Analysis of Alternative Bikeway Routes through Wellfleet to Truro

PREPARED FOR TOWN OF WELLFLEET SELECTBOARD
BY WELLFLEET BIKE & WALKWAYS COMMITTEE

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Executive Summary

The Town of Wellfleet Selectboard charged the Town Bike & Walkways Committee (BWC) to conduct an analysis of bikeway route alternatives through the town to connect the end of the Cape Cod Rail Trail in the south to the Town of Truro in the north.

The BWC reviewed state and federal guidelines and similar studies in other localities. The BWC engaged stakeholder agencies for their inputs and engaged the local public for recommendations regarding alternative routes and measures of success for a Wellfleet bikeway.

The BWC developed and applied a methodical, quantitative, and computational analysis method that is rigorous, comprehensive, detailed, objective, and systematic. The analysis processes and results are fully documented in this report.

RECOMMENDATIONS

Bikeway route from the Cape Cod Rail Trail through Wellfleet to Truro

The BWC proposes two options for the development of a Wellfleet Bikeway. These options address goals including safety, practicality, user experience, conservancy, and connectivity.

Option 1, Route Z is the highest-scoring bikeway option for Wellfleet (ranked 1st of 28 routes considered). It scores "excellent" and it serves all the intended users of the Wellfleet bikeway over its entire length. It is recommended by the BWC but faces resistance from the CCNS staff, who oppose any new bikeway within the Interior Department-owned CCNS.

Option 2, Route Q_2, is the highest scoring route that avoids the CCNS (ranked 17th of 28). It scores "acceptable" but It does not serve all the intended users of a Wellfleet bikeway over its entire length.

The combined DCR and MassDOT bikeway proposal scores lowest (ranked 28th of 28 routes analyzed).

Actions by the Wellfleet Selectboard:

DCR Rail Trail

- Reject the DCR project phase 2 beyond Old County Road.
- Advocate locating the Rail Trail terminus at Old County Road.
- Provide a transit stop and large-scale secure bicycle parking at the Rail Trail terminus.

MassDOT Route 6 reconstruction programs

- Reject a shared-use-path beside Route 6, replace it with a standard pedestrian sidewalk.
- Reject the work proposed on East Main Street.
- Advocate the following:
    - Ordinary pedestrian sidewalks along Route 6 (no shared-use-path)
    - Shoulder bike lanes along Route 6 near Main Street with painted buffers and removable barriers and/or bollards
    - Intersection safety improvement, but with no other construction on Main Street
    - Sharrows painted on Main Street indicating it is a share-the-road roadway
    - Improvement of the existing pedestrian trail on the south side of East Main Street

- Continue a pedestrian walkway further into Wellfleet using context-sensitive design
- Transit stops at the DCR Rail Trail terminus and at critical points on Route 6 and in town.

DCR engagement:

- Engage the DCR closely to end communication failures. Ask specific questions and obtain clear, direct answers from the DCR regarding all current and future DCR-related projects and plans affecting Wellfleet.

MassDOT and Stantec engagement:

- Offer a date and facilities for the 25% Design Public Hearing to take place in Fall 2021.
- Request the following design documentation: Design Justification Workbook, Alternatives Evaluation Matrix, and updated environmental impact determination.
- Consider bikeway solutions in the context of improving transit networks, with special attention to the planned affordable housing area at Lawrence Road and in any areas known to particularly attract seasonal workers.

Coordination with combined state agencies:

- Appoint a qualified person to report to the Selectboard who does not work on projects influenced by either of those agencies, and is not a member of the Selectboard, to act as the Town's conduit for clear and open communication with the DCR and MassDOT regarding ongoing and future plans and projects in Wellfleet.

CCNS engagement:

An unsuitable bikeway will not mark an end to the need to meet the region's interests. Work together with the CCNS staff to resolve their legitimate concerns and enable the most suitable bikeway route.

- Advocate standard methods to reduce negative impact, including native plantings, fences, and foliage barriers.
- Advocate environmentally friendly path surface-material options, particularly for any portions of a bikeway through the CCNS.
- Create a memorandum of agreement to formally address CCNS staff concerns and restrict further bikeway development within the CCNS boundaries.
- Work with the CCNS to explore the NPS and FHWA access programs and other opportunities.

Public communication:

- Increase transparency and communication with the public to encourage input and address public concerns.
- When a decision is made regarding the final bikeway route, it should be described in full, with the reasoning, advantages, and risk mitigations fully explained.
- Schedule the 25% design public hearing for the MassDOT Route 6 project after the end of the busy summer tourist season. Ensure it is well-advertised and residents are given ample opportunity to prepare and submit comments and questions ahead of the meeting.
- Ensure the public understands the 25% design public hearing is the final opportunity for meaningful input; no significant changes will likely occur to the design beyond then.

Introduction

Cape Cod's network of bikeways continues to expand; however, the Town of Wellfleet remains largely unconnected—a missing link. The Massachusetts Department of Transportation (MassDOT), and the Massachusetts Department of Conservation and Recreation (DCR), have proposed a connected set of bikeway routes through Wellfleet that faces strong public opposition, primarily over safety concerns but also over concerns about adversely impacting the town. This opposition highlighted the need for a more comprehensive look at the bikeway route options in Wellfleet. The Town Selectboard has charged the Bike & Walkways Committee (BWC) to work with the Cape Cod National Seashore (CCNS), the Towns of Provincetown and Truro and the Cape Cod Commission (CCC) to establish the continuation of the bike trail northward into Provincetown, and to prepare a plan for future bike and walking routes through the Town of Wellfleet.

With approval by the Selectboard, the BWC undertook a comprehensive study of potential bikeway routes proceeding from the Cape Cod Rail Trail through Wellfleet to Truro. This report presents the results of that study and the recommendations by the BWC to the Selectboard.

Purpose of study

PROBLEM STATEMENT

Are there any alternative bikeway routes through Wellfleet better than the unpopular route the state proposes?

The Cape Cod Rail Trail is Cape Cod's primary bikeway spine route. It extends along a former railway bed passing through southerly towns to South Wellfleet, where it terminates. The challenge is how to continue a primary bikeway through Wellfleet northward to Truro and then on to Provincetown at the Cape's northern tip.

VISION STATEMENT FOR THIS STUDY

To determine the best connecting route for bikers and pedestrians from the Cape Cod Rail Trail through Wellfleet to Truro.

MISSION STATEMENT FOR THIS STUDY

Use an objective numerical methodology to analyze route alternatives to plan a primary, or "spine," route through Wellfleet that extends to Truro from the Cape Cod Rail Trail intersection with Old County Road. The route will attract cycling and walking on the Outer Cape, promote the town's best interests, and accommodate an interconnected bicycle and pedestrian network linking the towns of Wellfleet, Truro, and Provincetown with the Cape Cod Rail Trail, Cape Cod National Seashore, and other destinations within the three communities.

Background

TOWN OF WELLFLEET

Wellfleet, Massachusetts, is an historic coastal village on Outer Cape Cod (also called the Lower Cape), renowned for shell fishing, beaches, art, architecture, natural beauty, and its sense of quiet solitude. Situated on a narrow, sandy peninsula thrusting into the Atlantic Ocean, more than 50% of Wellfleet's land area is managed by the National Park Service's (NPS) Cape Cod National Seashore (CCNS) and other conservation land trusts. Wellfleet's summer population swells approximately sevenfold as the town welcomes seasonal visitors attracted by its quiet seaside character, diverse cultural offerings, striking seaside landscape, and distinctive recreational opportunities.

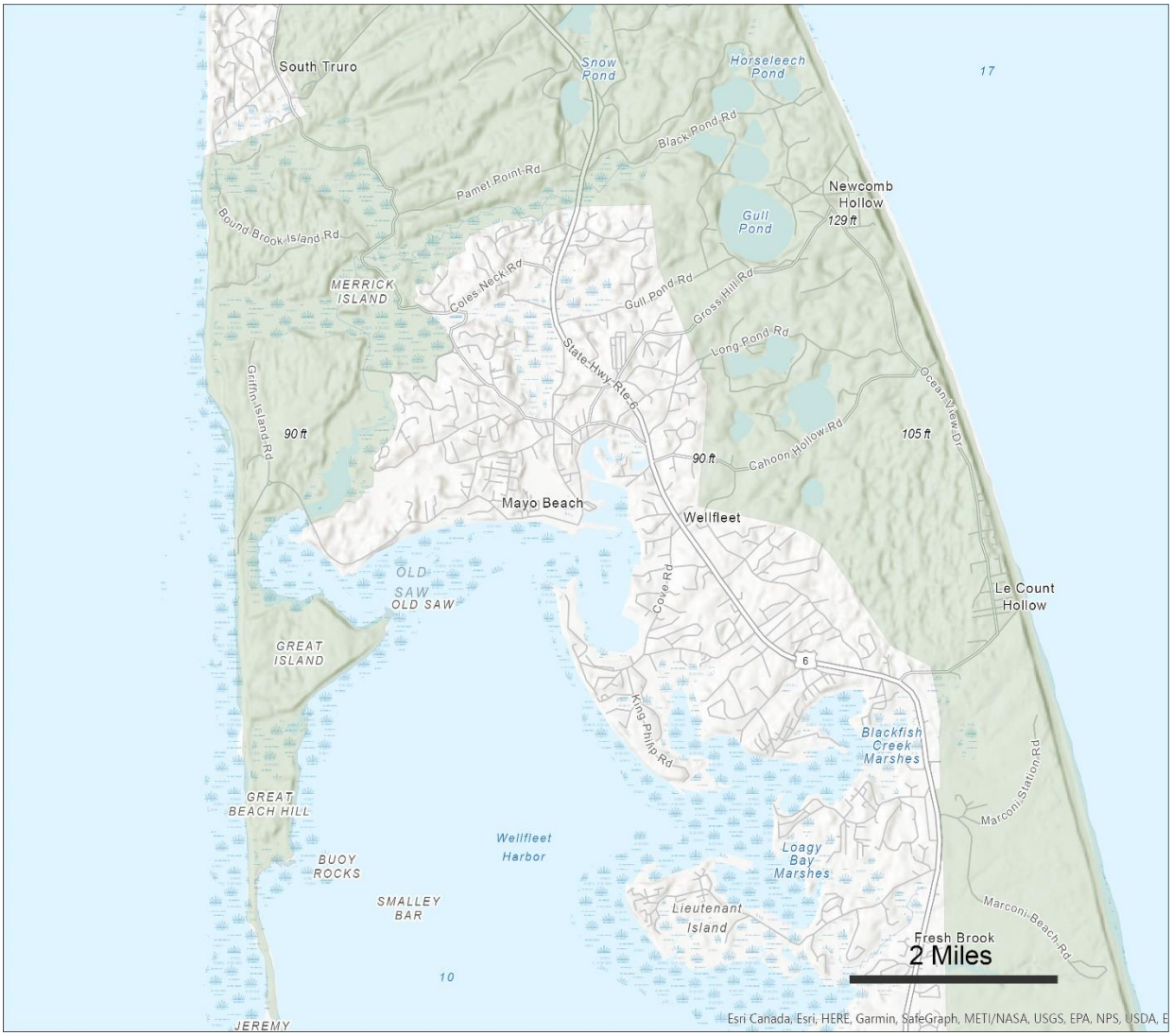

Figure 1. Map of Wellfleet. From ArcGIS

STATE & REGIONAL STUDIES FOR A BIKEWAY IN WELLFLEET

Since 1970, numerous conceptual and feasibility studies of bikeway alternatives in Wellfleet have been conducted with federal, state, and regional sponsorship. Bikeway corridors have been proposed and

debated, typically with the determination that further study is required. Three noteworthy studies—and their main points—are:

Parkwide Bicycle Trail Study and Traffic Safety (CCNS, 1987)

- "Significant increases in population and tourism in the last 30 years on the Cape have resulted in traffic congestion and bicycle/vehicle conflicts on existing roads, especially on US 6--the only major highway on the Lower Cape."
- Public survey results indicate preference for a shared-use path located away from Route 6.
- Proposed solution: A separated two-way shared-use path beside Route 6 from Wellfleet to Provincetown was the easiest option in terms of right-of-way, although the report concedes this will not serve hikers or casual cyclists. "Sight-seeing and pleasure riding would be secondary uses" and typical users would be "long-distance riders and touring groups."
- Safety is noted as a primary concern along Route 6 because of multiple at-grade crossings and the proximity of heavy motor vehicle traffic. The report also notes highway noise, traffic exhaust, and other stressors will affect the route negatively. The report does not recommend any solutions to these issues, it merely states them as facts of the situation.
- 2nd proposed option: A bikeway spine route using town-owned fire roads and/or within the CCNS, away from Route 6 to improve safety, provide a better user experience, and prevent adverse impacts to Route 6 traffic flow. However, right-of-way complexity makes this a runner-up to the Route 6 recommendation.

Integrated Bicycle Plan for Cape Cod: Bicycle Feasibility Study in Partnership with the Cape Cod Commission (CCNS, 2010)

In which the CCNS identifies the need to:

- Improve bicycle and pedestrian access to destinations and attractions within the CCNS.
- Enhance safety by eliminating the need for bicyclists and pedestrians to travel along Route 6.
- Provide a transportation alternative to facilitate non-motorized mobility and access to a significant number of Outer Cape destinations, thereby reducing traffic congestion, parking demand, and the associated environmental and sensitive land impacts.
- Develop a plan to incorporate walking and bicycle paths, dirt roads, and trails owned by the Town, the CCNS, and private conservation groups into one coherent system.

Outer Cape Bicycle and Pedestrian Master Plan (CCC, 2017)

The Outer Cape Bicycle and Pedestrian Master Plan (OCBPMP) states:

- "More detailed evaluation of possible route designs between the Wellfleet railbed and the Route 6/Main Street area in Wellfleet is needed. … given public concern about this portion of the primary route, the project team recommends further study to identify the most suitable option" (CCC, 2017, pp. 42-43).
- "Further study is needed to identify the best route for bicyclists" through Wellfleet (CCC, 2017, p. 47).
- No impact analysis was performed on several options within the CCNS lands. Upon recommendation from the CCNS staff, those routes were pre-emptively designated as

"considered and dismissed" before the CCC analysis was conducted. The CCNS cited potential "implementation difficulties" that would require "invoking the federal rulemaking process," and recommended seeking a suitable bikeway that "simplifies the implementation process" (CCC, 2017, p. 36-37).

STAKEHOLDERS

Development of a Wellfleet bikeway is influenced by several government agencies and other organizations within the state and local community. The BWC reached out to engage all the government agencies listed below and sought public input as this study was performed:

Table 1
Wellfleet bikeway stakeholders

Category	Description
Town of Wellfleet government departments	Town Administrator Police Department Fire & Rescue Department Department of Public Works (DPW) Recreation Department Beach Department Council on Aging
Town of Wellfleet boards & committees	Selectboard Bike & Walkways Committee Planning Board Conservation Commission Historical Commission Library Trustees Wellfleet Elementary School Committee
Neighboring town committees	Truro Bike and Walkways Committees Provincetown Bicycle Committee
Regional agencies	Cape Cod Commission (CCC) CCC Metropolitan Planning Organization (MPO) Region D representative
State agencies	Massachusetts Department of Conservation and Recreation (DCR) Massachusetts Department of Transportation (MassDOT)
Contractors	Designers (Stantec) Construction companies
Federal agencies	Cape Cod National Seashore (National Park Service)
Members of the public	Wellfleet residents Owners of property abutting proposed bikeway routes Wellfleet business owners Neighboring town residents Seasonal workers Visitors/vacationers

OPPOSITION TO THE STATE'S PROPOSED BIKEWAY

Proposed bikeway route

The Cape Cod Rail Trail, built and maintained by the DCR, utilizes a rail bed right-of-way on much of Cape Cod. The available rail bed right-of-way ends where it meets Route 6 in Wellfleet. The DCR plans to terminate the Cape Cod Rail Trail bikeway in a large terminus parking lot alongside Route 6 in Wellfleet. (Wellfleet Town Media, 2020).

Continuing from the DCR Rail Trail terminus on Route 6, MassDOT proposes several bikeway features proceeding along Route 6 to the Route 6-Main Street intersection approximately ½ mile away, including 1) a pedestrian sidewalk on the west side of Route 6; 2) a ten-foot wide shared-use bicycle/pedestrian path on the east side of Route 6; and 3) shoulder bike lanes on both sides of Route 6 which will proceed northward to Truro. Turning toward Wellfleet's village center, MassDOT plans to widen and reconstruct the first 450 feet of Wellfleet's quaint Main Street to accommodate shoulder bike lanes and a sidewalk, which will widen the Main Street corridor approximately 17 feet. The Main Street cycle and pedestrian facilities will terminate after 450 feet (Wellfleet Town Media, 2020).

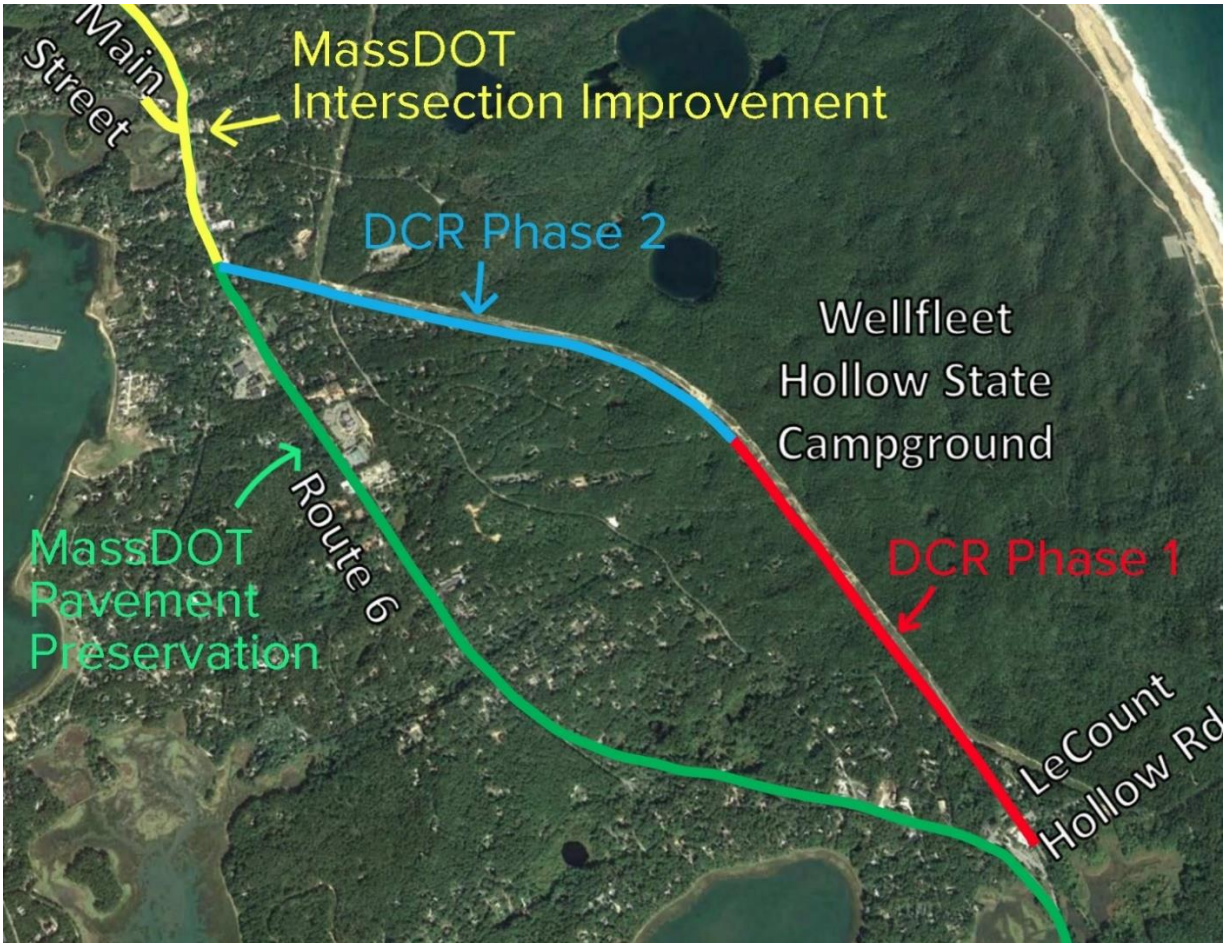

Figure 2. DCR and MassDOT plan for bikeway and pedestrian accommodation. From MassDOT & DCR presentation to Selectboard (March 10, 2020)

Overview of public opposition to state plan

The DCR and MassDOT bikeway plans have generated strong local opposition over concerns regarding public safety, environmental impact, and the negative effect on Wellfleet's character. The main arguments are summarized as follows:

- *Safety*- it is dangerous and impractical to encourage increased bicycle and pedestrian traffic along a congested, accident-prone stretch of highway. Although it is a rural area, that section of Route 6 crosses a dense cluster of high-traffic commercial driveway curb-cuts. This creates a dangerous situation for drivers, cyclists, and pedestrians alike.
- *Environment*- the DCR plans have already proceeded and removed many trees (which some members of the public consider excessive); the MassDOT plans will have direct impact to the Duck Creek marsh, including construction within the bounds of the marsh and tree removal within the marsh border, as well as tree removal on the affected private properties.
- *Town character*- Wellfleet is a small, rural community noted for shell fishing, artists, and services to summer visitors. In order to maintain and enhance this careful balance, bikeway designs must consider local context. The MassDOT plan has been criticized as both overly "suburban" and an attempt to "urbanize" Wellfleet. In fact, MassDOT has formally designated the small fishing village's roadways as "Urban Arteries" for program justification purposes.

At the Annual Town Meeting in April 2019, town voters voted nearly unanimously to approve Article 44 requesting the Selectboard to "…consider alternate routes for the Bike Trail Extension and to ask appropriate agencies of the Commonwealth to halt any planning or construction beyond Old County Road until those deliberations have occurred." The Town Meeting vote was followed by a petition sent in November 2019 to Governor Baker with 1,327 signatures opposing the state's bikeway plans in Wellfleet and requesting alternative routes be evaluated (Concerned Citizens, 2019). With further input from Cape Cod's state legislators, the state agencies delayed their project plans while the town prepared subsequent steps.

Town-State correspondence

On 26 Aug 2020, the Town of Wellfleet Selectboard sent a letter to Governor Baker calling the DCR's bikeway plans in Wellfleet "a serious ongoing public safety concern" and stating, "we request DCR postpone any further construction or planning of the bike trail extension beyond Old County Road" so that the town, state agencies, and others could "seek alternative routes and safely continue the Cape Cod Rail Trail through Wellfleet" (see Appendix A1).

Subsequently, on 24 Sep 2020, the DCR Commissioner sent a letter to the Selectboard Chair. With respect to extending the Cape Cod Rail Trail from Wellfleet Hollow Campground to a new terminus on Route 6, the DCR Commissioner wrote, "we have placed those plans on hold at this time." Regarding alternative routes, the DCR Commissioner wrote, "while we appreciate your desire to explore alternative shared-use pathway routes…," DCR "would defer any feasibility studies to the Town and other parties" (see Appendix A2).

Current project status

It is important to note that, although the state agencies' projects would create a continuous bikeway in Wellfleet, the DCR and MassDOT portions of the project are managed as separate efforts. They have coordinated their project schedules, but they have separate budgets and resources.

DCR project – paused but ready to move forward

At the time of this report (August 2021), the DCR Rail Trail Extension is being constructed from the Rail Trail's former terminus in South Wellfleet as far as the DCR-operated Wellfleet Hollow Campground in Phase 1 of their project (see Figure 2). The DCR has also begun construction at the site of their planned Phase 2 terminus, miles away from Phase 1 construction, removing trees and buildings and leveling the proposed terminus parking lot area. According to the DCR (Wellfleet Town Media, 2021), this construction at the Phase 2 parking lot site is not related to the paused Phase 2 portion of the project, and Phase 2 is not yet included in DCR's near-term plans. However, the DCR advocates carrying on with Phase 2 as proposed, despite the strong and consistent public opposition it continues to generate.

MassDOT project – nearing 25% design review, which will finalize basic design

The MassDOT proposal, interchangeably called the "Route 6 Pavement Preservation" project and "Route 6/Main Street Intersection Improvement" project, is currently at the 25% design phase. Though the design has met significant opposition, advocates of the plan continue to apply pressure to move forward based on incomplete information.

These misleading arguments (and important rebuttals) are as follows:

"This is only the 25% design" – The "25% design" nomenclature is misleading. According to MassDOT's Design Process Flowchart, at the end of the 25% design phase, the major details of the design plan are final; all subsequent design changes refer to engineering specifications. Once the 25% design is approved, the project will move to the 75% design phase (construction details) and then the 100% phase, which finalizes cost estimates, etc. (MassDOT, 2006, p. 79). The upcoming 25% Design Public Hearing is the final opportunity for meaningful input and must be approached with the understanding that no significant changes will likely occur to the design beyond then. Unless the designer agrees to make changes and resubmit the design as a result of the meeting, the project will proceed with the current plans despite public opposition.

"Wellfleet could lose $10M in federal funding" – Projects like the MassDOT Route 6 reconstruction compete against each other regionally at the Cape Cod Commission for prioritization based on public need and readiness to move forward. This project is one of several on an integrated priority list of multi-year infrastructure programs on Cape Cod. The list is continually reviewed and edited through a well-defined programming process to ensure priority needs are met and programs are well-developed for execution; changes in programming schedules occur all the time. There is no "falling off the list" for a high-priority need (such as the Route 6/Main St intersection improvement); there is merely a schedule change within the list. MassDOT's newly expressed project urgency is a direct contradiction to their past behavior—they have spent years growing the project scope instead of implementing an intersection fix.

"Wellfleet could lose the opportunity to improve the Route 6/Main St intersection" – Opposing the current design will not eliminate the opportunity to improve intersection safety. The need for

intersection improvements is undisputed; the real issue is that over several years since the "urgent" safety need was identified, MassDOT has failed to implement any fixes. Instead, it has grown the project scope beyond recognition to an unrequested multi-million-dollar highway and bikeway based on availability of more federal tax dollars. MassDOT has designated Route 6 and East Main Street as "urban" arterial roadways, which gives the project different budget thresholds than the more appropriate "rural" designation.

"There is an option to end the project without changes to Main Street" – This is misleading. Any "option to end the project" will not be exercised by government agencies primarily motivated to obtain budget increases and federal transportation dollars. The funding opportunity, not the resultant shoulder bike lanes on East Main Street, seems to be the goal. Note that within the last year, MassDOT's project cost estimate grew from approximately $7M to $10M.

"The design will tie into a future Town-planned sidewalk project" – It appears some in the Town Government are counting on the MassDOT project to succeed and are planning to refit Wellfleet's narrow historic lanes—specifically beginning with Main Street up to East Commercial Street and West Long Pond Road —with suburban sidewalks. The MassDOT project seems welcomed by some as the beginning of a longer-term roadway overhaul in Wellfleet with hopes for more federal funding. Again, the motivation seems to be agency and project budget growth rather than the interests or wishes of Wellfleet's residents and visitors who expressly oppose this kind of heavy-handed development.

NEED FOR ANALYSIS OF ALTERNATIVE ROUTES

Careful consideration of prioritized needs is critical to ensure a bikeway is a worthwhile investment and an improvement rather than a hindrance to a locality. Past bikeway feasibility studies for Wellfleet recommended further evaluation is needed. The state's bikeway proposals near Route 6 have received continuous and well-documented opposition from Wellfleet residents who must live with the consequences of the resultant bikeway and pedestrian facilities.

