City under Scenario 1, 2, and 3, respectively.
Table G-5: Annual Transportation Benefits

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$115,000</td>
<td>$128,000</td>
<td>$259,000</td>
<td>$356,000</td>
</tr>
<tr>
<td>$819,000</td>
<td>$914,000</td>
<td>$1,845,000</td>
<td>$2,540,000</td>
</tr>
<tr>
<td>Road Maintenance Cost Savings</td>
<td>Road Maintenance Cost Savings</td>
<td>Road Maintenance Cost Savings</td>
<td>Road Maintenance Cost Savings</td>
</tr>
<tr>
<td>$245,000</td>
<td>$274,000</td>
<td>$554,000</td>
<td>$761,000</td>
</tr>
<tr>
<td>Household Vehicle Cost Savings</td>
<td>Household Vehicle Cost Savings</td>
<td>Household Vehicle Cost Savings</td>
<td>Household Vehicle Cost Savings</td>
</tr>
<tr>
<td>$934,000</td>
<td>$1,042,000</td>
<td>$2,103,000</td>
<td>$2,894,000</td>
</tr>
<tr>
<td>Total Vehicle Costs Savings</td>
<td>Total Vehicle Costs Savings</td>
<td>Total Vehicle Costs Savings</td>
<td>Total Vehicle Costs Savings</td>
</tr>
<tr>
<td>$2,113,000</td>
<td>$2,358,000</td>
<td>$4,761,000</td>
<td>$6,551,000</td>
</tr>
<tr>
<td>Additional Cost Savings</td>
<td>Additional Cost Savings</td>
<td>Additional Cost Savings</td>
<td>Additional Cost Savings</td>
</tr>
<tr>
<td>(beyond baseline scenario)</td>
<td>(beyond baseline scenario)</td>
<td>(beyond baseline scenario)</td>
<td>(beyond baseline scenario)</td>
</tr>
<tr>
<td>$0</td>
<td>$245,000</td>
<td>$2,648,000</td>
<td>$4,438,000</td>
</tr>
</tbody>
</table>

Table G-6: Total Annual Benefits

<table>
<thead>
<tr>
<th>Annual Health Benefits</th>
<th>Annual Health Benefits</th>
<th>Annual Health Benefits</th>
<th>Annual Health Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>$105,000</td>
<td>$115,000</td>
<td>$262,000</td>
<td>$343,000</td>
</tr>
<tr>
<td>Annual Environmental Benefits</td>
<td>Annual Environmental Benefits</td>
<td>Annual Environmental Benefits</td>
<td>Annual Environmental Benefits</td>
</tr>
<tr>
<td>$55,000</td>
<td>$61,000</td>
<td>$123,000</td>
<td>$170,000</td>
</tr>
<tr>
<td>Annual Transportation Benefits</td>
<td>Annual Transportation Benefits</td>
<td>Annual Transportation Benefits</td>
<td>Annual Transportation Benefits</td>
</tr>
<tr>
<td>$2,113,000</td>
<td>$2,358,000</td>
<td>$4,761,000</td>
<td>$6,551,000</td>
</tr>
<tr>
<td>Total Annual Benefits</td>
<td>Total Annual Benefits</td>
<td>Total Annual Benefits</td>
<td>Total Annual Benefits</td>
</tr>
<tr>
<td>$2,273,000</td>
<td>$2,534,000</td>
<td>$5,146,000</td>
<td>$7,064,000</td>
</tr>
<tr>
<td>Total Additional Annual Benefits (beyond baseline scenario)</td>
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</tr>
<tr>
<td>$0</td>
<td>$261,000</td>
<td>$2,873,000</td>
<td>$4,791,000</td>
</tr>
</tbody>
</table>

Total Benefits

If all of the projects under Scenario 1 for the Englewood Walk and Wheel Master Plan are implemented, the City could experience a total of $261,000 in additional health-, environmental-, and transportation-related benefits per year. Scenario 2 could experience $2,873,000 in annual benefits, and Scenario 3 could experience $4,791,000 in annual benefits.