The Selectboard's charge to the BWC to conduct this study arises from the need to:

- Complete the detailed evaluation called for by previous bikeway studies, resulting in a comprehensive view of the Wellfleet bikeway issue supported by both objective data analysis and real-world context.
- Create transparency and build public trust in the bikeway planning process.
- Provide actionable recommendations for the Town to proceed with regards to state proposed plans.
- Engage with other agencies to identify positive, realistic, and workable next steps in pursuit of a Wellfleet bikeway.

This report is provided as a tool to strengthen the Selectboard's position in dealing with the state and other agencies as they determine how to proceed.

Bikeway planning principles

This report builds upon previous regional studies conducted by the CCC (2017) and the CCNS (2010), both of which were developed with inputs by state agencies, and which cite state and federal guidelines.

The BWC recommends reading those reports for their wealth of relevant material not repeated here. As an extension of those previous efforts, this local town study follows the same guidelines. The BWC also reviewed a large and diverse collection of bikeway studies conducted in various municipalities around the US and in Europe. For a full list of those resources, see Appendix B. The following fundamental points are worth highlighting.

TYPES OF BIKEWAYS & PATHS

Shared-use path

Also called a multi-use path in the OCBPMP. These are broad two-way paths separate from roadways with minimal vehicle crossflow, supporting the needs of cyclists, pedestrians, and diverse other types of users (CCC, 2017; MassDOT, 2006). For example, Cape Cod Rail Trail. Minimum 10' wide (MassDOT, 2020).

Shoulders

Bike lane borders are painted on the paved shoulders of the road. Each shoulder accommodates one-way bike traffic. Such lanes accommodate cycling but do not provide physical safety protections except a painted border and or painted buffer area (CCC, 2017), and sometimes bollards and/or physical barriers. They are sometimes accompanied by sidewalks to accommodate pedestrians. Shoulder bike lanes are often preferred by long-distance, experienced cyclists, in part because they are less used by novice cyclists or families. Examples exist in north Wellfleet and Truro along Route 6. Minimum 5' wide (MassDOT, 2020).

Share-the-road

These pathways mix bicycle and vehicle traffic in the same lanes and are suitable for light-traffic secondary roadways on which motor vehicle traffic dangers are minimal. If the roadway is paved, "sharrows" are painted on the surface. Share-the-road accommodations are a particularly appropriate option where narrow roads do not allow for separate bike lanes, provided there is minimal cross-traffic from driveway curb-cuts and intersections (CCC, 2017). Collins Road in Truro is a fine example of a share-the-road bikeway; Collins Road also happens to be a potential end point for the Wellfleet bikeway.

Sidewalk

A path that borders a street that is intended for pedestrians, not other users (e.g., cyclists). These are often separated and protected from the road by a planted buffer area, a raised curb, or other physical barriers (MassDOT, 2006). There are many examples of sidewalks throughout Wellfleet.

TYPES OF BIKEWAY USERS

Bikeway users have varying needs and expectations from a bike path. Users often have different goals, biking abilities, and comfort levels on different path types. Users can be broadly divided into two groups—purposive and recreational—with similar needs but different priorities.

Purposive users

"Purposive" bikeway users are typically interested in arriving at a destination at a particular time with minimum delay or complication. They are also called "utilitarian" riders (CCC, 2017) or commuters, as

they generally use the bikeway to travel to work, class, or for other errands. Purposive users also include athletes seeking to achieve time or distance cycling goals; their cycling is goal driven rather than recreational. Purposive users prioritize direct and efficient routes with few interruptions, stops, speed changes, or features or hazards that interrupt their progress.

In Wellfleet, a purposive user category particularly mentioned by bikeway advocates is seasonal workers who may not have access to other transportation. There is no comprehensive data available showing the annual numbers of seasonal workers, the numbers who do/would bike to work, or where they live and work while in Wellfleet. This makes it challenging to determine their needs, but nonetheless they must be considered. It is worth noting that public transportation can be developed as a better alternative for this group.

Recreational users

"Recreational" bikeway users are typically interested in unhurried leisure experiences, often combined with social or exercise goals. They are typically tolerant of sharing the path with a diversity of user experience levels and abilities (CCC, 2017). They include inexperienced or occasional cyclists, walkers and joggers, skateboarders, parents with small children or pets, teenagers, walkers with visual or other disabilities, and people in wheelchairs or other conveyances that enable people with disabilities to use the path. They prioritize safety and a low-stress user experience and are generally less comfortable near high-volume motor vehicle traffic.

In Wellfleet, recreational cycling may include some travel through Wellfleet's historic center but is likely to occur away from high-traffic areas. Wellfleet's seniors and vacationing families are likely to prefer safe, low-stress trails like the Cape Cod Rail Trail, travelling with minimal vehicle cross traffic or other stressors.

THE VALUE OF BIKEWAYS

Environment and quality of life

Bikeways invite environmentally friendly transportation modes. Cycling and walking reduce reliance on internal combustion engines, promote clean air and water, and reduce carbon footprint. Cycling makes healthy exercise accessible to a diverse range of age and ability groups.

A well-planned and well-placed bikeway can improve public safety and lifestyle options for residents and visitors. Such a bikeway promotes safe and confident cycling transportation and can provide a quality improvement consistent with Wellfleet's character, including environmental conservation. Such a bikeway contributes to an infrastructure that honors Wellfleet's heritage and prepares it for the future.

Transportation infrastructure

Bikeways promote socioeconomic independence by contributing to an infrastructure that enables choice from a greater range of transportation options. A properly situated and designed bikeway enables people to make more efficient personal mobility choices from a greater array of good options.

MassDOT's Healthy Transportation Policy (2013) is a call to improve biking, walking, and transit (e.g., public transportation) opportunities. In Wellfleet, seasonal workers and others with limited travel means could benefit from a safe transportation infrastructure that offers biking, walking, and public

transportation options. Wellfleet is also pursuing construction of affordable housing; a well-considered transportation network can play a key part in supporting that project.

Economic value

Investment in a properly developed and situated bikeway route linking Wellfleet with the other Cape Cod towns can pay off by increasing visitor volume without increasing congestion along motor roadways. Cyclists from other towns along the Cape will be more likely to visit Wellfleet if a safe, connected bikeway is well-planned to attract use and take advantage of Wellfleet's exceptional qualities.

Any economic gain will reflect the quality of the bikeway, not the amount spent on its construction; a high-stress bikeway that attracts few users will not generate return on investment. If Wellfleet is going to build a bikeway, then remember the key cost difference is not between a good route and doing nothing, it is between a good route and a bad route. "Cost per user" is an informative measure of successful infrastructure investment. It is poor economics to build an unsafe bikeway no one wants and few use. A lower cost high-stress bikeway is not a bargain compared to a more expensive popular bikeway that attracts thousands of cyclists (and keeps them off the roadways).

Equity

Bikeways promote socioeconomic equity when they embody the principle that everyone's transportation needs count. They achieve the greatest equity when they are designed and situated to attract use by–and accommodate the needs of–the most inclusive range of user groups.

In Wellfleet, the silent groups with underserved cycling needs include seasonal workers, children, the elderly, and those with accessibility limitations. Wellfleet's bikeway solution should serve the needs of those groups. A bikeway poorly situated, manifestly dangerous, or stressful does not lift up any segment of society.

BIKEWAY PLANNING CONSIDERATIONS

Bikeway feasibility and planning must be approached with a full sense of the local conditions and the needs of potential users. Research indicates the basic principles which indicate route feasibility include:

Safety

MassDOT's (2020) policies prioritize "safe, comfortable, and convenient" transportation solutions that "eliminate bicyclist [and] pedestrian fatalities and serious injuries." It is well-understood that motor vehicles pose a significant danger to cyclists; they are larger, faster, and even vigilant drivers may not see or react to a cyclist. Even at speeds as low as 30mph, a driver's cone of vision is significantly diminished, posing a serious risk of injury to any cyclist or pedestrian in or near the roadway (MassDOT, 2020). The safest bikeways physically separate users from motor vehicles. They employ distance or physical barriers and avoid areas for cross-traffic such as intersections and driveway curb-cuts.

Complete separation, such as on shared-use paths like the Cape Cod Rail Trail, is not always an option. Bike lanes along roadway shoulders and share-the-road "sharrows" can be appropriate depending on the volume, speed, and crossflow of traffic (CCC, 2017). However, neither provides for pedestrian safety and neither is safe in heavy or fast-moving traffic, or where there are many instances of cross-traffic.

Curb-cut (driveway) density

A bikeway that crosses several high-use curb-cuts within a short distance poses safety hazards to both users and motor vehicle traffic. Such a convergence forces cyclists, pedestrians, and drivers together suddenly in the same space without awareness or ability to react appropriately.

Along the stretch of Route 6 in Wellfleet where MassDOT plans a shared-use path, there are many high-traffic commercial driveways within a short distance (CCC, 2017). The high-volume of summer traffic along Route 6 means drivers frequently must wait to turn into or out of these driveways. Those areas create risk of accidents when drivers misjudge the flow of traffic. Adding a shared-use path with cyclists and pedestrians will create added stress, distraction, and danger for all involved.

Public acceptance

Public acceptance is a key component of successful bikeway development (FHWA, 2015). As discussed above, a bikeway creates value if it is actually used. This use depends not only on the suitability of the completed bikeway, but also on the public enthusiasm and acceptance during the planning process. If the public knows local concerns have influenced the design, they are more likely to support (and be users of) the bikeway. To this end, public forums and other input are a vital part of the process.

Another factor in public acceptance relates to path user stress-levels. Several stress factors, including traffic proximity, noise, pollution, and the perception of safety, impact the public's willingness to use the bikeway. MassDOT (2006) indicates many users, particularly less experienced cyclists, recreational cyclists, the elderly, and children avoid high-stress routes. These are significant demographic groups in Wellfleet, so the planned bikeway needs to minimize factors that create stress and deter path use.

Accessibility

In consultation with the Cape Cod Commission, the BWC identified two fundamental features to consider for assessing accessibility for alternative routes: path grade angle and path width.

Path grade angle- Ideally 5 degrees or less (DCR, 2019), however steeper angles may occur over short distances, as detailed in DCR trail design guidelines, and as already exist on the Rail Trail and similar off-road bikeways in the state. Technical solutions are available to reduce steep grades when necessary (i.e., stair-stepping or switchbacks).

Path width- Ideally a bikeway has a minimum width of five feet width per direction of travel (MassDOT, 2020). The BWC thus used ten feet as a desirable width for a two-way separated bikeway, plus a two-foot-wide shoulder on each side. Other accessibility provisions are best addressed during the technical phase of bikeway design.

Practicality

A route's practicality is based on many factors during the planning and construction phases, and later concerning use and maintenance. Initially, practicality is dependent on features such as constructability, affordability, and the authorization process. The choice of the bikeway route will suggest agencies to be involved, and since there is considerable interest in finally completing a connected bikeway along Cape Cod, it is likely state agencies will have motivation and jurisdiction to contribute funding. Many construction details—surface materials, for example—are left to the design phase, and are expected to

follow state-of-the-art practices in keeping with the precedents set by the Cape Cod Rail Trail and other Cape Cod bikeways.

Practical considerations for a bikeway include the impact on roadway traffic. A shared-use-path across curb-cuts along the east side of Route 6 is likely to impact northbound traffic flow through Wellfleet and consequently to Truro and Provincetown. When the population of Wellfleet increases at least seven-fold in the summer, traffic increases accordingly, most evidently on Route 6. According to the Wellfleet Police Department, summer traffic on Route 6 is the primary cause of traffic accidents and fatalities in Wellfleet.

Finally, the practicality of a Wellfleet bikeway as a transportation route depends on usability as influenced by seasonal weather. In Wellfleet, a bikeway would primarily be useful from around mid-May to mid-November, when the weather is generally mild. Cycling is less practical during the Cape's long winters. In planning for purposive users, it must be considered that for roughly half of each year, biking and walking are less feasible transportation options.

Conservancy

A bikeway should be compatible with its surroundings, not damage them. Wellfleet attracts residents and visitors who value the town's distinctive qualities, and any changes to the local transportation infrastructure—including a bikeway—should consider the impact on the character of the area. The town's architecture and layout reflect its long history as a shell-fishing and sea-faring village. Tourism grew from the late 1800s to become a major economic force in Wellfleet due to its appeal as an historic, seaside village with natural and diverse cultural offerings.

Wellfleet property owners rightly wish to protect their private interests, and visitors generally do not wish to see Wellfleet's charms lost through poorly conceived infrastructure projects; Wellfleet's narrow historic lanes are not a congruous setting for paving new bike lane shoulders. Bikeway planning for Wellfleet must place a high priority on preserving the qualities that make Wellfleet special to both residents and thousands of annual seasonal visitors.

Wellfleet's geography and relationship with the CCNS create unique environmental conservation considerations. Wellfleet occupies a narrow portion of Cape Cod's outer arm, ranging from 1.5 to 5 miles in width (see Figure 1). The developed, populated area of the town is virtually surrounded by the CCNS, which has special protections. This layout allows for only a narrow corridor of potential bikeway routes, which makes it especially challenging to find a suitable connecting route to Truro. Even outside of the protected CCNS lands, tidal marshes and other fragile features border many roadways and must be considered where bikeway construction is proposed.

Demographics

A bikeway should be suited to the community it aims to serve. As a summer destination, Wellfleet's population is highly variable. The groups to consider in developing Wellfleet's bikeway include:

Seniors

Cape Cod's year-round resident population is older than the national and state averages (CCC, 2017). Seniors, especially those with disabilities or who need assistance, are more likely to use low-stress, safe trails for recreation. Many would be entirely excluded from unsafe or high-stress bikeways.

Young families

These include residents with children and the large influx of summer visitors. They include recreational bikeway users with widely ranging ages, skill and comfort levels. It is worth bearing in mind that interest in cycling—especially purposive cycling—often begins with recreational cycling at an early age. Recreational cycling teaches cyclists the skills and confidence they need. A bikeway that is safe for young families is a training ground for future skilled, confident cycle commuters (Biking About Architecture, 2016).

Seasonal workers

This group primarily includes young people, many of whom come from abroad and are only in Wellfleet for a few months. They are likely to use bikeways recreationally—to enjoy their time on the Cape—and purposively—for transportation to and from work. These workers sometimes misconstrue US conventions for pedestrian and bicycle traffic and are more likely to use what is considered the wrong side of the road (CCNS, 2010).

Athletes

Some residents and visitors already use the shoulders along Route 6 for cycling in Wellfleet. They are predominantly well-equipped and seemingly experienced. These individuals are considered purposive users and tend to avoid the Rail Trail because of congestion from pedestrians, families, and other slow-moving users (Wellfleet Town Media, 2020). They also tend to be confident and aware of "rules of the road" when riding near motor vehicles. Safety precautions are still critical—even when cyclists know the rules, drivers may not.

Motorists

Although not strictly bikeway users, the driving population has a direct impact on the safety of cyclists and pedestrians in proximity to the road. According to the Cape Cod regional transportation plan, an increasing percentage of drivers on the Cape are seniors experiencing declines in vision, reaction time, and "dividing attention between potential conflicts and traffic information" among other age-related deficiencies of which most elderly drivers are not self-aware (CCC, 2015). This increases the risk from mixing bikes, pedestrians, and motor vehicles—more so than in a location with a younger demographic profile. Additional driver-related dangers are introduced in the summer, with an influx of visitors unfamiliar with the area and perhaps unaware they need to look out for cyclists. Visitors are more likely to be distracted by navigating unfamiliar roads, finding directions, etc., which leaves less attention for noticing bikes and pedestrians along the roadside and in cross-traffic areas.

Bikeway study analysis method

The BWC's analysis methods are presented to provide the study's logical scheme, to establish the study's validity and reliability, and to justify the chosen techniques.

EMPLOYING ANALYTICAL "BEST PRACTICES" AND LOCAL INPUTS

Fundamental Principles

The BWC analysis adheres to the fundamental principles while developing its analytical methods and identifying candidate bikeway routes:

The bikeway must:

- Use the extensive work of our regional, state, and federal stakeholder agencies as a guide.
- Embody the spirit of bikeway development accomplished so far on Outer Cape Cod.
- Promote cycling and public safety.
- Protect the environment, preserve the town's character, and respect private property interests.
- Minimize disruptions, interference, and safety impacts on Wellfleet's existing transportation network, particularly the primary motor vehicle traffic arteries upon which its residents and economy depend.

This analysis is anchored by qualities of sound research and analysis, and is:

- *Rigorous* - exhaustive, thorough, and accurate.
- *Comprehensive* - assessing all aspects of the alternative routes.
- *Detailed* - precise and careful.
- *Objective* - not influenced by personal opinions.
- *Systematic* - using a fixed methodology; all the route ideas received were evaluated using the same analysis criteria

Public engagement

The BWC engaged in open public interaction throughout the analysis process, including bi-weekly public Zoom meetings, with detailed meeting minutes posted online at the Town website. The BWC explicitly invited open discourse with the public in every meeting and repeatedly engaged the public for inputs regarding bikeway goals, objectives, and route recommendation. Respecting private property interests was an important objective of the analysis scoring methodology, and potential abutters were actively encouraged to provide input. In addition, the BWC collaborated with state and local agencies to ensure all stakeholder input was considered.

Transparency

Transparency was considered critical throughout the study, both to ensure objectivity and to enhance the usefulness of the study. The BWC applied an open, scientific approach to analyze every proposed alternative--regardless of its location—in an unbiased, replicable goals-based study that scores each specific alternative route using a universal set of goals, objectives, and criteria.

Key guidance sources

State and regional partners

These are the state and regional agencies which regularly propose and evaluate bike trail solutions on Cape Cod, including: MassDOT, the DCR, and the CCC, which are guided by US federal guidelines and MA state guidelines. The BWC study benefited greatly from these agencies' wealth and breadth of

knowledge and experience. Two major lessons from studying these agencies' prior analytical approaches are 1) how crucial it is to apply a rigorous approach for evaluating alternatives against goals and 2) to invite community participation.

Successful municipal bikeways around the globe

The BWC reviewed published reports of municipalities and regional authorities across the US and in Europe who analyzed alternative bikeway routes. Whether considering crowded city streets, rough mountainous terrain, or pristine landscapes, these bikeway studies demonstrate the best results come from neutral objective approaches which carefully and rigorously consider all the alternatives against a set of carefully developed goals, objectives, and evaluation criteria, with abundant input from the community. The best analyses preserve traceability from high-level goals down to the lowest-level evaluation criteria.

Wellfleet bikeway stakeholders

These include the stakeholder agencies; the citizens of Wellfleet and other interested parties who have offered open meeting inputs, written correspondence to the Selectboard, and online written inputs to State agencies; the intended users of the bikeway, as represented through the Committee's research on community needs and preferences; the relevant Town of Wellfleet departments, boards and committees; other organizations with vested interests, such as the CCNS, the corresponding Bike & Walkways Committees in Truro and Provincetown, the DCR, MassDOT, and CCC.

SELECTING ALTERNATIVES TO BE EVALUATED

Selection of routes

Other bikeway studies emphasize the value of community participation. Recognizing that, the BWC invited the public to suggest routes for the bikeway. All alternatives considered in this analysis were proposed by members of the public, stakeholder agencies, or identified in previous studies. No alternative was eliminated from consideration.

No route alternatives in this study originated with BWC members, and committee members did not play favorites with the received suggestions. The identities of the individuals or agencies proposing each alternative remained anonymous throughout the study, allowing each route to stand on its own merits.

The proposed routes cover a wide range of territory and are considered representative of the reasonable options. The BWC scored the alternatives side by side in an unbiased analysis of their attributes, both good and bad.

A total of 32 alternatives were examined in this study (see Appendix D). Some suggested routes did not represent an end-to-end solution for a bikeway through Wellfleet. However, no suggestions were eliminated from the study and the four incomplete route suggestions—or more accurately "spurs" off the main route—were also assessed. There are 28 complete end-to-end routes referred to by randomly assigned letters (i.e., Route A, Route Z). Two routes, Q_2 and R_2, were added during the analysis as the data highlighted opportunities to refine the original Q and R routes (which are still included as Q and R).

Selection of segments

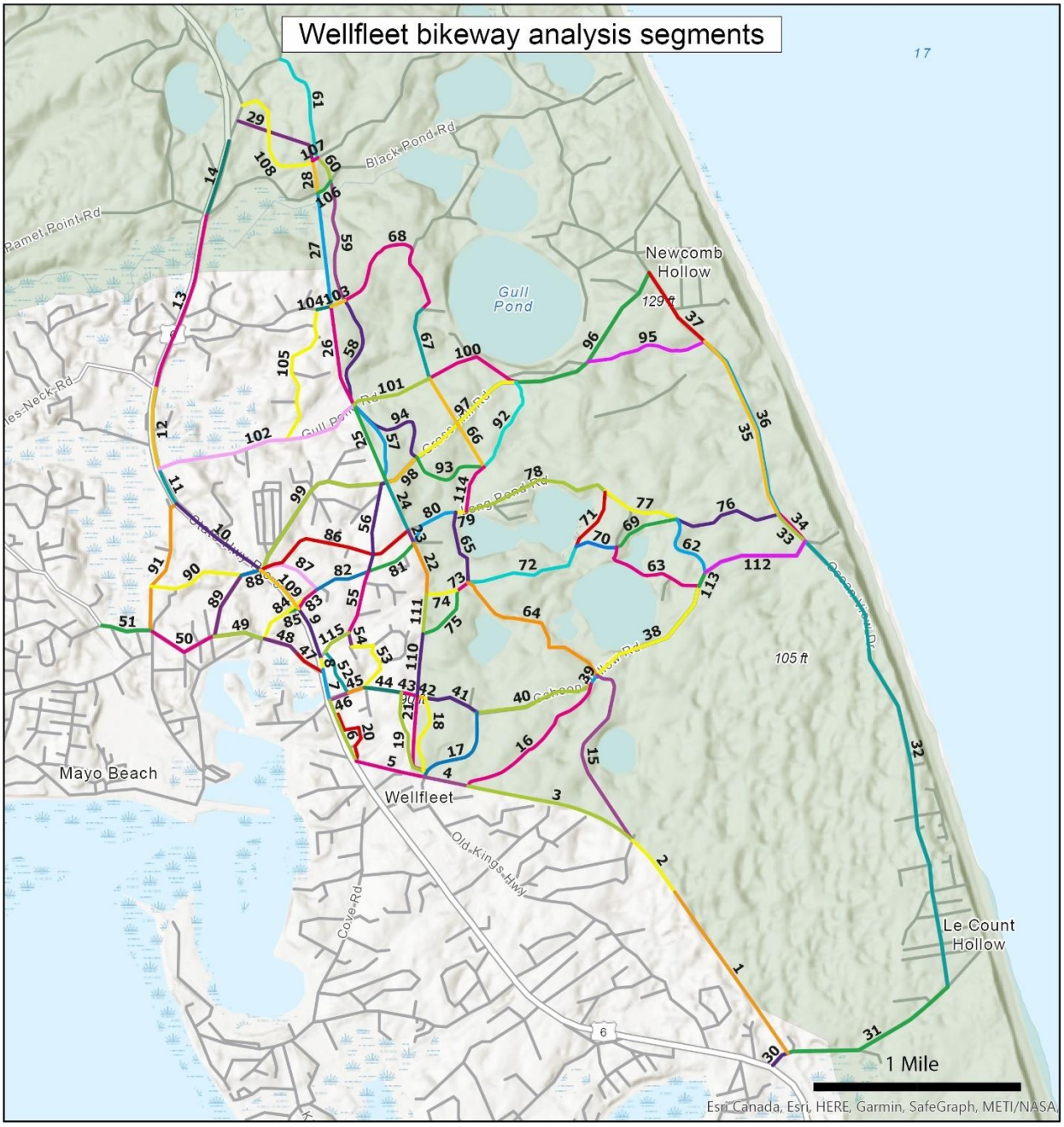

Figure 3. Map of Wellfleet bikeway analysis segments
Note. See Appendix E for details of each segment

To facilitate analysis, the proposed routes were broken into distinct pieces—called "segments"—based on natural split points. These include intersections where routes can take different directions, or at points where a trail changes enough to warrant being scored separately (e.g., where pavement ends).

Several of the segments are used in multiple routes. Some segments are not used in any route; the BWC included these because they appeared in past bikeway studies or because they are adjacent to route

alternatives. The BWC judged it valuable to score all potentially relevant segments so that, if other routes or spurs are proposed in the future, a baseline of analysis is already available.

There are a total of 115 segments analyzed in this study. They are referred to numerically (e.g., segment 1). The numbering is not assigned in any particular order.

DEFINING GOALS, OBJECTIVES, & CRITERIA

The BWC identified goals, objectives and scoring criteria within the following guidelines:

Goals

The BWC identified clear, non-overlapping goals to be satisfied by the route. These goals fully reflect the intent of the vision and mission statements and address the primary motives for determining the best possible path. There are five goals identified in this study:

- *Safety.* The hazards of exposure to motor vehicle traffic and bike path problems can be minimized.
- *Practicality.* The bike path will be reasonable to build and maintain, direct in its course, and with negligible adverse impact to traffic congestion on roadways.
- *User Experience*. The path will provide an interesting, satisfying, and supportive experience for all the diverse intended users, both recreational and purposive.
- *Conservancy*. The path will have minimum impact on private property and on Cultural, Scenic, Community, or Environmental areas or values.
- *Connectivity*. The path will facilitate high connectivity with cultural and community centers, off-path services, and off-path established scenic areas, with all the necessary infrastructure to promote wayfinding and encourage increasing usage.

Objectives

For each goal in turn, the BWC developed two to five specific objectives that mark progress to achieving the goal. The objectives represent all that is intended by the wording of the goal, and they do not overlap. There are 18 objectives derived from the study goals. Table 2 (below) includes an overview of the 18 objectives.

Criteria

For each objective, the BWC identified two to six criteria as measurable elements of success. Criteria are non-overlapping, and taken together, fully reflect how well an objective is met. These are the elements assessed, scored, and compiled to find the most suitable bikeway route. There are 60 criteria derived from the study objectives.

This study has preserved traceability between analysis goals and evaluation criteria, ensuring the criteria reflect the goals.

In this study, criteria are referred to by their goal, objective, a number (e.g., Criterion 1.a.1, Cr 1.a.2).

See Appendix C for a detailed discussion of the analysis goals, objectives, and criteria.

WEIGHTS OF GOALS, OBJECTIVES, & CRITERIA

The BWC assigned weights to goals, objectives, and criteria based on extensive research into bikeway planning best practices, MassDOT regulations, and past regional bikeway studies.

Rationale for goal weights

Each goal is weighted, with a total of 100 percentage points distributed across the five goals.

Safety is the most critical need expressed by the Wellfleet community, and is similarly emphasized in most bikeway studies reviewed by the Committee. It receives one-and-a-half times the weight of the next most important goals, at 30%.

The next three goals (Practicality, User Experience, and Conservancy) each address important points, and are weighted equally at 20% each.

Connectivity is a key element of the Mission Statement. It is a less analytically discriminating aspect of the study due to the close relative proximity of alternative routes on the narrow Outer Cape peninsula, so it is weighted less than the other goals, at 10%.

Objective weights

For each goal, its objectives are weighted, with 100 percentage points distributed across the objectives under that goal.

The following table summarizes the analysis goals and objectives, and their relative weights:

Table 2
Overview of bikeway analysis objectives

Goal	Objective	% of G	% of Tot
Goal 1: Safety			30%
	1.a: Limit exposure to traffic danger.	35%	
	1.b: Prevent accidents on path.	30%	
	1.c: Ensure intersection & road-share safety.	25%	
	1.d: Minimize risks to motor vehicle traffic.	10%	
Goal 2: Practicality			20%
	2.a: Promote constructability.	30%	
	2.b: Facilitate authorizations.	30%	
	2.c: Limit new traffic congestion.	15%	
	2.d: Ensure directness.	15%	
	2.e: Ensure reasonable maintenance reqs.	10%	
Goal 3: User Experience			20%
	3.a: Enhance usability.	30%	
	3.b: Share natural experiences.	25%	
	3.c: Accommodate areas for stopping along the path.	25%	
	3.d: Improve purposive user experience.	20%	
Goal 4: Conservancy			20%
	4.a: Protect the environment.	40%	
	4.b: Preserve the Town's character.	30%	

	4.c: Respect adjacent property.	30%	
Goal 5: Connectivity			10%
	5.a: Provide access to points-of-interest.	80%	
	5.b: Anticipate network improvement.	20%	

Calculating criteria weights

Overall criteria weights = Criteria weight x Objective weight x Goal weight

For example:
Goal 2 is 20% of the total
Obj 2.d is 15% of goal 2
Cr 2.d.1 is 70% of Obj 2.d
20% x 15% x 70% = 2.1% → Cr 2.d.1 makes up 2.1% of a route's overall score

A more detailed list of the weights of goals, objectives, and criteria is available in Appendix C. A list of all criteria with their relative weights within a route's overall score is available in Appendix F (Table F1).

NUMERICAL SCORING OF EACH CRITERIA

Scoring scale

Each criterion is scored on a 5-point scale ranging from low to high, where 1 is worst and 5 is best.

Table 3
Bikeway analysis criteria scoring scale

Score	Suitability	Description
1	Unsatisfactory	the segment/route fails to meet the intent of the criterion
2	Marginal	the segment/route demonstrates serious shortcomings and barely meets the intent of the criterion
3	Acceptable	the segment/route demonstrates a mix of shortcomings that make it acceptable in meeting the intent of the criterion, but is not a preferred solution
4	Excellent	the segment/route is generally suitable, with a a few minor shortcomings in meeting the intent of the criterion
5	Outstanding	the segment/route is ideal—a "gold standard" solution
5	N/A	the criterion does not apply to the segment/route (this criterion does not impact the segment/route's suitability)

Some routes—or segments within routes—may fail to meet one or more criteria (scoring a "1" for those criteria). This is not considered an automatic disqualification from consideration, but preference is given to routes and segments with few failed criteria.

Scoring process

The scoring process for the criteria depended on how adequate data can best be obtained and whether the criteria was applied at the segment- or route-level.

Table 4
Bikeway analysis criteria scoring processes

Scoring process	Criteria type	# of Cr.	Criteria
BWC in the field	segment-level	38	1.a.1, 1.a.2, 1.a.3, 1.a.4, 1.b.1, 1.b.2, 1.b.4, 1.c.1, 1.c.2, 1.c.3, 1.c.4, 1.d.1, 1.d.2, 2.a.2, 2.a.3, 2.a.4, 2.a.5, 2.b.1, 2.c.1, 2.c.2, 2.d.2, 2.e.1, 2.e.2, 3.a.1, 3.a.2, 3.a.3, 3.a.4, 3.b.1, 3.b.2, 3.b.3, 3.c.2, 3.c.3, 4.a.1, 4.a.3, 4.b.2, 4.b.3, 4.c.2, 4.c.3
BWC using ArcGIS	segment-level	5	2.a.1, 2.b.2, 2.b.4, 4.b.1, 4.c.1
BWC, verified by Wellfleet Police Dept	segment-level	1	1.c.5
BWC, verified by Wellfleet DPW	segment-level	2	2.a.6, 2.b.3
BWC, verified by CCNS	segment-level	3	4.a.2, 4.a.4, 4.c.4
BWC using ArcGIS	route-level	11	1.b.3, 2.d.1, 3.b.4, 3.c.1, 3.d.1, 3.d.2, 5.a.1, 5.a.2, 5.a.3, 5.b.1, 5.b.2

Segment-level criteria scored in the field by BWC

38 criteria were scored in the field by BWC members. Each segment was inspected and then scored by two or more committee members to ensure objectivity and consistent application of the criteria.

Segment-level criteria scored using ArcGIS

Five criteria were scored using ArcGIS mapping software, which allows for detailed analysis of terrain and other features. Each segment was traced within the software and the returned data indicated the degree to which segments met each criterion.

Segment-level criteria scored using inputs from external agencies

Six criteria were scored in consultation with outside agencies. Representatives from the Wellfleet DPW, Police Department, and CCNS each worked with the BWC. As the numerical scoring proceeded with their inputs, the BWC invited each of these scoring partners to indicate any segments which they subjectively regarded as fatally flawed and wholly unsatisfactory. Any such “vetoed” segments were immediately assigned an unsatisfactory score of “1” for all applicable criteria.

Route-level criteria scored by BWC

Eleven criteria were scored by examining routes as a whole—that is, as a string of segments. ArcGIS was a helpful tool for viewing the overall course of the routes. Two or more BWC members scored each criterion to ensure objectivity and consistent application of the criteria.

CALCULATING SCORES & RANKING

The weighted criteria scores are the basis for comparing segments and routes. All scores are measured by a point system, where a perfect score (5’s for every criteria) is 500 points. Details of the calculations used to compare segments and routes can be found in Appendix F.

Segment-level scores

Linked segments form each route, and each segment is scored independently using 49 of the 60 criteria (see Table 4). The segment-level criteria measure qualities like curb-cut density and proximity to private property which are most sensible to score for individual segments (versus at the route level). A segment carries its fixed segment-level criteria scores (using the 49 segment-level criteria) into any route variations.

The sum of all segment criteria, with criteria weights, results in the total segment score. This is used to identify "segment suitability" based on where the score falls within a percentage of available points. That is, the segments are compared against the criteria, not the other segments.

For example, the segments that accumulate scores in the top 10% of available points are designated "Outstanding"—not the top 10% of the 115 segments included in the study.

Table 5
Suitability ratings

Percentages	Rating	Color code
91% to 100%	Outstanding	
81% to 90%	Excellent	
71% to 80%	Satisfactory	
51% to 70%	Marginal	
0% to 50%	Unsatisfactory	

Note. The color coding of segments' suitability also appears in the ArcGIS software as a secondary measure to identify ideal routes that may have been missed otherwise.

Route-level scores

The 11 route-level criteria evaluate qualities like the route's overall length and connectivity. These criteria are scored using an end-to-end look at the route after the segments are combined.

These route level scores are combined with the route's segment scores (weighted based on their relative lengths) to find the total route suitability score. The route's score and suitability (determined on the same scale as segments—see Table 5) are the primary basis for comparing route alternaitves.

Additional calculations

See Appendix F for the full discussion of the computational mathematics, including:

- Segment suitability score
- Route-level criteria score
- Route length
- Route segment score
- Total route score
- Route goal scores
- Purposive users score
- Incidence of unsatisfactory ratings

ASSUMPTIONS

Assumption #1: The selected goals, objectives, and criteria are correct.

Rationale: The goals and objectives for this analysis were selected from research of other bikeway studies , inputs from the public, open meeting discussions, and recommendations the BWC solicited from the government agency stakeholders identified in Table 1 above. The BWC also reviewed past written correspondence in the town record, public feedback to state agencies, and video recordings of state public hearings, in order to capture as many potential ideas as possible measures of success for a Wellfleet bikeway. The result is a list of analysis parameters based on professional studies around the world combined with local knowledge and experience in Wellfleet.

Assumption #2: The weights used in this analysis are correct.

Rationale: The rationale for the relative goal weights is explained above. Objective and criteria weights were determined by the BWC based on public discussion and inputs, including inputs by external agencies. Weights were determined in isolation—firewalled--from the development of the list of alternative routes, so that undue influence could not occur. Ultimately, each criterion only influences 0.6-5.3% of the route's overall suitability, so no one criterion is a "deal maker or deal breaker."

STUDY LIMITATIONS AND RISK MITIGATIONS

Limitation #1: Volunteer-led study. The BWC's members are part-time volunteers; there is no outside funding or any major resources supporting the Wellfleet bikeway analysis.

Mitigation: The BWC reviewed applicable state and federal guidance and studies to ensure this study followed guidelines and applied best practices. The BWC also reviewed bikeway studies conducted in other regions and municipalities in order to incorporate lessons learned from those studies. The BWC also sought and incorporated local interests and inputs unique to the Outer Cape, so this study could credibly assess route suitability for the local case at hand. The BWC study team consists of qualified individuals experienced and capable in conducting high-level analysis, using a variety of available tools including Excel and ArcGIS, and possessing detailed local knowledge.

Limitation 2: Number of routes assessed. The study lacked capacity to compare an infinite quantity of potential routes.

Mitigation: Detailed local knowledge of a compact region guided the public's identification of proposed routes and segments of routes. As a result, this analysis includes virtually every segment that can reasonably be included in a bikeway route through Wellfleet to Truro, even if the segments weren't part of a proposed route. The BWC reviewed the alternative routes to ensure they represented a broad range of the region's qualities. The BWC also assessed each route's segment combinations to ascertain improvement opportunities. Through this review process, two of the routes proposed by the public were modified slightly and their evaluation scores increased (Routes Q_2 and R_2).

Results & discussion

BIKEWAY ALTERNATIVES ANALYSIS

Segment-level analysis

The scores for the segment-level criteria show certain trends among the segments (see Appendix G1 for the raw scores).

Segment suitability

In the analysis, 3 segments scored outstanding; 22 excellent; 42 acceptable; 33 marginal; and 15 unsatisfactory (see Appendix H1).

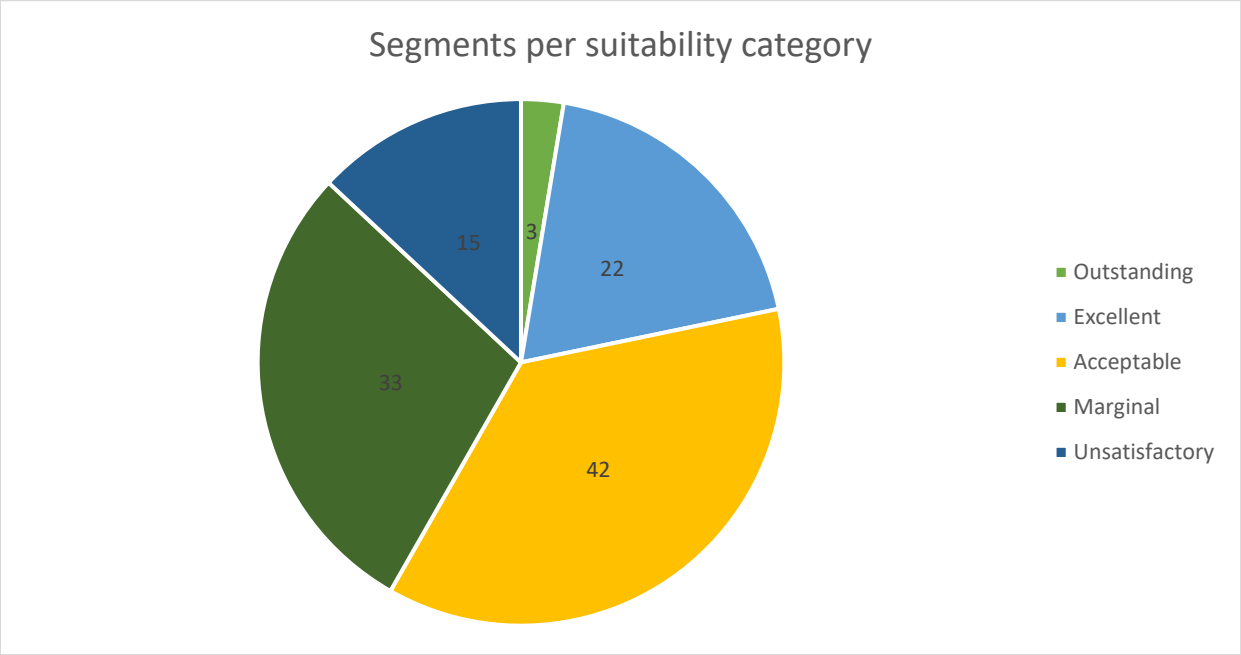

Figure 4. Number of segments per suitability category

Given that the majority of segments fall in the "excellent" and "acceptable" categories, those segments—and the small number of "outstanding" segments—comprise most of the best route alternatives.

The highest rated segments are Segments 2 and 3 with a tie score of 383 (out of 399 possible at the segment level). Segment 20 is the lowest ranked, with a score of 195 (80 is the lowest possible score at the segment level). The median segment score is 312, which falls in the "acceptable" range. High and low segment rankings are closely correlated to the quantity of "5" and "1" criteria scores, respectively, for each segment.

Applying these suitability ratings to the segments on a map revealed important trends in the relative suitability of different route alternatives through Wellfleet.

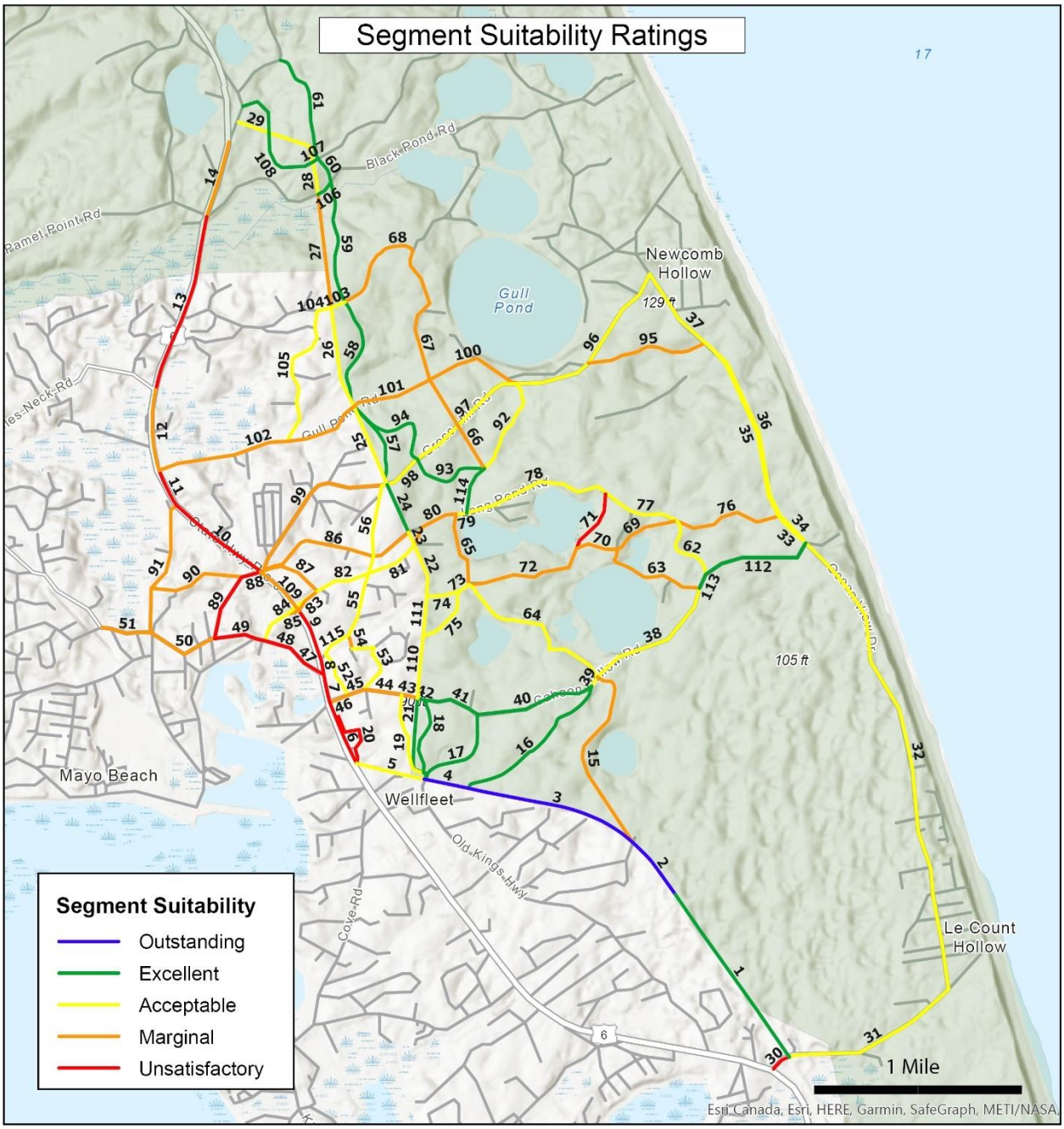

Figure 5. Segment suitability. From ArcGIS

"Unsatisfactory" criteria scores

A direct correlation exists between the calculated suitability score and the number of criteria a segment fails to meet, providing a positive sign that the study has yielded logical results.

42 segments did not receive any unsatisfactory criteria scores (see Figure 6). These segments represent a good starting point for planning other potential routes.

The nine highest rated segments (based on overall suitability score) received zero unsatisfactory scores across any of the segment-level criteria. By contrast, the eight lowest-rated segments each received 12 or more unsatisfactory criterion scores (see Appendix H1).

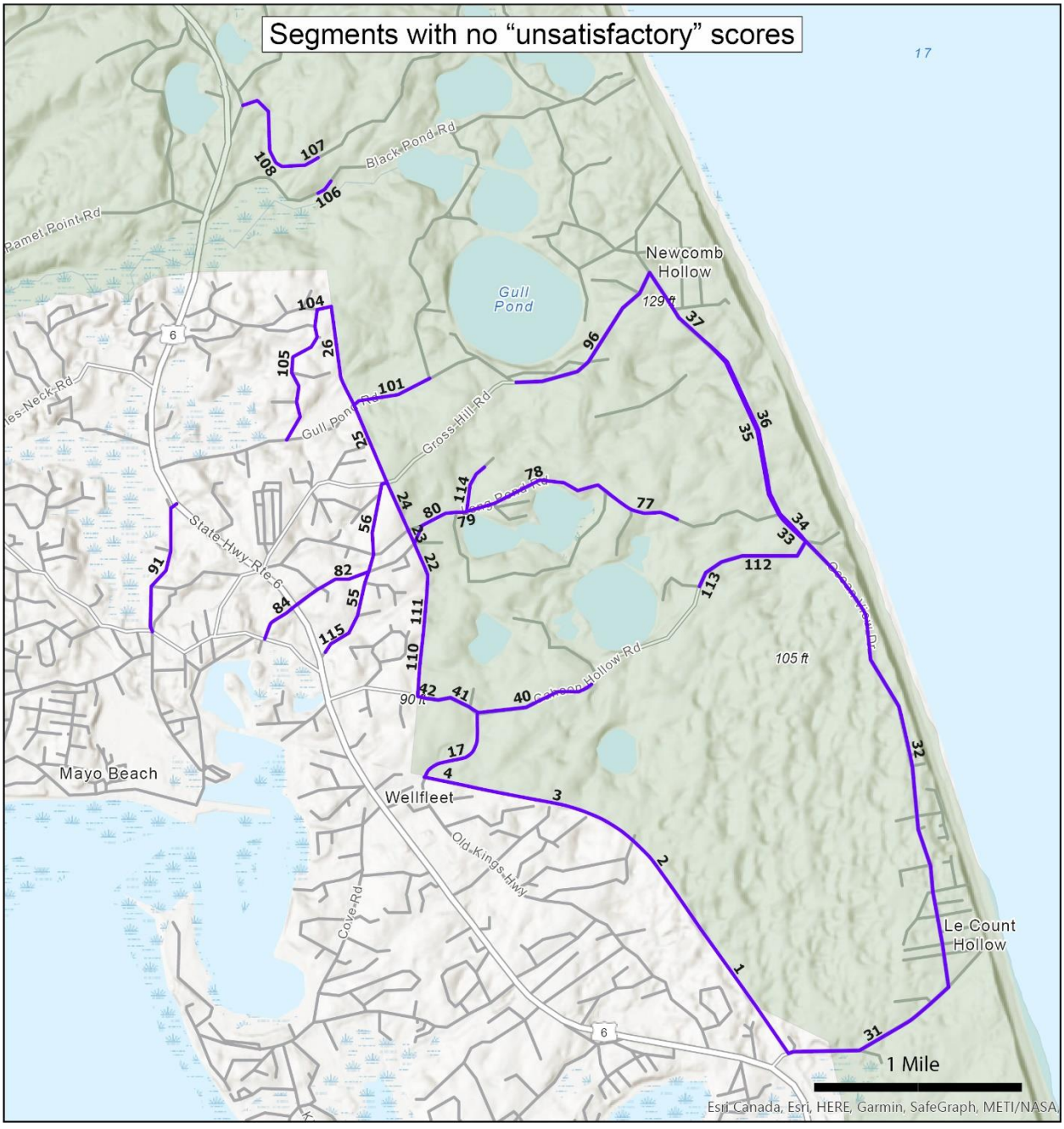

Figure 6. Segments with no “unsatisfactory” criteria ratings. From ArcGIS

Segment suitability per goal

Segment scores by goal (safety, practicality, user experience, and conservancy) generally demonstrate correlation trends (*Note.* Goal 5 is only measured at the route-level and therefore not included in segment-level analysis).

- Goal 1, safety, is most closely correlated to the overall suitability, which makes sense as it received the highest weight (30%) across the total (see Figure 7).
- Goals 3 and 4, user experience and conservancy, demonstrate similar correlation, though there are a few instances in which they counterbalance one another—cases in which a high score for one balances a low score in the other, resulting in a moderate overall suitability score.
- Goal 2, practicality, did not follow a clearly correlated trend related to overall suitability. This is likely because some of its criteria related to the construction, rather than the use, of the bikeway.

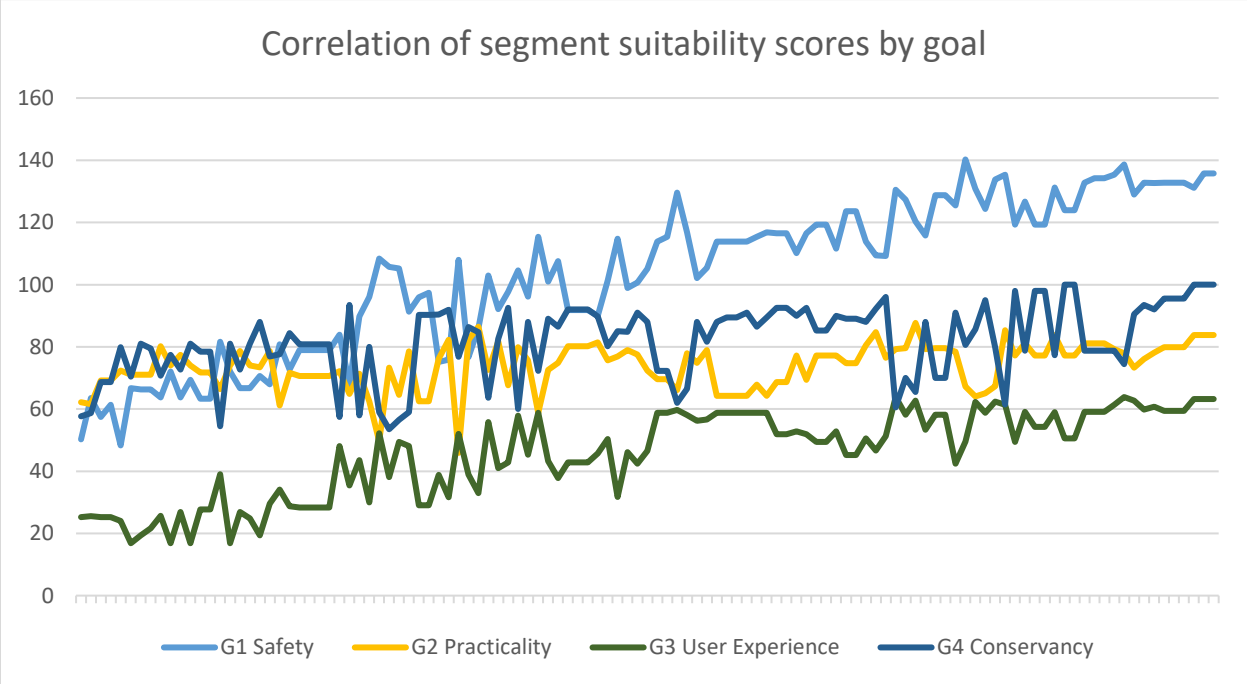

Figure 7. Correlation of segment suitability scores by goal

Figure 7 shows the correlation of segment suitability scores by goal. The 115 segments are rank-ordered on the X-axis from lowest to highest overall score. For a detailed score breakdown, see Appendix H1.

Segment-level criteria scored using inputs from external agencies

Six criteria were scored in consultation with outside agencies. Representatives from the Wellfleet DPW, Police Department, and the CCNS each worked with the BWC. As the numerical scoring proceeded with their inputs, the BWC invited each of these scoring partners to indicate any segments which they subjectively regarded as fatally flawed and wholly unsatisfactory. Any such "vetoed" segments were immediately assigned an unsatisfactory score of "1" for all applicable criteria. The Wellfleet DPW and Police Department did not exercise a "veto" for any bikeway segment. The CCNS staff exercised it broadly and rejected most segments proposed within the boundaries of the CCNS.

Route-level analysis

This analysis considered the 28 full-length routes proposed by the public to the BWC. Short-distance connecting spurs were also suggested by members of the public and were scored. Information and scoring data for the proposed spurs is available in Appendices F and G.

The route scores include route-level criteria ratings that apply at the route-level, rather than at the segment-level. These raw scores are in Appendix G2.

Route suitability

The highest score possible for a route was 500 points (scoring perfect across all criteria) and the lowest possible was 100 points. The spread of scores for all routes was between 353 and 444 points.

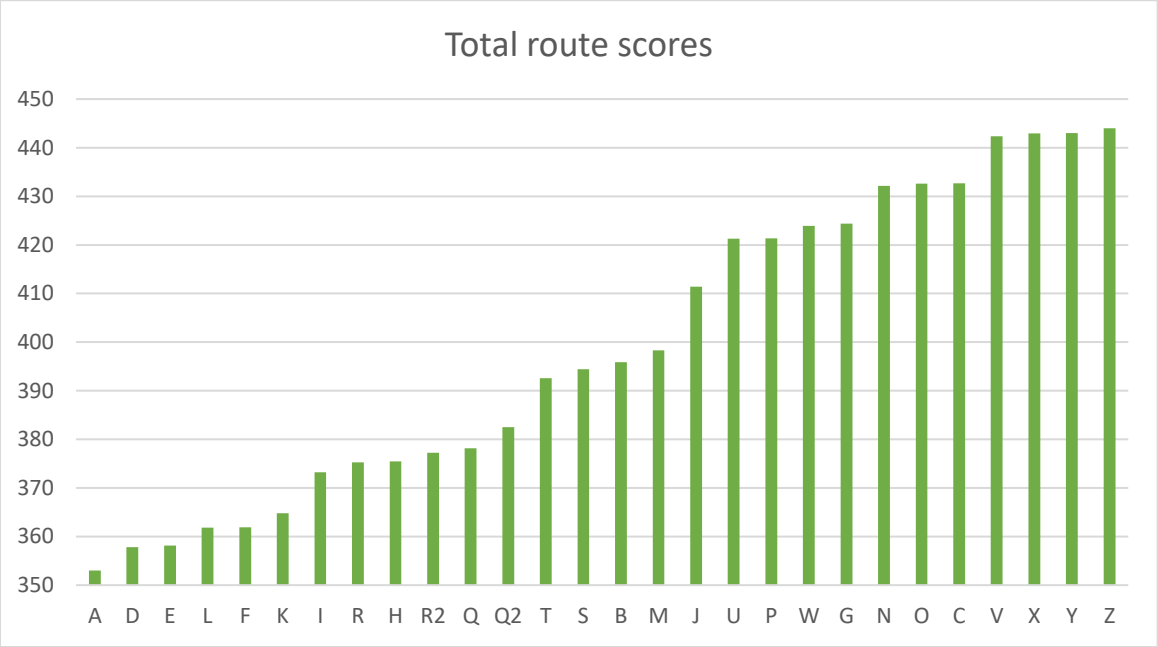

Figure 8. Route suitability (ranked lowest to highest)

Using the same suitability score categories as the segments, 11 routes scored as excellent, 6 acceptable, and 11 marginal. No routes scored outstanding or unsatisfactory.

Table 6
Route alternative suitability scores

Route	Segments sequence	Score	Suitability
Z	[1-2-3-4-17-41-42-110-111-22-23-24-57-58-59-60-61]	444	Excellent
Y	[1-2-3-4-18-42-110-111-22-23-24-57-58-59-60-61]	443	Excellent
X	[1-2-3-4-21-110-111-22-23-24-57-58-59-60-61]	443	Excellent
V	[1-2-3-4-18-42-110-75-74-22-23-24-57-58-59-60-61]	442	Excellent
C	[1-2-3-4-18-42-110-111-22-23-24-25-26-27-28-29]	433	Excellent
O	[1-2-3-4-21-110-111-22-23-24-25-26-27-28-29]	433	Excellent
N	[1-2-3-16-39-64-73-74-22-23-24-57-58-59-60-61]	432	Excellent
G	[1-2-3-4-17-41-42-43-44-45-52-55-56-57-58-59-60-61]	424	Excellent
W	[1-2-3-16-39-64-65-79-114-93-94-58-59-60-61]	424	Excellent
P	[1-2-3-4-21-110-111-22-80-79-114-92-100-101-58-59-60-61]	421	Excellent
U	[1-2-3-4-19-44-53-54-115-55-56-57-58-59-60-61]	421	Excellent
J	[1-2-3-4-17-40-39-64-65-79-114-92-100-101-58-59-60-61]	411	Acceptable
M	[1-2-3-4-17-40-39-38-63-69-77-78-114-92-100-101-58-59-60-61]	398	Acceptable
B	[1-2-3-16-39-38-113-112-33-35-37-96-100-101-58-59-60-61]	396	Acceptable

S	[1-2-15-64-65-79-114-66-67-68-59-60-107-108]	394	Acceptable
T	[1-2-15-64-65-79-114-66-67-68-59-60-61]	393	Acceptable
Q_2	[1-2-3-4-17-41-42-110-111-22-23-24-99-10-11-12-13-14]	390	Acceptable
Q	[1-2-3-4-17-41-42-110-111-22-23-86-10-11-12-13-14]	378	Marginal
R_2	[1-2-3-4-17-41-42-110-111-22-81-82-87-10-11-12-13-14]	377	Marginal
H	[1-2-3-4-17-40-39-64-65-80-23-86-10-11-12-13-14]	375	Marginal
R	[1-2-3-4-17-41-42-110-111-22-81-82-83-85-109-10-11-12-13-14]	375	Marginal
I	[1-2-3-4-17-40-39-64-65-80-81-82-83-85-109-10-11-12-13-14]	373	Marginal
K	[1-2-3-4-17-40-39-38-113-62-77-78-79-80-81-82-83-85-109-10-11-12-13-14]	365	Marginal
F	[1-2-3-4-17-41-42-43-44-45-46-7-8-9-109-10-11-12-13-14]	362	Marginal
L	[1-2-3-4-17-40-39-38-63-69-77-78-79-80-23-86-10-11-12-13-14]	362	Marginal
E	[1-2-3-4-18-42-43-44-45-46-7-8-9-109-10-11-12-13-14]	358	Marginal
D	[1-2-3-4-21-43-44-45-46-7-8-9-109-10-11-12-13-14]	358	Marginal
A	[1-2-3-4-5-6-7-8-9-109-10-11-12-13-14-47]	353	Marginal

Note. The routes are sorted by score from highest to lowest.

Correlation of total scores and individual goal scores

Analysis of goal scores compared to total score for each route reveals a clear correlation between the overall route suitability and Goals 1 and 3—safety and user experience.

For Goals 2 and 4, the best routes score slightly better than the worst routes, but in general there is no correlation of Goals 2 and 4 with the total score.

Figure 9 shows the correlation of route suitability scores by goal. The 28 routes are rank-ordered on the X-axis from lowest to highest overall score. For a detailed score breakdown of all routes and spurs (spurs were not included in Figure 9), see Appendix H2.

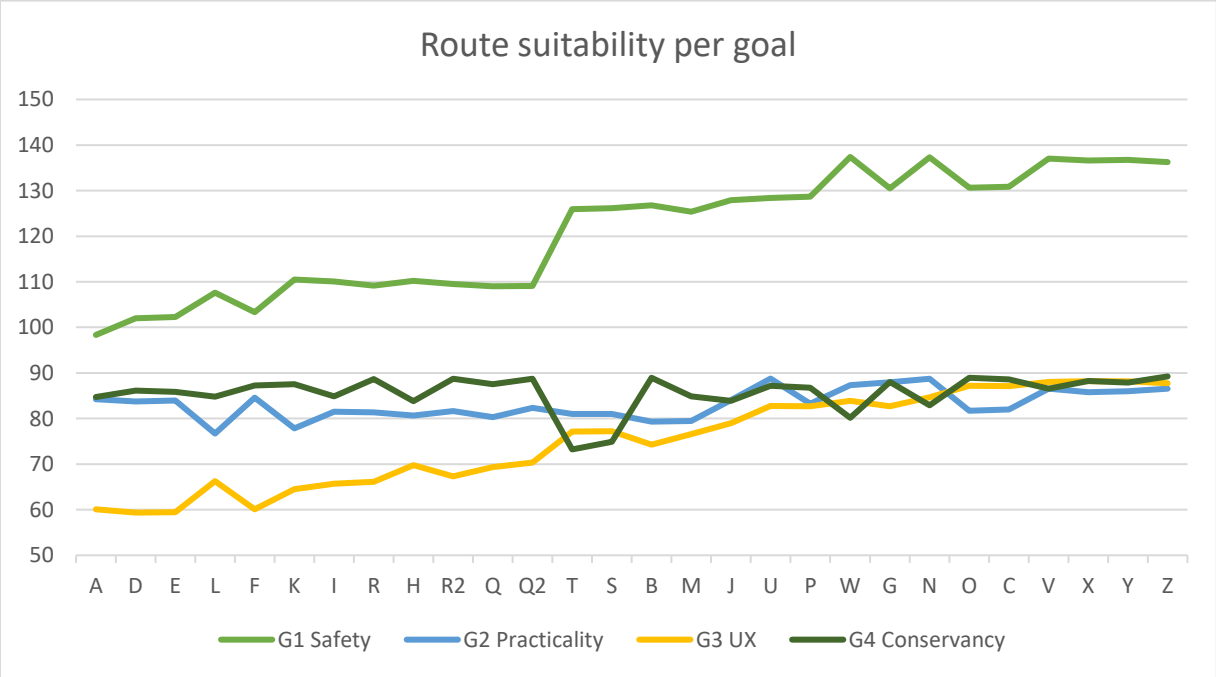

Figure 9. Route suitability per goal

The Route 6 effect

As shown in Figure 9, route safety scores spike upward beginning with Route Q_2. This route, and all the routes that scored lower, include segments along Route 6. Routes that avoid Route 6 scored higher, particularly for safety. In fact, Q_2 is the only route with segments along Route 6 that scored acceptable overall—all other routes incorporating segments along Route 6 scored marginal overall.

Optimal route from Old County Road to Cahoon Hollow Road

Several of the proposed end-to-end routes involved proceeding from the Rail Trail to the utility right of way north of Cahoon Hollow Road. Three series of segments were assessed, and appear in rank order below:

- *High score:* Segments [17-41-42]. Proceed northward beside and across Old County Road, then proceed westward beside and across Cahoon Hollow Road to meet the utility right of way on the north side of the road.
- *Second-highest score:* Segment [18-42]. Proceed through the woods behind the Wellfleet Council on Aging (COA).
- *Low score:* Segment [21]. Proceed along the utility right of way behind Howard Court

Based on the relative scores, and barring other considerations, the highest-scoring option was incorporated in all the end-to-end routes that passed through that area.

Suitability for purposive users

The route analysis identified the scoring criteria most relevant to purposive users (see the list of purposive user criteria in Appendix F). The aggregate of the purposive user criteria scores shows a direct correlation to the overall suitability score of each route.

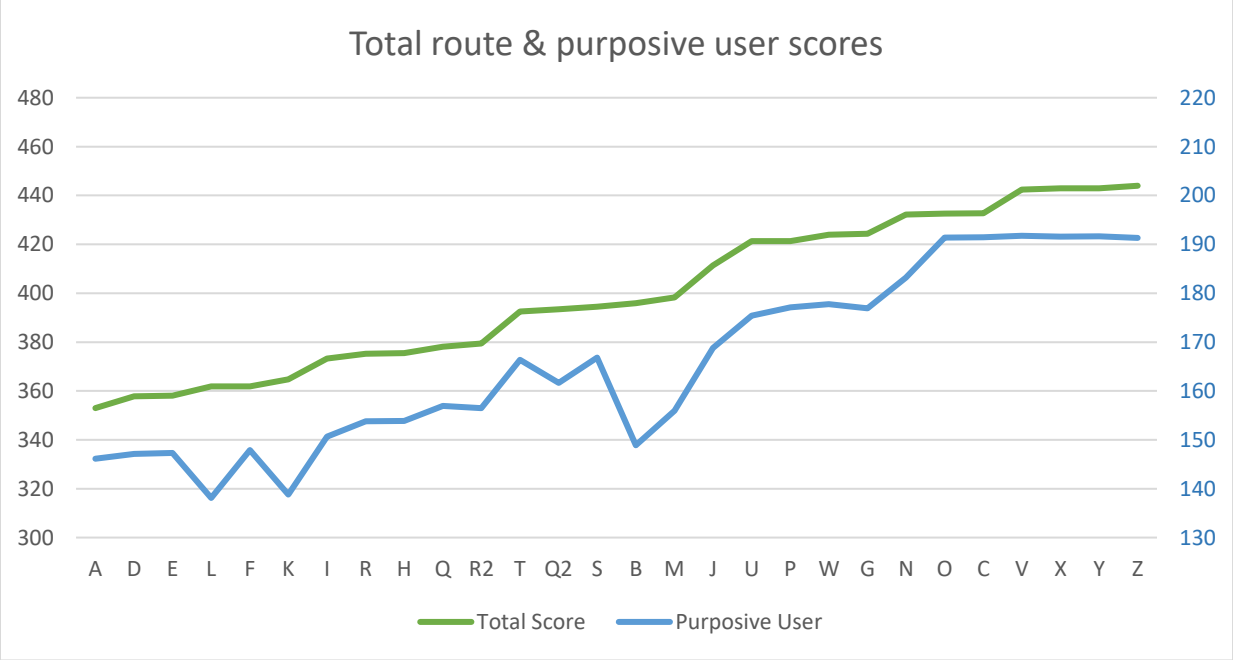

Figure 10. Overall and purposive user route scores
Note. The routes are rank-ordered on the X-axis from lowest to highest overall score.

PROBLEMS WITH STATE'S PROPOSED ROUTE

The state's proposed design, made up of the combined DCR and MassDOT projects (see Figure 2), warrants special discussion because it is the route Wellfleet will get if no action is taken. In this study, the state's proposed route is designated Route A.

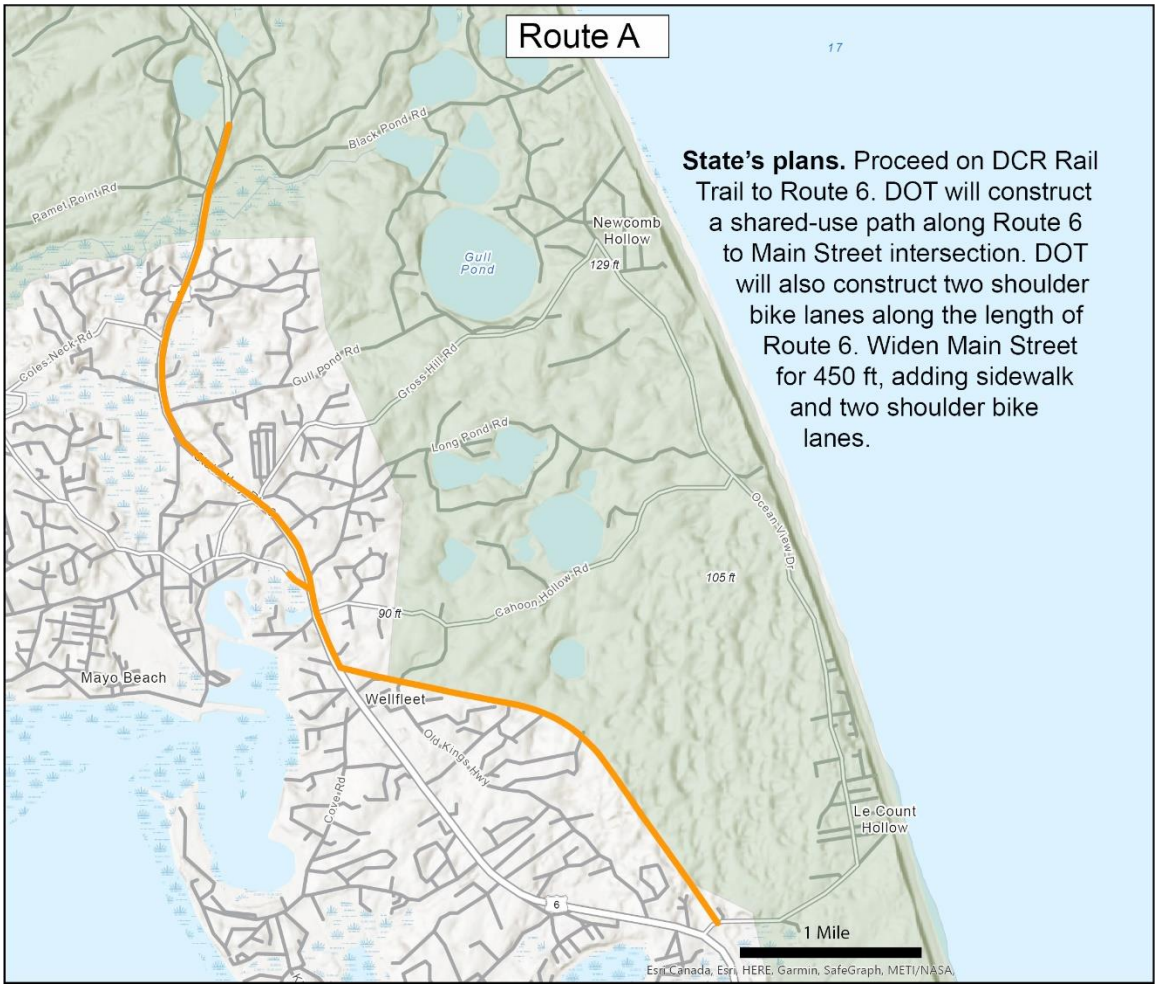

Figure 11. Route A

Goal after goal, Route A scored among the worst route alternatives. It ranked last (28th out of 28) for the total score and for safety, 27th for connectivity, 26th for purposive users, 25th for user experience, and 22nd for conservancy. Route A ranked 10th for practicality since there are existing plans for its development (making it easy to execute). Eight of the sixteen segments within Route A were rated unsatisfactory, and three more were marginal. The route has the most "unsatisfactory" criteria scores of all the proposed routes. In brief, the state plan (Route A) is:

Bad for public safety in Wellfleet

It unnecessarily promotes increased pedestrian and cyclist use beside a notoriously congested and dangerous roadway where users will be forced to contend with high-density motor vehicle traffic on the Outer Cape's sole highway artery.

Bad for Wellfleet's historic East Main Street

Widening East Main Street will deface the historic town's entrance and reduce its distinctive rural seaside character which is important to Wellfleet's economy, residents, visitors, and cultural value. The short extension of 450 feet of sidewalk and bike lanes will do little to increase access to the town. Continuing them would be difficult and at the town's expense, and many in the public oppose the idea.

Bad for traffic flow and safety on Route 6

Traffic flow on Route 6 is vital to the residents and commerce of Outer Cape Cod. Introducing a new convergence of bicycle and pedestrian traffic with motor vehicle traffic at an already dangerous choke point on Route 6 will likely cause accidents, congestion, delays, and road stress which will impact the economy and lifestyle of the Outer Cape towns. Already, cars frequently swerve into the bike lanes to pass others waiting to turn. The risk increases when drivers turning into or out of traffic must divide their attention between oncoming vehicle traffic, path users from two directions, and bike lane traffic.

Bad for recreational and purposive users

The Rail Trail portion of Route A is the only part suitable for recreational path users. The shared-use-path along Route 6 is likely to attract recreational cyclists and pedestrians hoping to link to Wellfleet Center or the ponds, but those connections do not exist. Instead, they will take risks crossing busy curb-cuts, then must use roads with limited or no bike or pedestrian facilities to reach their destinations. The safe conditions of the Rail Trail will not prepare them for the more dangerous, high-stress Route 6 shared-use path.

Some purposive users may use the shared-use path along Route 6 instead of the shoulder bike lanes, but it will be equally dangerous and high-stress for them as for recreational users. Those who prefer the road shoulder bike lanes will face more dangerous conditions than if there was no shared-use path, as drivers may not expect to see bikes on the road where a separate multi-use path is present.

In conflict with expert guidance on bikeway placement

Federal Highway Administration (FHWA) guidelines indicate user stress level is a primary factor in determining public acceptance and use of a bikeway (2015); this high-stress bikeway and pedestrian route will likely deter potential users.

The American Association of State Highway Transportation Officials (AASHTO) is a leading professional organization in the transportation community. The AASHTO 2012 Guide for the Development of Bicycle Facilities documents specific concerns regarding two-way shared use paths beside highways and advises they are not a desirable option. MassDOT's proposed shared-use path beside Route 6 creates high risk for negative outcomes related to this professional organization's advice, summarized as follows:

- Wrong-way travel by cyclists is a major cause of crashes. On a two-way path close beside a highway, cycle traffic in one direction will be forced to ride in the opposite direction of the adjacent highway lane, contrary to normal cycling rules of the road.
- Highway drivers turning in or out of driveways or side streets aren't used to looking both ways for cyclists since they normally expect one-way cycle traffic along the roadside.

- Where the two-way path ends, cyclists going against traffic will wind up riding on the wrong side of the street. Likewise, cyclists approaching a shared use path in one direction will be forced to travel on the wrong side to get to the path.
- Signs posted along the highway point toward the oncoming traffic. Cyclists riding in the opposite direction of the adjacent highway lane can't read signs without stopping and turning around, thereby putting themselves and others at risk.
- If one-way shoulder lanes and a two-way shared use path are both present as features along a highway (as MassDOT proposes along Route 6), each with different rules of the road, then motorists could become distracted and confused, mistaking where to look for what, which could create danger for motor vehicle traffic and cyclists on both the highway shoulder bike lanes and on the adjacent shared-use path.
- Many highway drivers expect cyclists to stop or yield when crossing driveways or side streets. However, many cyclists tend to proceed across driveways and cross streets without even slowing their speed.
- Motor vehicles entering or exiting side streets or driveways may block bikeway traffic in both directions while waiting to turn into highway traffic.
- Cyclists crossing driveways or side streets may block motor vehicles entering from the highway at speed, which may cause rear end collisions on the highway.

Given these AASHTO guidelines, it is clear the shared-use path proposed beside Route 6 is unsuitable—not just for Wellfleet, but for anywhere.

Potentially adverse long-term impacts

The development of a bikeway through Wellfleet can have many long-term impacts, and whether they are positive or negative will depend on proper planning. This project is an important decision point to determine Wellfleet's character going forward; the bikeway can serve the needs of a rural seaside town, or it can create a generic suburban landscape designed to meet basic criteria while completely ignoring local context.

Predictable long-term safety concerns

An increase in bicycle and pedestrian traffic through certain parts of town—specifically the busy sections along Route 6 and Main Street—will mean an increase in bicycle and pedestrian related accidents. An attitude that says any bikeway design is "better than nothing" is short-sighted—if the bikeway brings more pedestrians, cyclists, and vehicles together in an unsafe manner, it may be worse than nothing.

Even on a well-planned bikeway it is impossible to wholly prevent accidents, but obvious risks need to be mitigated. The town should consider that as accidents occur, there will likely be a demand to improve safety conditions. According to MassDOT design guidelines (2006) and bike lane guidelines (2015), appropriate measures for safety enhancement or "traffic-calming" include:

- street lighting
- street furniture (benches, planters, trashcans, fences, etc.)
- speed humps
- raised crosswalks

Predictable design failures

There are many instances where designs may fail in their intended purpose because users behave in contrary, but predictable, ways. A curved path through a park, for example, may go unused as pedestrians cut corners and trample vegetation to reach their destination by a more direct route. It is worthwhile to look at future likelihoods and attempt to mitigate potential design failures.

Wider road, faster driving - One of the three main principles for traffic-calming is by narrowing the apparent road width (MassDOT, 2006). For example, the state's design for a Route 6 "road diet" reduces two-lane portions to a single lane to achieve safer speeds. However, widening the Main Street corridor will have the opposite effect, and possibly result in faster, more aggressive driving into Wellfleet Center by creating the perception that it is a "big" road with the same proportions as Route 6.

On-street parking - MassDOT (2006) suggests that shoulder bike lanes on streets through small towns and villages be designed with the understanding that they are often converted into on-street parking. Since this is not a goal for Wellfleet, the town should be cautious and aware of plans that can have totally different outcomes than they intend.

Shared-use-path user priority over motor traffic - A separated two-way shared-use path running parallel to a highway typically has priority over driveways and secondary roads at intersections (AASHTO, 2012). As a consequence, shared-use-path users along Route 6 might naturally assume right-of-way priority across intersections and commercial driveways in that area, despite any signage indicating a different rule. Drivers turning in or out of those cross-flow zones might be unlikely to anticipate right of way issues. Right-of-way confusion in a congested, complicated set of curb-cut crossings will result in increased accidents. There is risk that, in the long-term, this would necessitate a traffic signal of some kind at Cahoon Hollow Road or elsewhere.

Unanticipated costs

The town must consider whether future, possibly major, costs will be incurred as a result of a poorly-planned bikeway.

Safety failures - If the bikeway proves to be unsafe, there may be a need for new features including street lighting, signage, new traffic lights, and possibly significant construction. The town will also potentially be liable if an unsafe bikeway proved to cause avoidable accidents, injuries, and deaths.

Practicality or connectivity failures - If the bikeway fails to serve practical and connectivity needs, new bikeway segments may be necessary. The MassDOT bike lanes and sidewalk proposed on Main Street, for example, would need to be extended to provide real connectivity into Wellfleet Center.

Ramifications of non-action

If the Town Government and Selectboard do not take decisive action, MassDOT and the DCR will continue with their projects as the designs currently show them. These plans, as described above, will have a permanent detrimental effect on Wellfleet. The targeted section of Route 6 near Main Street is dominated by a few iconic businesses and restaurants. East Main Street is a historic district that includes some of Wellfleet's oldest buildings. The area's qualities can be enhanced substantially with relatively low-cost, low-effort conservation initiatives to promote Wellfleet's picturesque rural character, rather

than paving it under. MassDOT's current plan could sterilize the area with a drab, urbanizing influence that, once started, could expand deeper into Wellfleet's historic district.

Recommendations

BEST BIKEWAY ROUTE OPTIONS

The BWC proposes two options for the development of a Wellfleet Bikeway. As the OCBPMP found, there is no easy solution for a bikeway through Wellfleet, but this study has provided framework for pursuing specific options.

Option 1, Route Z is the highest-scoring bikeway option for Wellfleet. It scores "excellent." It is recommended by the BWC but faces resistance from the CCNS staff who oppose any new bikeway within the boundaries of the Interior Department-owned CCNS.

Option 2, Route Q_2, is the highest scoring route that avoids the CCNS. It scores "acceptable." Nevertheless, it ranks in the bottom half of all the route alternatives and does not serve all the intended users of a Wellfleet bikeway.

Option 1: Route Z

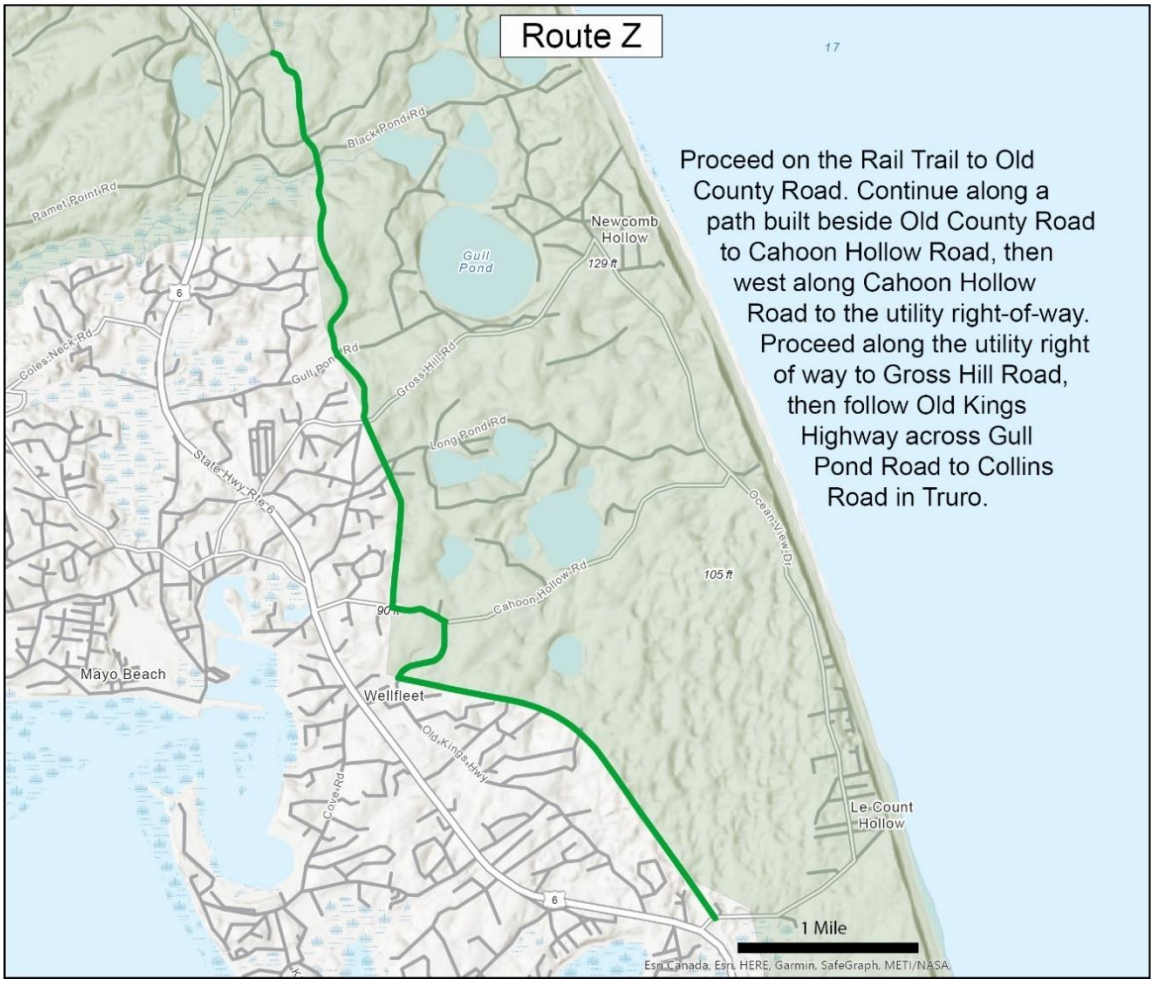

Figure 12. Route Z

Analysis shows that Route Z scores the highest for overall suitability and connectivity. It also ranks high for safety (6th), practicality (5th), user experience (4th), and conservancy (2nd). Note: the differences between Route Z's scores and the scores of routes that score higher on individual goals are minimal (see Appendix H2). Route Z can provide a safe, separate shared-use path along its entire length.

Selecting Route Z will enable canceling phase 2 of the DCR project beyond Old County Road and avoid a terminus parking lot at busy Route 6. The BWC recommends creating a Rail Trail terminus within the Utility Right of Way at Old County Road at the start of the Wellfleet bikeway. As an added benefit, a bikeway terminus set away from the noise and stress of Route 6 will be a much more comfortable place for recreational users—especially those with young children—to start or end their ride.

Route Z, in combination with one-way shoulder bike lanes on Route 6 with removable bollards and/or barriers (described below in "Recommendations for the State Plans"), provides a complete bikeway solution connecting Wellfleet to the north and south for all bikeway user types, including all skill levels and user groups, both recreational and purposeful.

The advantages of this route are substantial. It provides bikeway users a safe, comfortable, direct route through beautiful areas of Wellfleet. The use of the utility right-of-way to form the spine of the route means that there will be minimal environmental impact, and the short portion (1.7 miles) that travels inside the edge of the CCNS would use the existing town-owned Old Kings Highway.

The route strikes a unique balance—it forms a spine through Wellfleet that creates easy connectivity to the commercial area to the west and the ponds and beaches to the east but does not approach any of those areas so closely as to have negative impacts. Its distance from major roadways makes it quiet, comfortable, and safe. It crosses roads like Cahoon Hollow Road, Long Pond Road, and Gross Hill Road in areas with good sight distances and where traffic conditions can be managed safely. The route's distance from attractions like ponds and beaches makes it easy for path users to reach them safely (by connecting to other roads). However, the route never passes directly adjacent to or within sight of any of those features, so path users will be less likely to be tempted to walk or bike off the path through sensitive natural areas.

Route Z is the BWC's recommendation to the Selectboard, combined with Route 6 shoulder bike lanes to improve safety on Route 6. This recommendation scores high for each of the stated bikeway goals and highest overall, and provides a setting for the bikeway that promotes green transportation and enhances, rather than detracting from, Wellfleet.

Option 2: Route Q_2

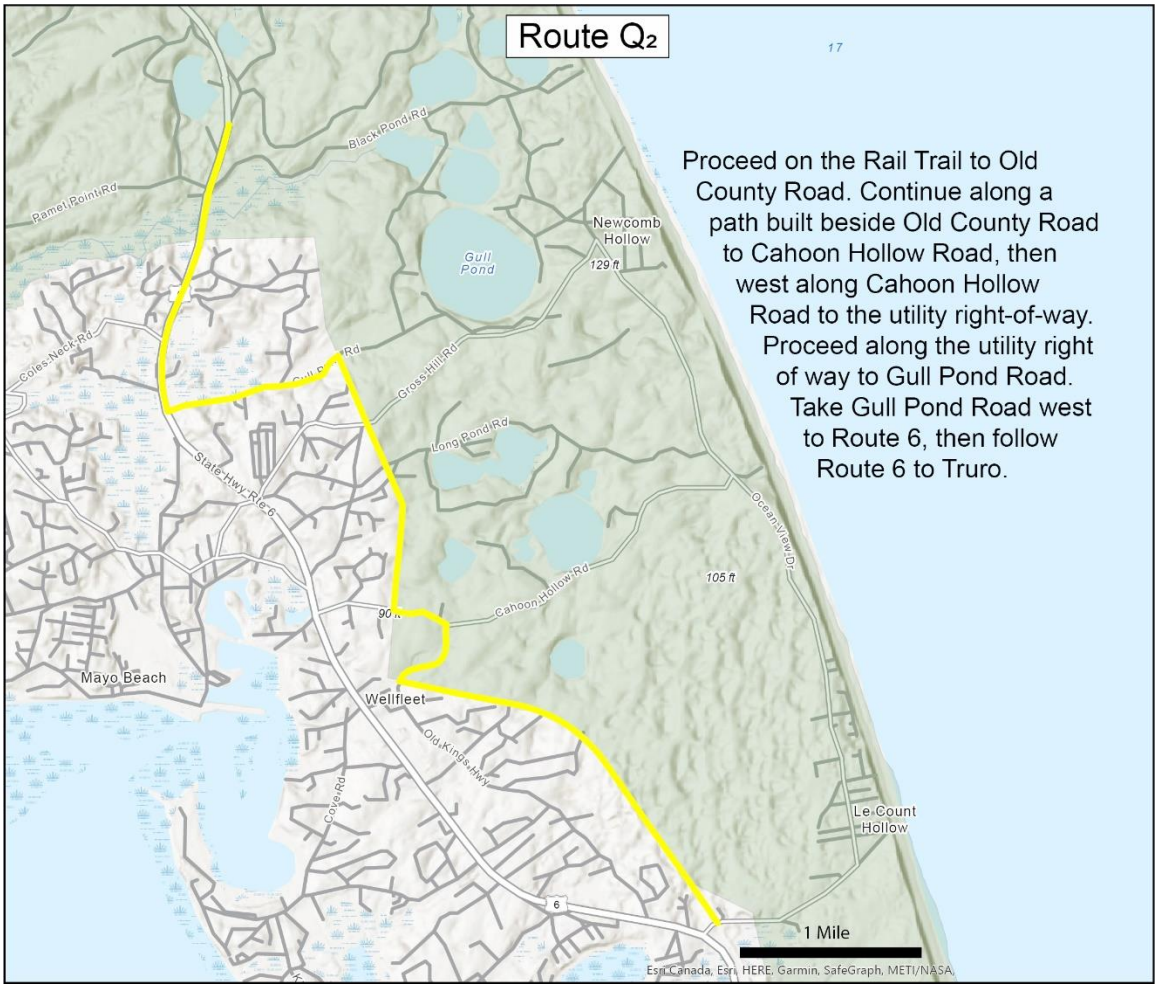

Figure 13. Routes Q_2

Route Q_2 scores in the acceptable range of bikeway routes, albeit in the bottom half. It ranks 17th overall, and scores in the bottom half for four of the five goals: it ranks 17th for safety, 15th for practicality, 17th for user experience, and 15th for connectivity. The only area it performed well was conservancy—it ranks 1st out of 28 because it does not travel through the CCNS. By comparison, Route Z ranks 2nd for conservancy, with minimal conservancy score difference between Z and Q_2 (see Appendix H2).

As with Route Z, using Route Q_2 would enable cancelling phase 2 of the DCR project beyond Old County Road, including the terminus parking lot beside Route 6. It would support a Rail Trail terminus within the Utility Right of Way at Old County Road at the start of the Wellfleet bikeway. Also, as with Route Z, Route Q_2 should be combined with Route 6 shoulder bike lanes to improve safety on Route 6.

Route Q_2 is a "middle of the pack" route. It is presented as a second option because it is the only "acceptable"-rated route outside the CCNS. All the others are "marginal." The route includes 3.5 miles of shared-use path bikeway providing a long, safe bikeway experience away from dangers and stressors along the highway.

The 2-mile northern portion of Route Q_2 turns onto Gull Pond Road, follows Gull Pond Road with "sharrows," and then continues to Truro using the shoulder bike lanes along Route 6. These segments of Route Q_2 would be undesirable for many path users, particularly children, the elderly, and families.

Comparison of selected route options and state's plan

Figure 15. Comparison of Routes Z, Q_2, and A

Table 7
Comparison of Route Z, Q_2, and A features

Features	Option 1 - Route Z	Option 2 - Route Q_2	State's plan - Route A
Provides connectivity from South Wellfleet to Truro	Shared-use-path links directly from South Wellfleet Rail Trail to Collins Rd in Truro	Shared-use-path from Rail Trail to Gull Pond Rd, share-the-road on Gull Pond Rd, then shoulder lanes on Rt 6 to Truro	Shared-use-path from Rail Trail to DCR terminus continuing along Rt 6 until just past Main St, then shoulder lanes along Rt 6 to Truro
Segments rejected by CCNS	57-58-59-60-61 1.7 mi along Old Kings Highway (town-owned)	--	--
Portions accessible to all users (including athletes, purposive users, families with children, individuals with limited mobility, pedestrians, etc.)	4.8 mi of shared-use-path accessible to all users	3.5 mi of shared-use-path accessible to all users	2.0 mi of shared-use-path accessible to all users
Portions for experienced cyclists only (not recommended for children, path users with limited mobility, or pedestrians)	--	0.8 mi of share-the-road (Gross Hill Rd) 1.2 mi of shoulder lanes along Rt 6	0.4 mi of shared-use-path along Rt 6; high-stress and dangerous due to curb cuts 2.3 mi shoulder lanes along Rt 6
Overall route ranking (out of 28)	1st	17th	28th

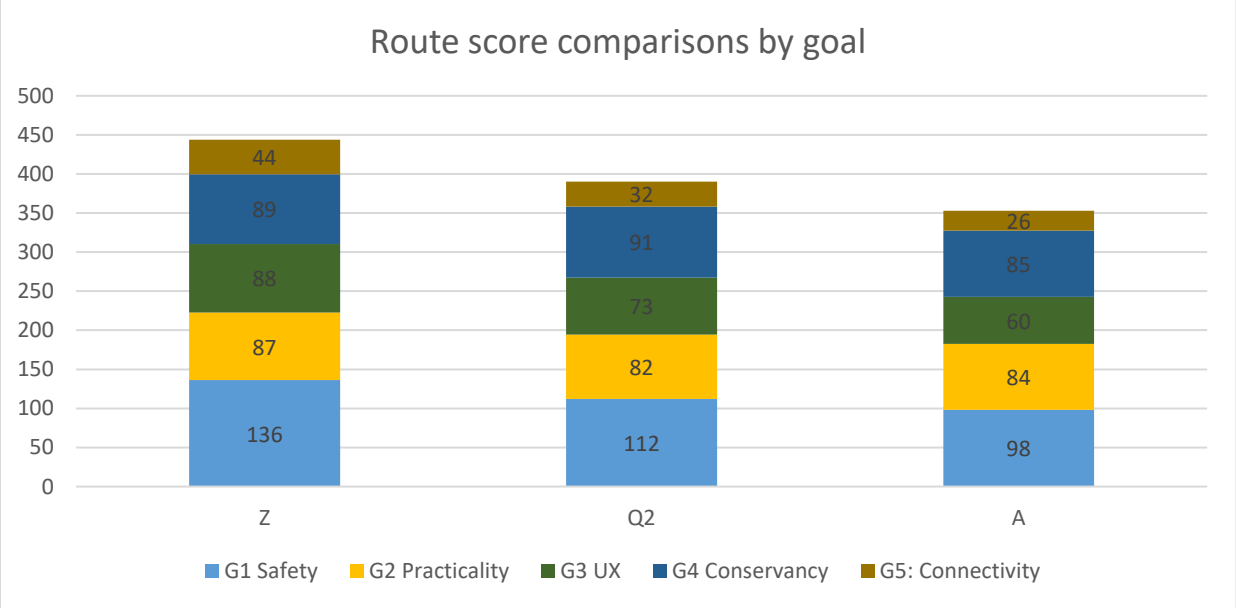

Figure 14. Score comparisons of Routes Z, Q_2, and A

RECOMMENDATIONS REGARDING THE STATE PLANS

The DCR and MassDOT bikeway plans, which comprise Route A in this study, score objectively as the least suitable option for Wellfleet (see details in the Results section of this report). However, it is likely the DCR and MassDOT, partnered with Stantec Corporation, will continue to apply pressure to the Town Government.

The DCR project

Reject phase 2 beyond Old County Road

The BWC recommends the Selectboard reject phase 2 of the DCR project beyond Old County Road. To be clear, the BWC recommends the Rail Trail terminate at Old County Road, where it can join the highest ranked bikeway route (Route Z) or second option (Route Q_2) discussed above.

Relocate the DCR proposed terminus to Old County Road

DCR states they are not yet building their bikeway terminus parking lot at Route 6 although the lot is already taking shape. It would be better to locate it away from Route 6. The BWC recommends the Selectboard identify and assess alternatives to propose to the DCR. Both Route Z and Q_2 support a terminus at Old County Road.

If the DCR forces their proposed Route 6 trail head and parking lot against the wishes of the town, the BWC recommends the Selectboard insist two additions to their designs must be put forward: a) a transit stop to provide safe connectivity to the town or to other points of interest, and b) secure bicycle parking to provide cyclists an option to leave their bikes and use safer transit options into town or to other points of interest.

The MassDOT project

Shoulder bike lanes: Increase buffers, add bollards/barriers for along the busiest segments of Route 6

Shoulder bike lanes provide a valuable addition to making Route 6 safer. The BWC recommends incorporating these bike lanes along Route 6 with increased safeguards described below.

On the busiest portions of Route 6 (segments 6, 7, 8, and 9), the road shoulder bike lanes should be separated from the motor vehicle lanes by a wide painted buffer instead of a narrow white border stripe. Vehicles frequently use the existing bike lanes to pass others waiting to turn—it is likely this will be more of a problem when MassDOT reduces the traffic lanes from two to one in each direction. A wide buffer helps remind motor vehicle drivers not to encroach into the bike lane and provides cyclists with more space if they need to swerve away from an encroaching motor vehicle (MassDOT, 2006).

The BWC recommends incorporating removable barriers and/or bollards) along the busiest portions of Route 6 (segments 6, 7, 8, and 9) that can be used seasonally when roadway and bikeway use are at their highest and be taken away during the low season to accommodate snow removal. Such devices are available in a wide array of designs, some of which are attractive and seem practical for Route 6 in Wellfleet.

No shared-use-path beside Route 6

An ordinary, 5-foot-wide pedestrian sidewalk will be a more appropriate option along the east side of Route 6. This allows for increased pedestrian safety for those who choose to use it but eliminates the dangers (and false sense of security) created by a broad shared-use-path that invites two-way cycle traffic and crosses a dense collection of commercial curb cuts along a highway known for high-volume and hazardous seasonal traffic. Cyclists who feel confident along Route 6 can thereby use the Route 6 shoulder bike lanes with greater safety. Other cyclists and hikers can use the nearby, highly accessible Route Z bikeway recommended by the BWC. The temptation for recreational cycling along Route 6 will decrease substantially; lives will likely be saved.

Add public transit options

Cyclists who do not feel confident along Route 6 can be encouraged to find alternative transportation means. For short distances along Route 6 they can walk along the provided pedestrian sidewalks; for longer distances they can use public transportation options or drive. MassDOT's design policies call for a thorough examination of opportunities to enhance transit opportunities such as public buses (MassDOT, 2020). Safe, easy-access buses and transit stops are comfortable and low-cost for users and have limited impact on traffic flow—especially compared to a predictably unsafe bikeway crossing high-use driveways and intersections. The BWC recommends the Selectboard work with MassDOT to provide enhanced transit opportunities (i.e., bus stops) at critical areas along Route 6, at the Rail Trail terminus, and in town. This will enable connectivity into Wellfleet Center for pedestrians or other bikeway users who do not choose to use share-the-road paths.

No sidewalk on East Main Street

The requirement for a paved sidewalk on the south side of the street was waived due to proximity to the marsh—the sidewalk on the north side should be waived for the same reason. Both sides of Main Street are well within the bounds of the 50' wetland no-go buffer, and the density of driveways and parking areas along that stretch makes a north-side sidewalk impractical. Looking at the MassDOT plans, more than 50% of the proposed Main Street sidewalk would consist of level driveway crossings—an unsightly and unnecessary strip of cement across shelled driveways, with no curb, offering no safety for pedestrians.

If a paved sidewalk is unavoidable, it can only be practical if businesses along that stretch of Main Street are required to close off their roadside parking areas and increase the available space for a sidewalk with a raised curb. To be clear: The BWC opposes this idea.

East Main Street is challenging for pedestrians, and the proximity of the marsh and business driveways means there is no straightforward solution. The BWC recommends the Selectboard explore the option of expanding the pedestrian trail on the south side of the road. If it were improved even slightly, the vegetation maintained, and more of the attractive stone or wooden posts added as a buffer, it can be a safe, and attractive pedestrian path for that portion of Main Street with little or no impact on the Duck Creek marsh. MassDOT's high valuation of context-sensitive design should allow for some leeway to enable this walkway alternative (MassDOT, 2006).

Sharrows, not shoulder bike lanes on Main Street

The proposed shoulder lanes end after only 450 ft and just before the crest of a hill. Cyclists and drivers alike may be surprised by the end of the shoulder bike lanes, making it more dangerous to merge the cyclists into Main Street traffic. The hill at that location also reduces sight distance, increasing risk of traffic accidents when drivers try to go around merging cyclists. The BWC recommends sharrows on Main Street indicating that cars and bikes share the road will be much safer than shifting traffic lane conditions and bike lanes which end. This same solution can be easily implemented further into town, and at low cost with no construction requirements.

NEXT STEPS

Improve communication with DCR

The DCR has demonstrated significant communication failures in the course of the Rail Trail project. The BWC advises the Selectboard to ask specific questions and require clear, direct answers from the DCR regarding any and all current and future DCR-related projects and plans affecting Wellfleet.

DCR says phase 2 is not currently on their near-term or 5-year plans.

- What is the cut-off date for putting this on their next year or 5-year plans?
- Will DCR notify the town when the issue does come up in their funding plans?

The Amsler lot is currently being used as a "staging area" for construction.

- What will happen to the lot when phase 1 construction is complete?
- If it takes years to decide to go forward (DCR pointed out that phase 2 is not on their 5-year plan), will they clean up the lot, stabilize the hill, plant ground cover, etc. in the interim?

Make a new plan with MassDOT and Stantec

The MassDOT project keeps moving ahead despite strong criticism from the public. Per MassDOT guidelines (2006), the Town is quickly running out of time to request any design changes. Ironically, the Town is funding the design its residents oppose. The contracted designers at Stantec, who have a longstanding work partnership with MassDOT, will provide the town-funded design to MassDOT for implementation. The BWC recommends that the Selectboard engage immediately with the project designers at Stantec and their MassDOT colleagues to do the following:

Implement design changes

MassDOT's Route 6 project should not be treated as a solution for a Wellfleet bikeway. The scope of the project should be limited to the following:

- Shoulder bike lanes with widened buffer and bollards/barriers along Route 6
- Ordinary pedestrian sidewalks along Route 6 (no shared-use-path)
- Intersection improvement as planned, but with no other construction on Main Street
- New transit stops at critical points on Route 6

Schedule the 25% Design Public Hearing

Initially MassDOT indicated great urgency in holding the hearing before the end of June 2021. On June 14, MassDOT postponed the hearing indefinitely (Wellfleet Town Media, 2021). The BWC recommends the Selectboard offer a date and facilities for the 25% Design Public Hearing to take place in Fall 2021. Wellfleet's summer season is a peak working time for many residents; a Fall hearing date will support--and does not exclude--town residents.

Request the Design Justification Workbook

Per MassDOT's updated policies (2020), the project designer must prepare a Design Justification Workbook explaining design decisions. Given the current stage of the project, this is very likely already completed. This information should be shared with the Selectboard and, if relevant, the public so there can be transparency throughout the design process. The MassDOT project is already contentious—if design documentation is held back, it will be harder to gain public support.

Request the Alternatives Evaluation Matrix

This MassDOT design documentation step precedes the newly required Design Justification Workbook listed above. Since the design has been in work for years, the evaluation matrix—a required step in prior planning—should be available. This matrix will help the Town understand the planning decisions made in the past that led to the current project situation.

Request the updated environmental impact determination

The requisite environmental impact study addresses many issues beyond natural environmental concerns (such as traffic flow, safety, etc.). The MassDOT project began as a smaller intersection improvement before it ballooned into a $10M highway reconstruction project. The intersection project was not originally linked to DCR Rail Trail extension, which may send over 1,000 cyclists per day to Route 6 (CCNS, 2010). The environmental impact study still reflects the original intersection project and was not updated when the scope of the project grew.

Discuss transit provisions

MassDOT's Healthy Transit policy places high value on transit (i.e., buses, shuttles, etc.), and these options may be excellent solutions for the largely seasonal needs of summer visitors and workers. The BWC recommends that the Selectboard work with MassDOT to improve the fixed-route transit networks, with special attention to the planned affordable housing area at Lawrence Road and in any areas known to particularly attract seasonal workers.

It may also be worthwhile to explore seasonal shuttles between areas of interest, such as town destinations and the beaches. This could prove a safe, comfortable alternative for recreational transportation that also reduces carbon emissions from private vehicles and the strain on shrinking ocean beach parking lots. It could be a convenient, low-impact solution to a seasonal problem. The BWC recommends the Selectboard explore this idea.

Designate a Wellfleet Liaison to DCR and MassDOT

The BWC advises that Wellfleet needs a more effective relationship with the DCR and MassDOT regarding ongoing and future plans and projects in Wellfleet. This can be achieved by a body or

individual duly authorized by the Town Government as a communication conduit. The BWC recommends the Selectboard appoint, in coordination with the Town Administrator, a qualified person who does not work on projects influenced by either of those agencies, and is not a member of the Selectboard, to act as the Town Liaison to the DCR and MassDOT regarding ongoing and future plans and projects in Wellfleet.

New discussions with CCNS

The CCNS opposition to the most desirable potential bikeway segments hamstrings Wellfleet's efforts to develop a suitable bikeway. The BWC recommends the Selectboard open new lines of communication with the CCNS to address their concerns. Wellfleet residents and visitors passionately share the CCNS staff's interest in protecting our unique, beautiful, publicly-owned natural resources, just as we know the CCNS staff shares Wellfleet's interest in enabling safe enjoyment of the outdoors. Given these mutual interests, it is likely that further discussion will lay open new options to mitigate the CCNS staff's concerns about the impact of a single bikeway on town-owned Old Kings Highway.

The BWC recommends the following points for future discussions with the CCNS:

- An unsuitable bikeway will not mark an end to the issue. There will be continued demand for a safe bikeway through Wellfleet (unlikely to be accomplished along Route 6). State policies are progressing rapidly for the development of more bike-friendly transport options (MassDOT, 2020). The town has a close relationship with CCNS; it is better to work together to put something acceptable in place, rather than to wait for the state to mandate something in the future that may not respect CCNS and town interests.
- There are many means of limiting negative environmental impact through park areas. Such means are used throughout the National Park Service, including existing CCNS trails and bikeways through CCNS land in Truro and Provincetown, and raised walkways through multiple wetlands with rare features (i.e., White Cedar Swamp, Red Cedar Swamp). Each trail or bikeway employs suitable means of protecting the natural surroundings. The BWC recommends the Selectboard advocate using these standard methods, including native plantings, fences, foliage barriers, and well-maintained trashcans, to reduce negative impact. The BWC likewise recommends the Selectboard advocate environmentally friendly path surface-material options, particularly for any portions of a bikeway through the CCNS.
- Wellfleet residents share the CCNS staff's desire to prevent overuse and overdevelopment of the public lands within the CCNS. To this end, the BWC recommends the Town and the CCNS create a memorandum of agreement that, after the installation of a single, carefully planned bikeway route on Old Kings Highway, there will not be any newly constructed (paved or otherwise) paths for bikes or pedestrians as "spur" routes through the CCNS. This can finally and formally address CCNS staff concerns and restrict further bikeway development within the CCNS boundaries.
- The CCNS staff has stated the CCNS is not budgeted for building a new bikeway through CCNS lands. Congress has created federal programs to facilitate transportation through federal lands, including lands managed by the NPS. Such programs provide means which might facilitate a bikeway using existing rights-of-way within the CCNS (including public roadways owned by the town). The BWC recommends the Selectboard work directly with the CCNS to explore these and other opportunities. CCNS partnership and local knowledge will prove valuable in planning.

- The Federal Lands Highway Program (FLHP), administered by the NPS, provides funding for an integrated approach to addressing transportation needs in national parks through the Park Roads and Parkways Program (PRPP) including infrastructure for alternative transportation (e.g., bikeways). The FLHP helps to manage existing transportation resources while also aiding in resource protection, energy conservation, and reducing noise and air pollution (NPS, 2018).
- The Federal Lands Access Program (FLAP) was established to improve transportation facilities that provide access to, are adjacent to, or are located within federal lands. The FLAP supplements state and local resources for public roads and other transportation facilities, with an emphasis on high-use recreation sites and economic generators (FHWA, 2021).
- Transportation Alternatives Set-Aside Program funds the development of facilities for nonmotorized transportation, community improvement activities such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity (FHWA, 2017).
- Recreational Trails Program (RTP) provides funding to states to create and maintain recreational trails for motorized and nonmotorized trail uses, including hiking and bicycling (NPS, 2017).
- Federal Lands Transportation Program (FLTP) was established under the Moving Ahead for Progress in the 21st Century Act (MAP-21) and continued under the Fixing America's Surface Transportation Act (FAST), (23 USC § 203) to improve transportation facilities for the Federal Land Management Agency (FLMA) partners, including the NPS (NPS, 2020).

Communicate with Wellfleet residents

The BWC recommends the Selectboard increase transparent communication with the public to encourage inputs and address concerns. When a decision is made regarding the final bikeway route, it should be described in full, with the reasoning, advantages, and risk mitigations fully explained.

It is crucial that the public be enabled to prepare for and participate in the MassDOT 25% Design Public Hearing. As noted previously but repeated here for emphasis, the BWC recommends the Selectboard ensure the 25% public hearing for the Route 6 project take place after the end of the busy summer tourist season, the public hearing is well-advertised, and residents are given ample opportunity to prepare and submit comments and questions ahead of the meeting.

Conclusion

Wellfleet seeks to develop a safe, usable, bikeway that serves the public and compliments the region's distinctive qualities. The challenge of creating a suitable bikeway through Wellfleet has continued for decades, with many environmental, geographic, and traffic concerns as obstacles. The diverse needs of a seasonally changing town population complicate the issue. Through this data-driven study, founded on bikeway planning best-practices and bolstered by public inputs and local context, the Wellfleet BWC has determined two options for developing a Wellfleet Bikeway. The BWC offers these options for the Selectboard's consideration, along with actionable recommendations, including next steps in engaging stakeholder agencies.

The highest-scoring option, identified as Route Z in this study, will provide a safe, practical, enjoyable bikeway through Wellfleet. The primary obstacle is the CCNS staff's resistance to Wellfleet's use of the town-owned Old Kings Highway which proceeds within the western boundary of the CCNS.

The second option is the highest scoring alternative that avoids the National Seashore. Route Q_2 is the highest-scoring route under that constraint. It is worth noting that although Route Q_2 scores in the acceptable range, it ranks in the bottom half of all the alternatives.

The route proposed by state agencies, identified as Route A in this study, ranks lowest of all the routes considered. It is worth repeating that the scoring parameters in this study were developed through an independent research effort which investigated best practices nationwide, firewalled from any consideration of the specific alternative routes to be evaluated in Wellfleet. Route A has scored, objectively, as the most dangerous to cyclists and pedestrians, the most dangerous to motor vehicle traffic, the least valuable to promote cycling or other transportation alternatives, and the most damaging to the Town of Wellfleet. Route A is not recommended. The BWC offers several actionable recommendations to make the state's projects less unsuitable if, in fact, the state agencies force their projects on Wellfleet despite public opposition and the objective results of this study.

With the information and recommendations provided in this report, the BWC hereby provides the Selectboard with tools to strengthen its position in working with external agencies to implement a safe and successful bikeway in Wellfleet.

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Appendix A. Town-State correspondence regarding Rail Trail Extension

Figure A1. Letter from Wellfleet Selectboard to Governor Baker – 26 August 2020

TOWN OF WELLFLEET
OFFICE OF THE SELECTBOARD
300 MAIN STREET WELLFLEET MASSACHUSETTS 02667
Tel (508) 349-0300 Fax (508) 349-0305
www.wellfleet-ma.gov

August 26, 2020

Massachusetts State House
24 Beacon St.
Office of the Governor, Room 280
Boston, MA 02133

Dear Governor Baker, Lt Governor Polito and DCR Commissioner Jim Montgomery,

As members of the Wellfleet Selectboard, we represent our residents and taxpayers in all matters that important public issues. We are writing to bring to your attention a serious, ongoing public safety concern related to where the DCR plans to end the Cape Cod Rail Trail Bike Path in Wellfleet.

Our town is very supportive of continuing the Bike Path through Wellfleet and appreciates all the hard work and planning that has gone into the project. However, we do not support the current DCR plan, as it has the proposed Bike Path project terminus immediately abutting and corresponding with an expanded bike lane on Route 6 proposed by the DOT, at the busiest and most congested stretch of the highway in Wellfleet. At issue is the foreseeable increase in use of this dangerous section of road for cyclists to reach nearby attractions. Members of our community have repeatedly voiced their public safety concerns with this proposal at public meetings hosted by the DCR, and in smaller gatherings with DCR and DOT staff, but they feel that their valid considerations have been overlooked.

On April 23, 2019 at our Annual Town Meeting, citizens of Wellfleet voted almost unanimously in favor of Article 44, which requested
"that the Board of Selectmen, the Conservation Commission and the Planning Board consider alternate routes for the Bike Trail Extension and to ask the appropriate agencies to halt any planning or construction of the bike trail extension beyond Old County Road until those deliberations have occurred."

Therefore, we formally request that the DCR postpone any further construction and planning of the bike trail extension beyond Old County Road (also known as Old Kings Highway) due to public safety concerns. We ask that in future planning, the DCR work with DOT staff, the Town, and the Superintendent of the Cape Cod National Seashore, to seek alternative routes and safely continue the Cape Cod Rail Trail through Wellfleet.

We request your help in giving the Town of Wellfleet an effective role in this process, so that we may protect the safety of our citizens and our visitors.

Sincerely,

The Wellfleet Selectboard

Michael DeVasto, Chair

Janet Reinhart, Vice-Chair

Ryan Curley, Clerk

Helen Miranda Wilson

Justina Carlson

CC:
The Honorable Lt. Governor Karen Polito
DCR Commissioner Jim Montgomery

Figure A2. Letter from DCR Commissioner to Wellfleet Selectboard – 24 September 2020

dcr
Massachusetts

September 24, 2020

Mr. Michael DeVasto, Chair
Town of Wellfleet Select Board
300 Main Street,
Wellfleet, MA 02267

Dear Chairman DeVasto,

I just received your letter of August 26, 2020, expressing the Town's concerns over the extent and current timeline of the DCR Wellfleet extension project for the Cape Cod Rail Trail (CCRT).

Thank you for your input and communication. At this time DCR has elected to phase our project and only construct the CCRT extension from the Lecount Hollow trailhead to DCR's Wellfleet Hollow Campground. We hope to initiate construction of this project early next calendar year and complete it sometime in 2022. We believe that this Phase One project will be a benefit to both Wellfleet and Commonwealth residents.

While we appreciate your desire to explore alternative shared-use pathway routes north of Old County Road, DCR does not own any other rights of way and would defer any feasibility studies to the Town and other parties. In addition, DCR continues to believe that the safest and best approach for users of the CCRT, and for Wellfleet residents of all ages, will be to continue the CCRT on the former railroad corridor to a new terminus trailhead at Route 6. However, as requested, we have placed those plans on hold for the present.

As a part of our current project, we do ask that the Town work with DCR to provide temporary alternative parking for the Lecount Hollow trailhead near the Chamber of Commerce on the Town-owned old State Highway.

We hope that this addresses the Town's concerns, and we look forward to working with you as the Phase One project moves into construction. Please feel free to reach out to me again, or to Craig Cashman, DCR Director of Legislative Affairs, (craig.r.cashman@mass.gov), or Paul Jahnige, DCR Director of Trails and Greenways (paul.jahnige@mass.gov) with any questions.

Sincerely,

Jim Montgomery
Commissioner

CC: Maria Broadbent, Town Administrator, Maria.Broadbent@Wellfleet-MA.gov
Senator Julian Cyr Julian.Cyr@masenate.gov
Rep. Sarah Peake: Sarah.Peake@mahouse.gov
Craig Cashman, DCR
Paul Jahnige, DCR

COMMONWEALTH OF MASSACHUSETTS · EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS

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www.mass.gov/orgs/department-of-conservation-recreation

Charles D. Baker
Governor

Karyn E. Polito
Lt. Governor

Kathleen A. Theoharides, Secretary, Executive
Office of Energy & Environmental Affairs

Jim Montgomery, Commissioner
Department of Conservation & Recreation

Appendix B. Resource documents for bikeway planning principles

Regional Reports	
Outer Cape Bicycle and Pedestrian Master Plan Final Report, 2017	https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/Website_Resources/initiatives/OuterCapeBikePedPlan/OCBPMPFinalReport9-2016UpdateFeb2017.pdf
Integrated Bicycle Plan for Cape Cod Bicycle Feasibility Study In Partnership with the Cape Cod Commission, 2010	https://www.capecodcommission.org/resource-library/file?url=%2Fdept%2Fcommission%2Fteam%2Ftr%2FReference%2FBike-Ped%2F2010_CCNS_Bike_Feasibility.pdf
Parkwide bicycle trail study/traffic safety study/environmental assessment, 1987	https://ia801601.us.archive.org/8/items/parkwidebicyclet00romo/parkwidebicyclet00romo.pdf
Cape Cod Commission 2011 report for bike lanes in all the 15 Cape towns	https://www.capecodcommission.org/resource-library/file?url=%2Fdept%2Fcommission%2Fteam%2FWebsite_Resources%2Ftransportation%2FBikePedPlanningRecReport_Sept2011.pdf
2016 Cape Cod Regional Transportation Plan	https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/tr/Transportation%20Plans/RTP/2016_RTP/Final%20Report/Cape%20Cod%202016%20Regional%20Transportation%20Plan%20-%20without%20Appendices%20(Endorsed%207-20-15).pdf
Cape Cod National Seashore Foundation Document	https://www.nps.gov/caco/learn/management/upload/CACO_FD_508.pdf
State and federal guidelines	
Federal Highway Administration Separated Bike Lane Planning and Design Guide	https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/page04.cfm
MassDOT Separated Bike Lane Planning and Design Guide	https://www.mass.gov/lists/separated-bike-lane-planning-design-guide
MassDOT Design Guides and Manuals	https://www.mass.gov/lists/design-guides-and-manuals#design-guides-and-manuals-
Massachusetts Bicycle Transportation Plan Public Engagement Results, 2019	https://www.mass.gov/doc/bike-plan-public-engagement-results/download
MassDOT Municipal Resource Guide for Bikeability, 2019	https://www.mass.gov/files/documents/2019/06/13/2019_Municipal_Resource_Guide_for_Bikeability.pdf
Massachusetts Bicycle Transportation Plan, 2019	https://massdot.maps.arcgis.com/apps/MapJournal/index.html?appid=c80930586c474a3486d391a850007694
National Environmental Policy Act	https://www.epa.gov/nepa/what-national-environmental-policy-act
National Historic Preservation Act	https://www.nps.gov/subjects/historicpreservation/laws.htm

Federal Lands Access Program	https://highways.dot.gov/federal-lands/programs-access/ma
DCR Trails Guidelines and Best Practices	https://www.americantrails.org/resources/dcr-trails-guidelines-and-best-practices-manual#:~:text=DCR%20Trails%20Guidelines%20and%20Best%20Practices%20Manual.%20The,procedures%2C%20and%20best%20practices%20in%20sustainable%20trail%20development
Other bikeway studies	
South Orleans to Orleans Trail Study	https://www.town.orleans.ma.us/bike-and-pedestrian-committee/pages/south-orleans-to-orleans-trail-study
Billerica MA evaluation of bikeway alternatives	(http://www.town.billerica.ma.us/DocumentCenter/View/3539/Yankee-Doodle-Bike-Path-Alternative-Analysis?bidId=)
Cupertino CA study, listing 7 criteria.	https://altago.com/wp-content/uploads/Cupertino-Bicycle-Transportation-Plan-6.pdf
Sunnyvale CA study	https://sunnyvale.ca.gov/civicax/filebank/blobdload.aspx?BlobID=23225
Marin County CA study of routes, listing 13 criteria (pp3-3 and 3-4).	http://walkbikemarin.org/documents/mv_cm_study/FINAL%20Study/3%20Alternatives%20Evaluation.pdf
Santa Clara CA study giving 12 general criteria but a wealth of information and perspectives about the methodologies of choosing alternative paths.	https://www.stevenscreektrail.org/Resources/LosAltos/LA_SCT_FeasibilityStudy/Alta_FinalReport/SCT%20FINAL%20FEASIBILITY%20STUDY.pdf
Portland OR study of improving a city bike lane that lists 8 general criteria.	https://www.portlandoregon.gov/transportation/article/702764
A Florida study that lists 8 general criteria (p4).	https://www.ecrc.org/document_center/Programs/Bay%20County%20TPO/Plans%20and%20Documents/DRAFT%20Bay%20TA%20Scoring%20Criteria%20.pdf
Meta-study by Texas looking at how other states evaluate options for bike routes (and other things), and then what they recommend for TX.	https://static.tti.tamu.edu/tti.tamu.edu/documents/3988-1.pdf
2020 National Cycling Plan for Germany.	https://nationaler-radverkehrsplan.de/en/federal-initiatives/national-cycling-plan-nvp-2020
How the European Union (EU) approaches selection, design, operation, and maintenance of bike paths.	https://ec.europa.eu/transport/themes/clean-transport-urban-transport/cycling_en
A Greek (Thessaloniki) study of alternative bike routes with 8 criteria.	https://www.researchgate.net/publication/236630986_The_implementation_of_a_cycle_network_in_the_city_of_Thessaloniki-Greece_Evaluation_remedial_proposals_and_policies

Appendix C. Bikeway analysis goals, objectives, and criteria

Goal 1: ***Safety*** [30%]: Minimize accident risk.

Objective 1.a: *Limit exposure to motor vehicle traffic danger*. Minimize users' direct exposure to the collision threats, stress, noise, pollution, and other dangers of roadways. [35%]

Criterion 1.a.1: Motor vehicles cannot accidentally intrude onto the route. [50%]

Criterion 1.a.2: The route does not discourage use by less experienced cyclists or pedestrians by presenting obvious dangers. [15%]

Criterion 1.a.3: Stressors such as noise, pollution, or proximity to high-velocity high-volume traffic are unlikely to create risks for users of varying ability levels, such as children and seniors. [20%]

Criterion 1.a.4: The route does not cross dense clusters of roadway curb cuts. [15%]

Objective 1.b: *Prevent accidents on the path.* Ensure sufficient path width, visibility, grades, and turn radii to minimize user collisions, going off track, over-working, and other physical problems. [30%]

Criterion 1.b.1: The route's features are unlikely to cause user loss of control or collision. [30%]

Criterion 1.b.2: The route edges will not immediately border dangerous features such as drop-offs, wetlands and streams, or solid natural walls. [30%]

Criterion 1.b.3: There is sufficient space for a reasonable distribution of stopping points along the route (e.g., at points of interest), to enhance user safety. [15%]

Criterion 1.b.4: The route is not excessively arduous such that it will predictably lead to injury/overexertion for some users. [25%]

Objective 1.c: *Ensure intersection and road-sharing safety.* Implement best-practices safety measures when the path intersects with, or road-shares on, secondary roads. [25%]

Criterion 1.c.1: Road crossings are not at points which present significant difficulties, such as a steeply banked surface, multiple roads, or frequent surface water/sand. [20%]

Criterion 1.c.2: Route users have adequate visibility at intersections. [20%]

Criterion 1.c.3: Roadway drivers have adequate visibility at intersections. [20%]

Criterion 1.c.4: Road-sharing does not occur on narrow roads or where side features preclude a safe shoulder. [20%]

Criterion 1.c.5: Road crossing or road-sharing does not occur on stretches of secondary roads known to be unsafe (verified by the Wellfleet Police Department). [20%]

Objective 1.d: *Minimize risks to motor vehicle traffic.* Limit driver distraction or overload that increases the risk of vehicular traffic accidents. [10%]

Criterion 1.d.1: Route users are unlikely to impede high-volume road traffic by obstructing high-use curb cuts. [50%]

Criterion 1.d.2: Route users and required safety signage are unlikely to distract drivers, especially in high-volume traffic. [50%]

Goal 2: ***Practicality*** [20%]: Ensure that the bike path will be reasonable to build and maintain, direct in its course, and have negligible adverse impact to traffic congestion on roadways.

Objective 2.a: *Promote constructability.* Select routes with features that reduce expected construction difficulty. [30%]

Criterion 2.a.1: The route follows public rights of way. [20%]

Criterion 2.a.2: No new trails will be blazed through deep, untraveled, undisturbed, virgin natural terrain unaligned with existing rights of way. [20%]

Criterion 2.a.3: No bridges or underpasses need to be built. [15%]

Criterion 2.a.4: Extensive grading of the route is not required. [15%]

Criterion 2.a.5: Construction costs are likely to be reasonable. [15%]

Criterion 2.a.6: The route does not adversely impact utility easements, drainage features, and similar roadway considerations, nor shall these features unnecessarily prevent a path route (verified by the Wellfleet Department of Public Works). [15%]

Objective 2.b: *Facilitate authorizations.* Avoid major foreseeable difficulties in obtaining approvals and legal actions. [30%]

Criterion 2.b.1: The authorization process to use rights-of-way is anticipated to be reasonable. [30%]

Criterion 2.b.2: The route does not require authorization of new trails through undeveloped National Seashore land. [30%]

Criterion 2.b.3: Town-owned land has no intended purpose that would conflict with a path route (verified by the Wellfleet Department of Public Works). [10%]

Criterion 2.b.4: The route does not require acquisition of privately-owned land. [30%]

Objective 2.c: *Limit new traffic congestion*. Limit adverse impact on traffic congestion along traffic arteries. [15%]

Criterion 2.c.1: The route will not foreseeably create significant adverse impacts to the flow of roadway traffic. [50%]

Criterion 2.c.2: The route will not foreseeably require speed limit adjustments or additional traffic lights on a roadway. [50%]

Objective 2.d: *Ensure directness.* Avoid unreasonably circuitous routes through Wellfleet. [15%]

Criterion 2.d.1: The route distance is close to the straight-line distance from Wellfleet Hollow Campground to Rose Road or Collins Road in Truro. [70%]

Criterion 2.d.2: The route's natural features do not reduce travel efficiency (e.g., sharp turns, steep slopes). [30%]

Objective 2.e: *Ensure reasonable maintenance requirements.* The route will not require extraordinary effort to maintain. [10%]

Criterion 2.e.1: The route's features will not pose foreseeable and chronic special maintenance issues (e.g. excessive accumulation of sand, water, or roadway debris). [60%]

Criterion 2.e.2: No special support structures (e.g. guy wires, buttresses, special borders, special shoring up) appear necessary on the route. [40%]

Goal 3: ***User Experience*** [20%]: Provide an interesting, satisfying, and supportive experience for both recreational and purposive users.

Objective 3.a: *Enhance usability.* Accommodate users passing in both directions. [30%]

Criterion 3.a.1: There is sufficient space for multi-directional traffic, ideally a 12' wide 2-way separated bikeway with a 2' shoulder on each side. [40%]

Criterion 3.a.2: The route side features will enable a path that is laterally even and flat so users can comfortably pass in both directions. [20%]

Criterion 3.a.3: The route is accessible for less able users. [20%]

Criterion 3.a.4: The route provides users reasonable visibility to comfortably share the pathway with other users. [20%]

Objective 3.b: *Share natural experiences.* Expose path users to Wellfleet's natural beauty. [25%]

Criterion 3.b.1: There is little vehicular or industrial noise or smell on the route. [25%]

Criterion 3.b.2: There are few buildings or commercial equipment/structures visible on the route. [25%]

Criterion 3.b.3: The route provides 360° immersion in nature. [30%]

Criterion 3.b.4: The route offers one or more unobstructed natural vista (e.g. view of ponds, marsh, dunes). [20%]

Objective 3.c: *Accommodate areas for stopping along the path. Allow* for reasonable stopping areas to access nearby public car parking, rest and repair areas, and points of interest. [25%]

Criterion 3.c.1: The route is close to areas which have or could accommodate public car parking for path users. [35%]

Criterion 3.c.2: Space exists to construct off-path rest areas for extended stops (e.g. eating, attending to equipment, and making calls). [35%]

Criterion 3.c.3: Space exists to construct pull-over areas for quick stops (e.g. reading signs, taking photos). [30%]

Objective 3.d: *Improve purposive user experience.* Serve the timeliness and travel efficiency intentions of purposive users. [20%]

Criterion 3.d.1: The route's location and practical qualities are likely to promote an increase in cycling transportation. [50%]

Criterion 3.d.2: The route promotes low-stress travel both to centers of town activity and to recreational locations. [50%]

Goal 4: ***Conservancy*** [20%]: Minimize impact on cultural, scenic, community, or environmental areas or values.

Objective 4.a: *Protect the environment.* The path will not negatively impact any aspect of Wellfleet's environment. This includes natural (e.g. ponds, streams, marshes, wildlife) and iconic cultural features. [40%]

Criterion 4.a.1: Path construction on the route will not disrupt the physical environment (e.g. diverting natural water flows, increasing dune instability, removing slope-anchoring plant life, or cutting through forested hills). [25%]

Criterion 4.a.2: The route does not cause significant disruption to wildlife patterns (e.g. encroaching on animal breeding areas) (verified by the National Seashore). [10%]

Criterion 4.a.3: The route does not directly border any pond in the National Seashore (verified by the National Seashore). [40%]

Criterion 4.a.4: The route does not border the protected "Cape Cod Modern" buildings (verified by the National Seashore). [25%]

Objective 4.b: *Preserve the Town's character.* Preserve Wellfleet's existing historical and iconic streets, sidewalks, architecture, small-town character, historical legacy, and cultural nature. [30%]

Criterion 4.b.1: The route does not require land that is currently part of historic properties. [30%]

Criterion 4.b.2: The route will not create traffic conditions which overcrowd the parking areas, streets, and sidewalks in Wellfleet Center. [40%]

Criterion 4.b.3: The route does not foreseeably lead to roadway expansion within the Town of Wellfleet that would disrupt the character, historical legacy, architecture, and cultural nature of Wellfleet. [30%]

Objective 4.c: *Respect adjacent property.* Minimize adverse effects on adjacent private or public property, including temptation to trespass, negative impacts on views, noise levels, and ambient light experience of abutters or others who can view or hear the path. [30%]

Criterion 4.c.1: The route does not disrupt or eliminate the sole means of access of a property owner to or from their property. [25%]

Criterion 4.c.2: The route does not create a foreseeable major disturbance, obstruct views, or otherwise cause concern to nearby private residences. [25%]

Criterion 4.c.3: Necessary path stops on the route (e.g., at intersections or attractive vistas) are located away from and out of sight of abutting residences. [25%]

Criterion 4.c.4: The route will not foreseeably encourage unauthorized access to sensitive National Seashore sites (verified by the National Seashore). [25%]

Goal 5: ***Connectivity*** [10%]: Facilitate connectivity with cultural, commercial, and community centers; public transportation; services; and scenic areas.

Objective 5.a: *Provide access to points-of-interest.* Accommodate convenient connections to Wellfleet Town Center, businesses and services, the National Seashore sights and beaches, and bikeways in the neighboring towns. [80%]

Criterion 5.a.1: The route promotes convenient connectivity to the Town center and commercial sites. [30%]

Criterion 5.a.2: The route promotes convenient connectivity to scenic and recreational sites (e.g., beaches). [30%]

Criterion 5.a.3: The route supports diverse user interests by providing convenient connectivity to a balanced mix of destinations. [40%]

Objective 5.b: *Anticipate network improvement.* Plan for future possibilities for low-impact expansion to points of interest. [20%]

Criterion 5.b.1: There are reasonable opportunities for future bikeway expansion to additional points of interest (e.g., links to highly-rated segments from the bikeway study that are not used in final route). [50%]

Criterion 5.b.2: There are reasonable opportunities for future foot path expansion to additional points of interest. [50%]

Appendix D. Suggested route alternatives

Table D1
Proposed route alternatives included in bikeway analysis

Route	Description	Segments
A	[State's proposal] Proceed on the DCR Rail Trail to Route 6, then follow Route 6 to Truro. Also add a 450ft spur along Main Street from Route 6.	[1-2-3-4-5-6-7-8-9-109-10-11-12-13-14-47]
B	Proceed on the Rail Trail to Dog Park Fire Road. Proceed to Cahoon Hollow Road, then follow Cahoon Hollow Rd to Ocean View Drive. Take Ocean View Drive to Gross Hill Road, then Gross Hill Road to Gull Pond Rd. Proceed to Old Kings Highway, then follow Old Kings Highway to Collins Road in Truro.	[1-2-3-16-39-38-113-112-33-35-37-96-100-101-58-59-60-61]
C	Proceed on the Rail Trail to Old County Road. Follow a new path just inside the edge of the woods east of the power lines, then proceed a short distance west along Cahoon Hollow Road to the utility right-of-way. Follow the utility right-of-way all the way to Rose Road in Truro.	[1-2-3-4-18-42-110-111-22-23-24-25-26-27-28-29]
D	Proceed on the Rail Trail to Old County Road. Proceed to the utility right-of-way and continue to Cahoon Hollow Road. Follow Cahoon Hollow Road to Route 6, then follow Route 6 to Truro.	[1-2-3-4-21-43-44-45-46-7-8-9-109-10-11-12-13-14]
E	Proceed on the Rail Trail to Old County Road. Follow a new path just inside the edge of the woods east of the power lines. Proceed along Cahoon Hollow Road to Route 6, then follow Route 6 to Truro.	[1-2-3-4-18-42-43-44-45-46-7-8-9-109-10-11-12-13-14]
F	Proceed on the Rail Trail to Old County Road. Continue along a path built beside Old County Road to Cahoon Hollow Road, then west along Cahoon Hollow Road to Route 6, then follow Route 6 to Truro.	[1-2-3-4-17-41-42-43-44-45-46-7-8-9-109-10-11-12-13-14]
G	Proceed on the Rail Trail to Old County Road. Continue along a path built beside Old County Road to Cahoon Hollow Road, then west along Cahoon Hollow Road to a path just east of the cemetery that connects to Old Kings Highway. Follow Old Kings Highway to Collins Road in Truro.	[1-2-3-4-17-41-42-43-44-45-52-55-56-57-58-59-60-61]
H	Proceed on the Rail Trail to Old County Road. Proceed to Cahoon Hollow Road, then follow Cahoon Hollow Road east to Way 623/Forrest Road. Take Forrest Road to Long Pond Road, then Long Pond Rd to Old Long Pond Rd to Route 6. Follow Route 6 to Truro.	[1-2-3-4-17-40-39-64-65-80-23-86-10-11-12-13-14]
I	Proceed on the Rail Trail to Old County Road. Proceed to Cahoon Hollow Road, then follow Cahoon Hollow Road east to Way 623/Forrest Road. Take Forrest Road to Long Pond Road, and Long Pond Road to Route 6 (via a ramp), then follow Route 6 to Truro.	[1-2-3-4-17-40-39-64-65-80-81-82-83-85-109-10-11-12-13-14]
J	Proceed on the Rail Trail to Old County Road. Proceed to Cahoon Hollow Road, then follow Cahoon Hollow Road east to Way 623/Forrest Road. Take Forrest Road to Long Pond Road, and Long Pond Road to Sapokonish Way to Gull Pond Road. Take Gull Pond Road to Old Kings Highway, then follow Old Kings Highway to Collins Road in Truro.	[1-2-3-4-17-40-39-64-65-79-114-92-100-101-58-59-60-61]

K	Proceed on the Rail Trail to Old County Road. Proceed to Cahoon Hollow Road, then follow Cahoon Hollow Road east to Way 54. Continue on Way 626 to Long Pond Road. Take Long Pond Road to Route 6 (via a ramp), then follow Route 6 to Truro.	[1-2-3-4-17-40-39-38-113-62-77-78-79-80-81-82-83-85-109-10-11-12-13-14]
L	Proceed on the Rail Trail to Old County Road. Proceed to Cahoon Hollow Road, then follow Cahoon Hollow Road east to Way 54. Continue on Way 626 to Long Pond Road. Take Long Pond Road to Old Long Pond Road to Route 6. Follow Route 6 to Truro.	[1-2-3-4-17-40-39-38-63-69-77-78-79-80-23-86-10-11-12-13-14]
M	Proceed on the Rail Trail to Old County Road. Proceed to Cahoon Hollow Road, then follow Cahoon Hollow Road east to Way 54. Continue on Way 626 to Long Pond Road. Take Long Pond Road east to Sapokonish Way to Gull Pond Road. Take Gull Pond Road to Old Kings Highway, and proceed to Collins Road in Truro.	[1-2-3-4-17-40-39-38-63-69-77-78-114-92-100-101-58-59-60-61]
N	Proceed on the Rail Trail to Dog Park Fire Road. Proceed to Cahoon Hollow Road, then follow Way 623 to bear northward just after Dyer Pond along the fire road to the utility right-of-way. Continue along the utility right-of-way across Gross Hill Road to Old Kings Highway, then follow Old Kings Highway to Collins Road in Truro.	[1-2-3-16-39-64-73-74-22-23-24-57-58-59-60-61]
O	Proceed on the Rail Trail to Old County Road, then follow the utility right-of-way all the way to Rose Road in Truro.	[1-2-3-4-21-110-111-22-23-24-25-26-27-28-29]
P	Proceed on the Rail Trail to Old County Road. Proceed along the utility right-of-way and continue to Long Pond Road. Take Long Pond Road east to Sapokonish Way to Gull Pond Road. Proceed along Gull Pond Road to Old Kings Highway, then follow Old Kings Highway to Collins Road in Truro.	[1-2-3-4-21-110-111-22-80-79-114-92-100-101-58-59-60-61]
Q	Proceed on the Rail Trail to Old County Road. Continue along a path built beside Old County Road to Cahoon Hollow Road, then west along Cahoon Hollow Road to the utility right-of-way. Proceed along the utility right-of-way to Old Long Pond Road, take Old Long Pond Road to Route 6, then follow Route 6 to Truro.	[1-2-3-4-17-41-42-110-111-22-23-86-10-11-12-13-14]
Q_2	Proceed on the Rail Trail to Old County Road. Continue along a path built beside Old County Road to Cahoon Hollow Road, then west along Cahoon Hollow Road to the utility right-of-way. Proceed along the utility right-of-way to Gull Pond Road. Take Gull Pond Road west to Route 6, then follow Route 6 to Truro.	[1-2-3-4-17-41-42-110-111-22-23-24-25-102-12-13-14]
R	Proceed on the Rail Trail to Old County Road. Continue along a path built beside Old County Road to Cahoon Hollow Road, then west along Cahoon Hollow Road to the utility right-of-way. Proceed along the utility right-of-way to Long Pond Road. Take Long Pond Road to Route 6 (via a ramp), then follow Route 6 to Truro.	[1-2-3-4-17-41-42-110-111-22-81-82-83-85-109-10-11-12-13-14]
R_2	Proceed on the Rail Trail to Old County Road. Continue along a path built beside Old County Road to Cahoon Hollow Road, then west along Cahoon Hollow Road to the utility right-of-way. Proceed along the utility right-of-way to Long Pond Road. Take Long Pond Road to Lawrence Rd. Take Lawrence Road/Gross Hill Rd to Route 6, then follow Route 6 to Truro.	[1-2-3-4-17-41-42-110-111-22-81-82-87-10-11-12-13-14]

S	Proceed on the Rail Trail to Dog Park Fire Road to Cahoon Hollow Road. Continue along Way 623/Forrest Road to Long Pond Road. Take Long Pond Road east to Sapokonish Way. Approximately halfway along Sapokonish Way, proceed on a new trail through the woods directly to the intersection of Gull Pond Road and School House Hill Road. Proceed along School House Hill Road almost to Old Hay Road. Cut the corner through the woods a short distance to Old Hay Road, then proceed to Old Kings Highway. Follow Old Kings Highway to Slough Pond Road, then take Slough Pond Road to Rose Road in Truro.	[1-2-15-64-65-79-114-66-67-68-59-60-107-108]
T	Proceed on the Rail Trail to Dog Park Fire Road to Cahoon Hollow Road. Continue along Way 623/Forrest Road to Long Pond Road. Take Long Pond Road east to Sapokonish Way. Approximately halfway along Sapokonish Way, proceed on a new trail through the woods directly to the intersection of Gull Pond Road and School House Hill Road. Proceed along School House Hill Road almost to Old Hay Road. Cut the corner through the woods a short distance to Old Hay Road, then proceed to Old Kings Highway. Follow Old Kings Highway to Collins Road in Truro.	[1-2-15-64-65-79-114-66-67-68-59-60-61]
U	Proceed on the Rail Trail to Old County Road. Take the utility right-of-way briefly to connect to the Old Kings Highway right-of-way that connects to Howard Court. Proceed on Howard Court to Cahoon Hollow Road. Follow Cahoon Hollow Road to Zoeth Smith Way, then down steep slope on a new pathway to Old Kings Highway behind the Seamen's Bank on Route 6. Continue on Old Kings Highway to Collins Road in Truro.	[1-2-3-4-19-44-53-54-115-55-56-57-58-59-60-61]
V	Proceed on the Rail Trail to Old County Road. Follow a new path just inside the edge of the woods east of the power lines, then proceed a short distance west along Cahoon Hollow Road to the utility right-of-way. Proceed along the utility right-of-way to the trail leading in the direction of Forrest Road. Prior to Forrest Road, turn left onto the Fire Road leading back to the utility right-of-way. Proceed along the utility right-of-way to Gross Hill Road, then follow Old Kings Highway to Collins Road in Truro.	[1-2-3-4-18-42-110-75-74-22-23-24-57-58-59-60-61]
W	Proceed on the Rail Trail to Dog Park Fire Road. Proceed to Cahoon Hollow Road, then follow Way 623 to Forrest Road. Take Forrest Road to Long Pond Road to Sapokonish Way. Approximately halfway along Sapokonish Way, proceed on the trail that leads northwest to Gross Hill Road, which it then crosses and intersects with Old Kings Highway. Follow Old Kings Highway to Collins Road in Truro.	[1-2-3-16-39-64-65-79-114-93-94-58-59-60-61]
X	Proceed on the Rail Trail to Old County Road. Proceed to the utility right-of-way and continue to Gross Hill Road, then follow Old Kings Highway across Gull Pond Road to Collins Road in Truro.	[1-2-3-4-21-110-111-22-23-24-57-58-59-60-61]
Y	Proceed on the Rail Trail to Old County Road. Follow a new path just inside the edge of the woods east of the power lines, then proceed a short distance along Cahoon Hollow Road to the utility right-of-way. Continue along the utility right-of-way to Gross Hill Road, then	[1-2-3-4-18-42-110-111-22-23-24-57-58-59-60-61]

	follow Old Kings Highway across Gull Pond Road to Collins Road in Truro.	
Z	Proceed on the Rail Trail to Old County Road. Continue along a path built beside Old County Road to Cahoon Hollow Road, then west along Cahoon Hollow Road to the utility right-of-way. Proceed along the utility right-of-way to Gross Hill Road, then follow Old Kings Highway across Gull Pond Road to Collins Road in Truro.	[1-2-3-4-17-41-42-110-111-22-23-24-57-58-59-60-61]

The following route spurs were proposed and analyzed, but not included in the final consideration for a route because they do not serve the intent to create a new spine route that links the South Wellfleet and Truro bikeway routes.

Table D2
Route spur alternatives

Route	Description	Segments
Spur A	Inner Cape Corridor: Proceed using the state's plans into East Main Street, then a share-the-road route to connect to the Saltonstall Route – West Main Street to Pole Dike Road, Bound Brook Island Road, Old County Road up to Truro, eventually to Collins Rd.	[47-48-49-50-51]
Spur B	From DCR Rail Trail to Route 6, then Oriole Lane to rear of Bay Sails Marine. Continue behind Bay Sails Marine to Cumberland's parking lot, across to PJs Restaurant parking lot.	[5-20]
Spur C	From any route which intersects Long Pond Road, add a spur west on Long Pond Road to Main Street – a share-the-road route to connect to the Saltonstall Route at Wellfleet Center.	[81-82-84]
Spur D	From the South Wellfleet Rail Trail, proceed along Le Count Hollow Road to Ocean View Drive, to Long Pond Road. Another spur would continue on Ocean View Drive to Newcomb Hollow Beach. The main path would turn off Long Pond Road at Lawrence Road to Gross Hill Road/Route 6.	[31-32-33-35-112-62-77-78-79-80-81-82-87]

Appendix E. Bikeway analysis segments

Segment	Length	Pathway	Proposed path type
1	0.717 mi	DCR Rail Trail Ext LeCount Hollow Rd → Campground	DCR Rail Trail Ext - shared-use-path
2	0.242 mi	DCR Rail Trail Ext Campground → Duck Pond Fire Rd	DCR Rail Trail Ext - shared-use-path
3	0.637 mi	DCR Rail Trail Ext Duck Pond Fire Rd → Dog Park Fire Rd	DCR Rail Trail Ext - shared-use-path
4	0.164 mi	DCR Rail Trail Ext Dog Park Fire Rd → Old County Rd	DCR Rail Trail Ext - shared-use-path
5	0.251 mi	DCR Rail Trail Ext Old County Rd → Route 6	DCR Rail Trail Ext - shared-use-path
6	0.244 mi	Route 6 DCR Rail Trail proposed terminus → Cahoon Hollow Rd	Shared-use-path along east side of Route 6 & shoulder bike lanes
7	0.114 mi	Route 6 Cahoon Hollow Rd → Main St	Shared-use-path along east side of Route 6 & shoulder bike lanes
8	0.037 mi	Route 6 Main St → Old Kings Hwy	Shared-use-path along east side of Route 6 & shoulder bike lanes
9	0.211 mi	Route 6 Old Kings Hwy → Long Pond Rd	Shoulder bike lanes
10	0.39 mi	Route 6 Gross Hill Rd → Briar Ln	Shoulder bike lanes
11	0.142 mi	Route 6 Briar Ln → Gull Pond Rd	Shoulder bike lanes
12	0.293 mi	Route 6 Gull Pond Rd → Coles Neck Rd	Shoulder bike lanes
13	0.653 mi	Route 6 Coles Neck Rd → Black Pond Rd	Shoulder bike lanes
14	0.281 mi	Route 6 Black Pond Rd → Rose Rd	Shoulder bike lanes
15	0.729 mi	Duck Pond Fire Rd DCR Rail Trail Ext → Cahoon Hollow Rd	Shared-use-path
16	0.604 mi	Dog Park Fire Rd DCR Rail Trail Ext → Cahoon Hollow Rd	Shared-use-path
17	0.354 mi	Old County Rd DCR Rail Trail Ext → Cahoon Hollow Rd	Shared-use-path
18	0.316 mi	New path behind COA DCR Rail Trail Ext → Cahoon Hollow Rd	Shared-use-path
19	0.353 mi	Old Kings Hwy ROW/ Howard Ct DCR Rail Trail Ext at Old County Rd → Cahoon Hollow Rd	Shared-use-path
20	0.247 mi	Oriole Ln/ New pathway DCR Rail Trail Ext → PJ's parking lot	Shared-use-path

21	0.323 mi	Utility ROW DCR Rail Trail Ext → Cahoon Hollow Rd	Shared-use-path
22	0.192 mi	Utility ROW E-W Fire Rd SW of Long Pond → Long Pond Rd	Shared-use-path
23	0.051 mi	Utility ROW Long Pond Rd → Old Long Pond Rd	Shared-use-path
24	0.189 mi	Utility ROW Old Long Pond Rd → Gross Hill Rd	Shared-use-path
25	0.305 mi	Utility ROW Gross Hill Rd → Gull Pond Rd	Shared-use-path
26	0.37 mi	Utility ROW Gull Pond Rd → Old Hay Rd	Shared-use-path
27	0.411 mi	Utility ROW Old Hay Rd → Black Pond Rd	Shared-use-path
28	0.116 mi	Utility ROW Black Pond Rd → Slough Pond Rd	Shared-use-path
29	0.329 mi	Utility ROW Slough Pond Rd → Rose Rd	Shared-use-path
30	0.074 mi	LeCount Hollow Rd Route 6 → Old Railroad - DCR Ext	Share-the-road
31	0.657 mi	LeCount Hollow Rd DCR Rail Trail Ext → Ocean View Drive	Shared-use-path along side of road
32	1.74 mi	Ocean View Drive Lecount Hollow Rd → Cahoon Hollow Rd	Share-the-road
33	0.141 mi	New path adjacent to Ocean View Drive Cahoon Hollow Rd → Long Pond Rd	Shared-use-path along inland Ocean View Dr
34	0.134 mi	Ocean View Drive Cahoon Hollow Rd → Long Pond Rd	Share-the-road
35	0.694 mi	New path adjacent to Ocean View Drive Long Pond Rd→ Way 634	Shared-use-path along inland Ocean View Dr
36	0.698 mi	New path adjacent to Ocean View Drive Long Pond Rd → Way 634	Share-the-road
37	0.314 mi	New path adjacent to Ocean View Drive Way 634 → Gross Hill Rd	Shared-use-path along inland Ocean View Dr
38	0.523 mi	Cahoon Hollow Rd Ocean View Drive → Forrest Rd	Shared-use-path along side of road
39	0.039 mi	Cahoon Hollow Rd Forrest Rd → Dog Park Fire Rd	Shared-use-path along side of road
40	0.433 mi	Cahoon Hollow Rd Dog Park Fire Rd → Old County Rd	Shared-use-path along side of road
41	0.205 mi	Cahoon Hollow Rd Old County Rd → New path behind COA	Shared-use-path along side of road
42	0.031 mi	Cahoon Hollow Rd New path behind COA → Utility ROW	Shared-use-path along side of road
43	0.059 mi	Cahoon Hollow Rd Utility ROW → Howard Ct	Share-the-road

44	0.136 mi	Cahoon Hollow Rd Howard Ct → Zoheth Smith Way	Share-the-road
45	0.062 mi	Cahoon Hollow Rd Zoheth Smith Way → New path behind cemetery	Share-the-road
46	0.075 mi	Cahoon Hollow Rd New path behind cemetery → Route 6	Share-the-road
47	0.106 mi	Main St Route 6 → Wicked Oyster	Shoulder bike lanes
48	0.143 mi	Main St Wicked Oyster → Long Pond Rd	Share-the-road
49	0.186 mi	Main St Long Pond Rd → School St	Share-the-road
50	0.262 mi	Main St School St → Briar Ln	Share-the-road
51	0.19 mi	West Main St Briar Ln → Old Chequessett Neck Rd	Share-the-road
52	0.167 mi	New path behind cemetery Cahoon Hollow Rd → Old Kings Hwy	Shared-use-path
53	0.273 mi	Zoheth Smith Way/Major Doane Rd Cahoon Hollow Rd → New path on hill	Share-the-road
54	0.047 mi	New path on hill Major Doane Rd → Old Kings Hwy	Shared-use-path
55	0.244 mi	Old Kings Hwy New path on hill → Long Pond Rd	Share-the-road
56	0.326 mi	Old Kings Hwy Long Pond Rd → Gross Hill Rd	Share-the-road
57	0.327 mi	Old Kings Hwy Gross Hill Rd → Gull Pond Rd	Shared-use-path
58	0.415 mi	Old Kings Hwy Gull Pond Rd → Old Hay Rd	Shared-use-path
59	0.432 mi	Old Kings Hwy Old Hay Rd → Black Pond Rd	Shared-use-path
60	0.11 mi	Old Kings Hwy Black Pond Rd → Slough Pond Rd	Shared-use-path
61	0.407 mi	Old Kings Hwy Slough Pond Rd → Collins Rd	Shared-use-path
62	0.263 mi	Trail east of Northeast Pond Cahoon Hollow Rd → Long Pond Rd	Shared-use-path
63	0.39 mi	Way 54/Trail on north shore of Great Pond Cahoon Hollow Rd → Way 626	Share-the-road
64	0.64 mi	Way 623 Cahoon Hollow Rd → Forrest Rd	Share-the-road
65	0.279 mi	Forrest Rd Way 623 → Long Pond Rd	Share-the-road
66	0.377 mi	Interpond transect Long Pond Rd → Gull Pond Rd	Shared-use-path

67	0.268 mi	School House Hill Rd Gull Pond Rd → Gull Pond Landing	Share-the-road
68	0.605 mi	School House Hill Rd and Old Hay Rd Gull Pond Landing → Old Kings Hwy	Share-the-road
69	0.25 mi	Way 626 Long Pond Rd → Trail on north shore of Great Pond	Share-the-road
70	0.151 mi	Way 626 Trail on north shore of Great Pond → Way 625	Share-the-road
71	0.241 mi	Buttry Way Long Pond Rd → Way 626	Share-the-road
72	0.463 mi	Way 625 Way 626 → Forrest Rd	Share-the-road
73	0.041 mi	E-W Fire Rd SW of Long Pond Forrest Rd → NE Trail from ROW toward Dyer Pond	Shared-use-path
74	0.124 mi	E-W Fire Rd SW of Long Pond NE Trail from ROW toward Dyer Pond → Utility ROW	Shared-use-path
75	0.227 mi	Fire Rd South of Long Pond Utility ROW → Fire Rd from ROW toward Dyer Pond	Shared-use-path
76	0.413 mi	Long Pond Rd Ocean View Drive → Way 626	Shared-use-path along side of road
77	0.288 mi	Long Pond Rd Way 626 → Way 625	Shared-use-path along side of road
78	0.548 mi	Long Pond Rd Way 625 → Sapokonish Way	Shared-use-path along side of road
79	0.037 mi	Long Pond Rd Sapokonish Way → Forrest Rd	Shared-use-path along side of road
80	0.212 mi	Long Pond Rd Forrest Rd → Utility ROW	Shared-use-path along side of road
81	0.193 mi	Long Pond Rd Utility ROW → Old Kings Hwy	Shared-use-path along side of road
82	0.199 mi	Long Pond Rd Old Kings Hwy → Lawrence Rd	Shared-use-path along side of road
83	0.162 mi	Long Pond Rd new westbound exit ramp Lawrence Rd → Route 6	Shared-use-path
84	0.276 mi	Long Pond Rd Lawrence Rd → Main St	Share-the-road
85	0.085 mi	Long Pond Rd new east bound exit ramp Maine St → Route 6	Shared-use-path
86	0.598 mi	Old Long Pond Rd Utility ROW → Gross Hill Rd	Share-the-road
87	0.173 mi	Lawrence Rd Long Pond Rd → Old Long Pond Rd	Share-the-road
88	0.069 mi	School St Route 6 → Mill Hill Rd	Share-the-road

89	0.249 mi	School St Mill Hill Rd → Main St	Share-the-road
90	0.354 mi	Mill Hill Rd School St → Briar Ln	Share-the-road
91	0.494 mi	Briar Ln Main St → Route 6	Share-the-road
92	0.361 mi	Sapokonish Way Interpond Transect → Gross Hill Rd	Share-the-road
93	0.296 mi	E-W Fire Rd NW of Long Pond Sapokonish Way → Gross Hill Rd	Shared-use-path
94	0.312 mi	E-W Fire Rd NW of Long Pond Gross Hill Rd → Old Kings Hwy	Shared-use-path
95	0.441 mi	Way 634/Way 632 Ocean View Drive → Gross Hill Rd	Share-the-road
96	0.665 mi	Gross Hill Rd Ocean View Drive → Gull Pond Rd	Shared-use-path along side of road
97	0.472 mi	Gross Hill Rd Gull Pond Rd → E-W Fire Rd NW of Long Pond	Shared-use-path along side of road
98	0.146 mi	Gross Hill Rd E-W Fire Rd NW of Long Pond→ Utility ROW	Shared-use-path along side of road
99	0.629 mi	Gross Hill Rd Utility ROW → Route 6	Share-the-road
100	0.372 mi	Gull Pond Rd Gross Hill Rd → School House Hill Rd	Share-the-road
101	0.292 mi	Gull Pond Rd School House Hill Rd → Old Kings Hwy	Share-the-road
102	0.77 mi	Gull Pond Rd Old Kings Hwy → Route 6	Share-the-road
103	0.054 mi	Old Hay Rd Old Kings Hwy → Utility ROW	Share-the-road
104	0.051 mi	Old Hay Rd Utility ROW → Mayflower Dr	Share-the-road
105	0.554 mi	Mayflower Dr/Chris Dr Old Hay Rd → Gull Pond Rd	Share-the-road
106	0.064 mi	Black Pond Rd Old Kings Hwy → Utility ROW	Share-the-road
107	0.025 mi	Slough Pond Rd Old Kings Hwy → Utility ROW	Share-the-road
108	0.454 mi	Slough Pond Rd Utility ROW → Rose Rd	Share-the-road
109	0.186 mi	Route 6 Long Pond Rd → Gross Hill Rd	Shoulder bike lanes
110	0.226 mi	Utility ROW Cahoon Hollow Rd → Fire Rd South of Long Pond	Shared-use-path
111	0.142 mi	Utility ROW Fire Rd South of Long Pond → E-W Fire Rd SW of Long Pond	Shared-use-path

112	0.416 mi	Cahoon Hollow Rd Trail east of Northeast Pond → Ocean View Drive	Shared-use-path along side of road
113	0.052 mi	Cahoon Hollow Rd Way 626 → Trail east of Northeast Pond	Shared-use-path along side of road
114	0.177 mi	Sapokonish Way Long Pond Rd → Interpond Transect	Share-the-road
115	0.109 mi	Old Kings Hwy New path behind cemetery → New path on hill	Share-the-road

Appendix F. Description of bikeway analysis calculations

Bikeway analysis criteria weights

Overall criteria weights = Criteria weight x Objective weight x Goal weight

Table F1
Overview of bikeway analysis weighted criteria

Goal/Obj	Criteria	Weight (%)
Goal 1: Safety [30%]		
1.a	1.a.1 Motor vehicles cannot intrude on route	5.3%
	1.a.2 Obvious dangers discourage use	1.6%
	1.a.3 Few stressors (noise, pollution, traffic)	2.1%
	1.a.4 No dense clusters of curb cuts	1.6%
1.b	1.b.1 Features will not cause loss of control	2.7%
	1.b.2 No dangerous route edges	2.7%
	1.b.3 Space for distributed stop points along route	1.4%
	1.b.4 Not arduous leading to injury	2.3%
1.c	1.c.1 Road crossings not at difficult points	1.5%
	1.c.2 Route users have visibility at intersections	1.5%
	1.c.3 Drivers have visibility at intersections	1.5%
	1.c.4 No road-sharing where narrow or no shoulder	1.5%
	1.c.5 No road-sharing/crossing unsafe 2 roads	1.5%
1.d	1.d.1 Route users will not impede curb cuts	1.5%
	1.d.2 Route users and signs will not distract drivers	1.5%
Goal 2: Practicality [20%]		
2.a	2.a.1 Route follows public rights of way	1.2%
	2.a.2 No trails blazed through undisturbed terrain	1.2%
	2.a.3 No bridges or underpasses need to be built	0.9%
	2.a.4 Extensive grading of route not required	0.9%
	2.a.5 Construction costs likely reasonable	0.9%
	2.a.6 Route does not impact utilities, drainage, etc	0.9%
2.b	2.b.1 Authorization process will be reasonable	1.8%
	2.b.2 No auth required for new trails on NS land	1.8%
	2.b.3 No intended use conflict on Town land	0.6%
	2.b.4 No required acquisition of private land	1.8%
2.c	2.c.1 Does not adversely impact road traffic flow	1.5%
	2.c.2 No need for speed limit change or new lights	1.5%
2.d	2.d.1 Route distance close to straight-line distance	2.1%
	2.d.2 Features do not reduce travel efficiency	0.9%
2.e	2.e.1 No chronic special maintenance issues	1.2%
	2.e.2 No special support structures needed	0.8%
Goal 3: User experience [20%]		
3.a	3.a.1 Space for 2-way traffic, preferably 12’ with 2’ shoulder	2.4%
	3.a.2 Side features allow comfortable even/flat path	1.2%
	3.a.3 Accessible for less able users	1.2%

	3.a.4 Users have visibility to comfortably share path	1.2%
3.b	3.b.1 Little vehicular or industrial noise or smell	1.3%
	3.b.2 Few buildings, commercial equipment visible	1.3%
	3.b.3 360° immersion in nature	1.5%
	3.b.4 One or more unobstructed natural vista	1.0%
3.c	3.c.1 Close to existing or potential public parking	1.8%
	3.c.2 Space for off-path rest areas for long stops	1.8%
	3.c.3 Space for pull-over areas for quick stops	1.5%
3.d	3.d.1 Practical for more cycling transportation	2.0%
	3.d.2 Low-stress travel to town and rec sites	2.0%
Goal 4: Conservancy [20%]		
4.a	4.a.1 Construction will not disrupt physical environment	2.0%
	4.a.2 No disruption to wildlife patterns	0.8%
	4.a.3 Does not border pond in National Seashore	3.2%
	4.a.4 Does not border “Cape Cod Modern” buildings	2.0%
4.b	4.b.1 Route does not require historic property land	1.8%
	4.b.2 Will not cause traffic overcrowding in town	2.4%
	4.b.3 Will not lead to road expansion in town	1.8%
4.c	4.c.1 Does not disrupt sole access to property	1.5%
	4.c.2 Will not be major disturbance to private property	1.5%
	4.c.3 Path stops are out of sight of abutting residences	1.5%
	4.c.4 Will not encourage access to sensitive NS sites	1.5%
Goal 5: Connectivity [10%]		
5.a	5.a.1 Promotes connectivity to town center and biz	2.4%
	5.a.2 Promotes connectivity to scenic and rec sites	2.4%
	5.a.3 Supports diverse user interests, mix destinations	3.2%
5.b	5.b.1 Opportunities for future bikeway expansion	1.0%
	5.b.2. Opportunities for improving future access to specific attractions	1.0%

Segment-level criteria calculations

The scores of the 49 criteria assessed at the segment level are added together, along with their weights, to yield an overall Segment Suitability Score.

> *Segment Suitability Score = (1.a.1 score x 1.a.1 weight) + (1.a.2 score x 1.a.2 weight) +… (etc.)*

The weighted segment-level criteria make up 79.8% of the total criteria, so the highest possible Segment Suitability Score is 399 points. The lowest possible segment score is 79.8 points.

Route-level criteria calculations

The route-level criteria are calculated using the same method as the segment-level criteria.

> *Route-level Cr. Score = (1.b.3 score x 1.b.3 weight) + (2.d.1 score x 2.d.1 weight) +… (etc.)*

The weighted route-level criteria make up 20.2% of the total criteria, so the highest possible Route-level Criteria Score is 101 points. The lowest possible score is 20.2 points.

Route segment score

Not all routes contain the same number of segments, nor are the segments of even lengths. Therefore, segment scores must be weighted against their lengths relative to the total route length before they can be added into the total Route Score.

> *Route Segment Score = Seg_1 Score x (Seg_1 Lgth/Rte Lgth) + Seg_2 Score x (Seg_2 Lgth/Rte Lgth) +… (etc.)*

Total route score

The total route score is the sum of the route segment score and the route-level criteria score. The highest possible score is 500 points; the lowest possible score is 100 points.

> *Total route score = route segment score + route-level criteria score*

This is the first value used for route analysis, as it gives an overview of the comparative suitability of all proposed routes.

Route goal scores

The route scores for each goal, indicating how well the route meets the separate bikeway goals, are broken out from the total by combining just the segment scores (weighted by segment length) with the route-level criteria related to each goal.

> *Goal 1 Score = (Seg_1 G1 Score x Seg_1 Lgth + Seg_2 G1 Score x Seg_2 Lgth +… (etc.))/Rte Lgth + Rte G1 Criteria Score*

Note. See Table 4 for which goal criteria are segment-level vs route-level

Purposive users score

46% of the total score directly addresses the needs of purposive users—or rather, people who use bikeways to get to destinations. They prefer shorter distances, they don't like delays, and they want to get where they're going efficiently and without undue risk of accident or injury.

The following are the weighted goals, objectives, and criteria that most directly affect purposive users:

- *Criterion 1.a.2* - few obvious dangers to discourage use
- *Objective 1.b* - path accident prevention
- *Objective 1.c* - intersection safety
- *Objective 1.d* - traffic safety
- *Objective 2.d* - directness
- *Objective 3.a* - usability
- *Criterion 3.c.1* - close to (potential) parking
- *Criterion 3.d.1* - practical for cycling transportation
- *Criterion 3.d.2* - enable low-stress travel

- *Goal 5* - connectivity

These are combined using the same method as the route goal score calculations to compare routes' suitability for purposive users.

> *Purposive User Score = (Seg_1 Purp User Score x Seg_1 Lgth + Seg_2 Purp User Score x Seg_2 Lgth +… (etc.))/Rte Lgth + Rte Purp User Criteria Score*

Incidence of unsatisfactory ratings

The number of unsatisfactory scores of "1" at the criteria level are tracked to inform decisions in selecting a final route. This is calculated by a simple count of the number of times a score of 1 appears in the segment- or route-level criteria ratings.

Appendix G. Bikeway analysis raw criteria scores

Table G1. *Segment-level criteria raw scores*

	Safety														Practicality														User Experience												Conservancy												Connectivity					
Seg.	1.a.1	1.a.2	1.a.3	1.a.4	1.b.1	1.b.2	1.b.3	1.b.4	1.c.1	1.c.2	1.c.3	1.c.4	1.c.5	1.d.1	1.d.2	2.a.1	2.a.2	2.a.3	2.a.4	2.a.5	2.a.6	2.b.1	2.b.2	2.b.3	2.b.4	2.c.1	2.c.2	2.d.1	2.d.2	2.e.1	2.e.2	3.a.1	3.a.2	3.a.3	3.a.4	3.b.1	3.b.2	3.b.3	3.b.4	3.c.1	3.c.2	3.c.3	4.a.1	4.a.2	4.a.3	4.a.4	4.b.1	4.b.2	4.b.3	4.c.1	4.c.2	4.c.3	4.c.4	5.a.1	5.a.2	5.a.3	5.b.1	5.b.2
1	5	5	5	4	5	5		5	5	4	3	5	2	5	5	5	5	5	3	3	5	3	5	5	5	4	4		5	4	5	5	5	5	5	3	4		5	4		4	5	5	5	5	5	5	5	3	3	5						
2	5	5	5	5	5	5		5	5	4	3	3	5	5	5	5	5	5	4	3	5	5	5	5	5	4	4		5	5	5	5	5	5	5	5	4		5	4		5	5	5	5	5	5	5	5	5	5	5						
3	5	5	5	5	5	5		5	5	4	3	3	5	5	5	5	5	5	4	3	5	5	5	5	5	4	4		5	5	5	5	5	5	5	5	4		5	4		5	5	5	5	5	5	5	5	5	5	5						
4	5	5	5	4	5	5		5	5	4	3	3	3	5	5	5	5	5	4	3	5	5	5	5	5	4	4		5	5	5	5	5	5	5	5	4		5	4		5	5	5	5	5	5	5	5	5	5	5						
5	4	5	3	4	4	4		5	3	3	2	4	2	2	2	5	5	5	3	4	5	5	5	5	5	2	2		4	4	5	5	5	3	4	2	3	2		5	4		5	5	5	5	5	1	1	5	4	4	5						
6	1	1	1	1	1	5		5	1	3	2	3	2	1	1	5	5	5	3	2	5	5	5	5	5	1	1		3	4	4	2	5	3	3	1	1	1		1	1		3	5	5	5	5	1	1	5	2	1	5						
7	1	1	1	1	3	5		5	1	3	2	3	1	1	1	5	5	5	3	2	5	5	5	5	5	1	1		3	4	4	2	5	3	3	1	1	1		1	1		3	5	5	5	5	1	1	5	2	1	5						
8	1	1	1	3	5	2		5	2	3	2	3	1	2	2	5	5	5	3	4	5	5	5	5	5	1	1		3	4	4	3	3	1	2	1	1	1		1	1		3	5	5	5	5	4	3	5	2	1	5						
9	1	1	1	3	4	3		5	2	2	2	3	2	2	2	5	5	5	3	4	5	5	5	5	5	1	1		3	4	4	1	3	1	2	1	3	1		1	1		3	5	5	5	5	4	3	5	3	1	5						
10	1	1	1	4	4	2		5	2	3	2	3	2	2	2	5	5	5	3	4	5	5	5	5	5	1	1		3	4	4	1	3	1	2	1	1	1		1	1		1	5	5	5	5	4	1	5	1	1	5						
11	1	1	1	4	4	4		5	2	3	2	3	2	2	2	5	5	5	3	4	5	4	5	5	5	2	2		5	4	4	1	3	1	2	1	1	1		1	1		3	5	5	5	5	4	1	5	3	1	5						
12	1	1	1	4	4	4		5	2	3	2	3	2	2	2	5	5	5	3	4	5	4	5	5	5	2	2		5	4	4	1	3	1	2	1	1	1		1	1		3	5	5	5	5	4	3	5	3	1	5						
13	1	1	1	4	4	3		5	2	3	2	3	2	2	2	5	5	5	3	4	5	4	5	5	5	2	2		5	4	4	1	3	1	2	1	1	1		1	1		3	5	5	5	5	4	3	5	3	1	5						
14	1	1	1	4	4	2		5	2	3	2	3	2	2	2	5	5	5	3	4	5	4	5	5	5	2	2		5	4	4	1	3	1	2	1	5	3		1	1		3	5	5	5	5	4	3	5	3	1	5						
15	5	2	5	5	2	1		2	5	5	5	4	3	5	5	1	1	5	1	1	5	1	1	5	5	5	5		2	2	2	4	2	2	4	5	5	5		4	4		1	1	1	1	5	5	5	5	4	4	1						
16	5	4	5	5	5	5		5	5	5	5	5	3	5	5	5	4	5	4	4	5	3	5	5	5	4	4		5	4	4	5	4	4	5	5	5	5		5	5		4	1	3	1	5	5	5	5	5	5	1						
17	5	5	4	5	4	4		5	5	5	5	5	3	5	5	5	3	5	3	4	5	3	5	5	5	4	4		4	5	4	5	5	4	4	4	4	4		5	5		4	5	5	5	5	5	5	5	4	3	5						
18	5	5	5	5	4	5		4	4	5	5	5	3	5	5	1	3	5	3	4	5	3	1	5	5	5	4		5	5	5	5	5	5	4	4	5	5	4		5	5		5	1	5	1	5	5	5	5	4	4	1						
19	3	4	4	4	3	5		4	5	5	5	5	3	3	5	5	5	5	4	5	5	4	5	5	5	3	4		3	5	5	4	5	5	5	4	3	3		3	3		5	5	5	5	5	5	5	5	1	1	5						
20	1	1	2	1	1	1		5	2	3	2	2	3	1	1	1	5	5	5	4	5	3	5	5	1	2	2		3	5	5	3	3	2	4	1	1	1		1	1		3	1	5	5	1	1	4	2	1	1	5						
21	5	5	5	5	4	5		4	4	4	4	5	3	5	5	2	5	5	5	3	5	5	2	3	5	2	2		5	4	5	5	4	5	5	5	4	4		5	5		5	2	5	5	5	5	5	5	1	1	5						
22	4	4	4	4	4	4		3	4	4	4	5	3	4	5	2	4	5	2	3	5	3	3	5	5	4	4		3	3	3	5	3	3	4	5	5	4		5	5		2	5	5	5	5	5	5	5	3	5	5						
23	4	4	4	4	4	4		3	4	4	4	5	4	4	5	2	4	5	2	3	5	3	5	5	5	4	4		3	3	3	5	3	3	4	5	5	4		5	5		2	5	5	5	5	5	5	5	2	3	5						
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26	4	4	4	4	4	4		3	4	4	4	5	3	4	5	2	4	5	2	3	5	3	3	5	5	4	4		3	3	3	5	3	3	4	5	5	4		5	5		2	5	5	5	5	5	5	5	2	5	5						
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	Safety														Practicality														User Experience												Conservancy												Connectivity					
Seg.	1.a.1	1.a.2	1.a.3	1.a.4	1.b.1	1.b.2	1.b.3	1.b.4	1.c.1	1.c.2	1.c.3	1.c.4	1.c.5	1.d.1	1.d.2	2.a.1	2.a.2	2.a.3	2.a.4	2.a.5	2.a.6	2.b.1	2.b.2	2.b.3	2.b.4	2.c.1	2.c.2	2.d.1	2.d.2	2.e.1	2.e.2	3.a.1	3.a.2	3.a.3	3.a.4	3.b.1	3.b.2	3.b.3	3.c.1	3.c.2	3.c.3	3.d.1	3.d.2	3.d.3	4.a.1	4.a.2	4.a.3	4.a.4	4.b.1	4.b.2	4.b.3	4.c.1	4.c.2	4.c.3	4.c.4	5.a.1	5.a.2	5.a.3	5.b.1	5.b.2	5.b.3
30	1	1	1	1	1	3		4	1	3	3	1	2	1	1	5	5	5	5	2	5	4	5	5	5	1	3		1		5	5	2	5	2	3	1	1	1				1	1																		
31	5	3	3	4	4	4		5	3	4	4	3	2	3	3	5	5	5	5	4	5	5	5	5	5	3	5		4		5	5	2	5	4	4	3	4	3				4	4																		
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36	3	3	3	5	4	3		3	4	3	3	3	2	3	3	5	5	5	5	5	5	5	5	5	5	2	3		3		5	5	3	3	2	3	3	4	5				3	3																		
37	5	5	4	5	5	2		3	3	3	3	5	3	5	5	5	3	3	2	3	5	2	5	5	5	4	4		4		4	3	3	3	3	5	5	5	4				4	4																		
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40	5	5	3	4	4	4		4	4	4	4	4	4	4	4	5	4	5	3	3	5	3	5	5	5	4	4		4		5	5	3	3	3	4	4	5	4				4	4																		
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42	5	5	3	4	4	4		4	4	4	4	4	4	4	4	5	4	5	3	3	5	3	5	5	5	4	4		4		5	5	4	4	4	4	4	5	4				4	4																		
43	2	2	3	3	4	5		2	2	2	2	5	2	2	2	5	5	5	3	2	5	3	5	5	5	2	2		3		5	5	3	4	1	2	2	2	2				1	2																		
44	2	2	3	3	4	5		2	2	2	2	5	2	2	2	5	5	5	3	2	5	3	5	5	5	2	2		3		5	5	3	4	1	2	2	2	2				1	2																		
45	2	2	3	3	4	5		2	2	2	2	5	2	2	2	5	5	5	3	2	5	3	5	5	5	2	2		3		5	5	3	4	1	2	2	2	2				1	2																		
46	2	2	3	3	4	5		2	2	2	2	5	2	2	2	5	5	5	3	2	5	3	5	5	5	2	2		3		5	5	3	4	1	2	2	2	2				1	2																		
47	1	3	2	2	3	3		4	3	2	2	1	1	2	3	5	4	5	5	2	5	2	5	5	1	2	4		3		4	2	1	3	4	4	1	2	2				1	1																		
48	2	2	2	2	2	3		3	3	2	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	2	3		3		4	3	3	3	1	2	3	2	2				1	1																		
49	2	2	2	2	2	3		3	2	2	2	2	3	2	2	5	5	5	5	5	5	5	5	5	5	2	3		3		5	5	3	3	1	2	2	2	2				1	1																		
50	2	2	2	2	2	3		3	2	3	3	2	3	2	2	5	5	5	5	5	5	5	5	5	5	2	2		3		5	5	3	3	1	2	3	2	2				1	1																		
51	2	2	2	2	3	3		3	2	3	3	2	2	2	2	5	5	5	5	5	5	5	5	5	5	2	2		3		5	5	3	3	2	2	3	2	2				1	2																		
52	5	5	5	5	5	5		5	5	5	5	5	3	5	5	5	1	5	1	2	5	1	5	5	5	5	5		5		3	3	5	5	5	5	3	4	5				1	1																		
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54	5	1	2	5	2	1		2	5	4	5	2	3	5	5	5	1	5	1	2	5	1	5	5	5	5	5		2		2	2	2	2	2	3	3	3	3				1	2																		
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61	5	5	5	5	5	5		3	5	4	3	5	4	5	5	5	4	5	2	4	5	5	5	5	5	4	5		4		4	5	5	5	3	2	4	5	5	5			5	5																		
62	5	5	5	5	5	3		4	5	5	3	5	3	5	5	5	1	5	1	2	5	1	5	5	5	5	5		2		3	5	5	5	5	5	5	5	5				3	3																		
63	5	3	5	5	2	2		2	5	3	3	3	3	5	5	5	2	4	2	3	5	2	5	5	5	5	3		2		3	2	2	2	3	2	2	5	5	5			5	5																		
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	Safety														Practicality														User Experience												Conservancy												Connectivity					
Seg.	1.a.1	1.a.2	1.a.3	1.a.4	1.b.1	1.b.2	1.b.3	1.b.4	1.c.1	1.c.2	1.c.3	1.c.4	1.c.5	1.d.1	1.d.2	2.a.1	2.a.2	2.a.3	2.a.4	2.a.5	2.a.6	2.b.1	2.b.2	2.b.3	2.b.4	2.c.1	2.c.2	2.d.1	2.d.2	2.e.1	2.e.2	3.a.1	3.a.2	3.a.3	3.a.4	3.b.1	3.b.2	3.b.3	3.b.4	3.c.1	3.c.2	3.c.3	3.d.1	3.d.2	4.a.1	4.a.2	4.a.3	4.a.4	4.b.1	4.b.2	4.b.3	4.c.1	4.c.2	4.c.3	4.c.4	4.d.1	4.d.2	4.d.3	4.d.4	4.d.5
66	5	3	5	5	3	4		3	1	2	2	4	3	5	5	1	1	5	2	2	5	1	1	5	5	3	2		2	3	3	5	5	2	3	5	5	5		2	3			2	1	5	1	5	5	5	5	5	5	1					
67	2	3	3	4	5	4		4	3	4	5	4	3	5	5	5	3	5	3	4	5	3	5	5	5	5	5		4	5	5	4	4	5	5	5	4	4		4	4			3	1	1	1	5	5	5	5	3	3	1					
68	3	3	4	5	4	3		3	4	4	4	4	4	3	4	5	2	5	2	3	5	3	5	5	5	4	5		4	4	3	5	3	2	4	5	5	5		4	4			3	1	1	1	5	4	5	5	5	5	1					
69	3	3	5	5	3	2		2	5	2	2	2	3	2	2	5	3	5	2	3	5	3	5	5	5	3	5		3	4	4	5	3	3	3	4	5	5		2	2			1	1	1	1	5	5	5	5	4	3	1					
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71	1	3	5	5	3	2		3	5	3	2	2	3	3	4	5	3	5	2	4	5	2	5	5	5	3	5		2	2	2	1	2	2	3	4	5	5		2	4			1	1	1	1	5	5	5	5	2	3	1					
72	3	3	5	5	3	2		4	5	3	2	2	4	2	2	5	3	5	4	4	5	5	5	5	5	3	5		3	4	4	5	3	3	3	4	5	5		2	2			1	1	1	1	5	5	5	5	5	3	1					
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74	5	4	5	5	3	5		3	5	4	4	5	5	5	5	5	4	5	3	4	5	3	5	5	5	4	5		4	5	5	5	4	3	5	4	5	5		4	4			5	1	1	1	5	5	5	5	5	5	1					
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76	5	3	3	5	3	2		2	3	2	2	5	4	4	3	5	5	5	2	2	5	3	5	5	5	3	4		1	3	2	5	2	2	4	3	4	4		2	2			2	5	5	5	5	5	5	5	4	5	5					
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78	5	3	3	5	3	2		4	5	2	2	5	3	3	3	5	5	5	2	2	5	3	5	5	5	3	5		2	5	5	5	3	3	4	3	5	4		5	5			2	5	5	5	5	5	5	5	3	3	5					
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82	5	4	3	4	4	3		4	4	3	3	2	3	4	4	5	4	5	5	3	5	3	5	5	5	3	3		4	4	5	2	3	4	4	3	4	3		2	2			2	5	5	5	5	5	5	5	2	3	5					
83	5	2	2	5	3	3		3	3	3	3	3	3	5	2	5	5	5	2	2	5	2	5	5	5	2	3		2	2	2	3	3	2	3	2	4	1		1	1			3	5	5	5	5	4	4	5	5	4	5					
84	3	3	2	4	3	3		3	3	3	3	3	2	5	5	5	5	5	5	4	5	4	5	5	5	3	4		4	5	5	5	5	2	3	3	3	3		3	3			5	5	5	5	5	4	4	5	3	3	5					
85	5	2	2	5	3	3		3	3	3	3	3	2	5	2	5	5	5	2	2	5	2	5	5	5	2	3		2	2	2	3	3	2	3	2	4	1		1	1			3	5	5	5	5	4	4	5	5	4	5					
86	2	3	3	4	3	3		3	2	2	2	2	3	5	4	5	4	5	2	2	5	1	5	5	5	2	3		3	2	3	1	4	4	3	4	2	3		2	2			1	5	5	5	5	4	5	5	1	1	5					
87	3	2	2	2	2	4		2	1	2	2	3	2	2	2	5	5	5	1	2	5	2	5	5	5	2	2		2	4	5	2	2	2	3	3	2	2		4	4			4	5	5	5	5	5	5	5	4	3	5					
88	1	2	3	2	3	3		3	2	2	2	3	2	2	2	5	5	5	5	1	5	4	5	5	5	2	1		3	5	5	1	3	2	3	3	2	2		2	2			5	5	5	5	5	2	2	5	2	2	5					
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91	3	3	2	2	3	5		3	5	3	3	5	2	3	3	5	5	5	5	3	5	5	5	5	5	3	3		5	5	5	5	5	2	3	3	3	2		2	2			5	5	5	5	5	3	3	5	2	2	5					
92	5	5	5	5	5	5		4	4	3	3	5	3	5	5	5	5	5	4	3	5	3	5	5	5	4	4		4	5	5	5	5	3	5	5	5	5		5	5			4	1	1	1	5	5	5	5	2	3	1					
93	5	5	5	5	5	4		4	5	5	5	5	3	5	5	5	3	5	4	5	5	5	5	5	5	5	5		4	5	5	5	4	4	4	4	5	5		5	5			3	1	1	1	5	5	5	2	5	5	1					
94	5	5	5	5	5	4		4	5	5	5	5	3	5	5	3	3	5	4	5	5	5	3	5	5	5	5		4	5	5	5	4	4	4	4	5	5		5	5			3	1	5	1	5	5	5	5	5	5	1					
95	4	4	4	5	4	2		3	2	3	3	2	3	5	5	5	2	5	4	2	5	3	5	5	5	5	5		4	2	3	2	4	3	3	5	5	5		2	2			1	5	5	5	5	5	5	5	4	4	5					
96	5	3	4	5	4	2		3	3	3	3	5	2	5	5	5	5	5	3	3	5	3	5	5	5	5	5		3	3	3	3	4	4	5	4	5	4		3	4			3	5	5	5	5	5	5	5	5	5	5					
97	5	3	4	5	4	4		3	5	5	5	5	2	5	5	5	4	5	3	3	5	3	5	5	5	4	4		3	5	3	2	3	4	4	4	4	4		3	4			4	5	5	5	5	5	5	5	1	3	5					
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99	2	1	2	3	3	4		3	3	4	3	3	2	2	3	5	5	5	3	3	5	5	5	5	5	5	5		1	5	5	2	2	2	3	3	5	4		3	3			3	5	5	5	5	5	3	5	3	3	5					
100	2	2	3	3	3	2		4	2	2	2	2	3	3	3	5	5	5	3	3	5	5	5	5	5	2	3		2	3	3	1	3	2	3	2	4	4		1	1			5	5	5	5	5	5	3	5	1	1	5					

	Safety														Practicality														User Experience												Conservancy												Connectivity					
Seg.	1.a.1	1.a.2	1.a.3	1.a.4	1.b.1	1.b.2	1.b.3	1.b.4	1.c.1	1.c.2	1.c.3	1.c.4	1.c.5	1.d.1	1.d.2	2.a.1	2.a.2	2.a.3	2.a.4	2.a.5	2.a.6	2.b.1	2.b.2	2.b.3	2.b.4	2.c.1	2.c.2	2.c.3	2.d.2	2.e.1	2.e.2	3.a.1	3.a.2	3.a.3	3.a.4	3.b.1	3.b.2	3.b.3	3.b.5	3.c.1	3.c.2	3.c.3	3.d.1	3.d.2	4.a.1	4.a.2	4.a.3	4.a.4	4.b.1	4.b.2	4.b.3	4.c.1	4.c.2	4.c.3	4.c.4	5.a.1	5.a.2	5.a.3	5.a.4	5.b.1	5.b.2
101	2	3	2	3	3	2		4	3	3	3	2	3	3	2	5	5	5	5	4	5	5	5	5	5	2	3		4	3	3	2	3	3	3	2	4	4			3	3			5	5	5	5	5	5	3	5	3	3	5						
102	3	2	2	3	3	2		2	3	3	3	2	3	3	3	5	5	5	5	5	5	5	5	5	5	3	4		2	5	5	3	3	1	2	3	2	3			2	2			5	5	5	5	5	5	3	5	3	4	5						
103	3	5	5	5	4	4		5	5	5	5	2	5	3	3	5	5	5	3	3	5	3	5	5	5	4	5		4	4	4	4	5	5	5	4	4	5			4	4			4	1	1	1	5	5	5	5	4	5	1						
104	5	5	5	4	4	5		3	3	3	3	5	5	5	5	5	5	5	5	3	5	4	5	5	5	2	3		5	5	5	5	5	3	3	3	2	2			2	3			5	5	5	5	5	5	5	5	2	2	5						
105	3	3	4	3	4	5		3	3	3	3	5	4	3	3	5	5	5	5	3	5	4	5	5	5	2	3		4	5	5	5	5	3	3	3	2	2			2	3			5	5	5	5	5	5	5	5	2	2	5						
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111	4	4	4	4	4	4		3	4	4	4	5	5	4	5	2	4	5	2	3	5	3	3	5	5	4	4		3	3	3	5	3	3	4	5	5	4			5	5			2	5	5	5	5	5	5	5	2	5	5						
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113	5	3	5	5	4	5		3	5	3	3	5	3	5	5	5	5	5	5	5	5	3	5	5	5	3	3		2	5	5	3	5	3	4	4	4	4			4	4			5	5	5	5	5	5	5	5	5	5	5						
114	5	4	5	5	5	5		4	4	3	3	5	3	5	5	3	5	5	4	3	5	3	3	5	5	4	4		4	5	5	5	4	4	4	5	5	5			5	5			4	5	5	5	5	5	5	5	2	3	5						
115	2	3	4	3	5	5		5	5	5	4	4	2	4	5	5	4	5	4	3	5	2	5	5	5	3	5		5	5	5	4	4	3	4	5	4	5			3	5			3	5	5	5	5	5	5	5	3	3	5						

Table G2. *Route-level criteria scores*

	Safety	Practicali	User Experience				Connectivity				
Route	1.b.3	2.d.1	3.b.4	3.c.1	3.d.1	3.d.2	5.a.1	5.a.2	5.a.3	5.b.1	5.b.2
A	3	4	2	5	4	2	3	2	3	2	2
B	4	1	5	5	1	2	1	4	3	2	3
C	5	5	4	5	3	4	3	5	5	5	4
D	3	4	2	5	3	2	3	2	3	3	2
E	3	4	2	5	3	2	3	2	3	3	2
F	3	4	2	5	3	2	3	2	3	3	2
G	3	4	5	5	3	3	3	3	4	4	4
H	4	2	5	5	3	3	3	3	3	4	3
I	3	2	4	5	2	3	3	3	3	4	3
J	4	2	4	5	2	3	3	4	4	4	3
K	3	1	4	5	2	2	2	3	2	3	3
L	3	1	5	5	2	2	2	3	2	4	4
M	5	1	5	5	2	2	2	4	3	4	4
N	5	4	5	5	2	3	2	5	4	5	4
O	5	5	4	5	3	4	3	5	5	5	4
P	5	3	5	5	3	3	3	5	4	4	4
Q	4	3	5	5	3	3	3	3	3	4	4
Q_2	4	3	5	5	3	3	3	3	4	4	4
R	3	3	3	5	3	3	3	3	3	3	3
R_2	3	4	3	5	3	3	3	3	3	3	3
S	5	4	5	3	2	3	2	4	4	4	4
T	5	4	5	3	2	3	2	4	4	4	4
U	3	4	5	5	3	3	3	3	4	3	4
V	5	4	5	5	3	4	3	5	5	5	4
W	5	3	5	5	2	3	2	4	4	4	4
X	5	4	5	5	3	4	3	5	5	5	4
Y	5	4	5	5	3	4	3	5	5	5	4
Z	5	4	5	5	3	4	3	5	5	5	4
Spur A	3	5	2	2	4	2	3	2	3	3	3
Spur B	3	5	3	5	3	2	3	1	1	2	1
Spur C	2	5	2	2	4	4	5	3	3	3	3
Spur D	2	3	2	2	4	4	5	3	3	3	3

Appendix H. Bikeway analysis calculated scores

Table H1. *Segment suitability scores*

	Safety Weighted Score					Practicality Weighted Score						UX Weighted Score				Cons. Weighted Score				Overall Suitability		Score Incidence	
Seg.	1.a	1.b	1.c	1.d	*Tot G1*	2.a	2.b	2.c	2.d	2.e	*Tot G2*	3.a	3.b	3.c	*Tot G3*	4.a	4.b	4.c	*Tot G4*	TOTAL	Suitability	"1"	"5"
1	51	38	29	15	*132.7*	26	26	12	4.5	8.8	*78.1*	30	16	15	*60.75*	38	30	24	*92*	**363.53**	Excellent	0	33
2	53	38	30	15	*135.8*	27	30	12	4.5	10	*83.8*	30	19	15	*63.25*	40	30	30	*100*	**382.8**	Outstanding	0	40
3	53	38	30	15	*135.8*	27	30	12	4.5	10	*83.8*	30	19	15	*63.25*	40	30	30	*100*	**382.8**	Outstanding	0	40
4	51	38	27	15	*131.2*	27	30	12	4.5	10	*83.8*	30	19	15	*63.25*	40	30	30	*100*	**378.23**	Outstanding	0	38
5	41	33	21	6	*101.3*	27	30	6	3.6	8.8	*75.7*	26	9.3	15	*50.4*	40	13	27	*80.2*	**307.63**	Acceptable	2	21
6	11	27	17	3	*57.45*	26	30	3	2.7	8	*69.2*	18	4	3.3	*25.25*	36	13	20	*68.7*	**220.6**	Unsatisfactory	18	17
7	11	33	15	3	*61.35*	26	30	3	2.7	8	*69.2*	18	4	3.3	*25.25*	36	13	20	*68.7*	**224.5**	Unsatisfactory	18	17
8	14	30	17	6	*66.3*	27	30	3	2.7	8	*71*	14	4	3.3	*21.65*	36	24	20	*79.5*	**238.45**	Unsatisfactory	13	16
9	14	30	17	6	*66.3*	27	30	3	2.7	8	*71*	9.6	6.5	3.3	*19.35*	36	24	21	*81*	**237.65**	Unsatisfactory	12	15
10	15	27	18	6	*66.68*	27	30	3	2.7	8	*71*	9.6	4	3.3	*16.85*	32	20	18	*70.4*	**224.93**	Unsatisfactory	16	15
11	15	33	18	6	*72.08*	27	28	6	4.5	8	*74*	9.6	4	3.3	*16.85*	36	20	21	*77.4*	**240.33**	Unsatisfactory	12	15
12	15	33	18	6	*72.08*	27	28	6	4.5	8	*74*	9.6	4	3.3	*16.85*	36	24	21	*81*	**243.93**	Marginal	11	15
13	15	30	18	6	*69.38*	27	28	6	4.5	8	*74*	9.6	4	3.3	*16.85*	36	24	21	*81*	**241.23**	Unsatisfactory	11	15
14	15	27	18	6	*66.68*	27	28	6	4.5	8	*74*	9.6	12	3.3	*24.85*	36	24	21	*81*	**246.53**	Marginal	9	16
15	48	13	33	15	*108.4*	13	16	15	1.8	4	*49.6*	19	20	13	*52.2*	8	30	21	*59*	**269.18**	Marginal	12	21
16	51	38	35	15	*138.7*	27	26	12	4.5	8	*77.9*	28	20	16	*63.85*	20	30	24	*74.4*	**354.83**	Excellent	3	32
17	50	33	35	15	*132.8*	25	26	12	3.6	9.2	*76.1*	28	16	16	*59.85*	38	30	26	*93.5*	**362.2**	Excellent	0	29
18	53	33	33	15	*133.8*	20	19	14	4.5	10	*67.3*	28	19	16	*62.35*	29	30	21	*79.8*	**343.25**	Excellent	5	30
19	37	31	35	12	*113.9*	29	28	11	2.7	10	*80.5*	28	13	9.8	*50.6*	40	30	18	*88*	**332.95**	Acceptable	2	28
20	13	17	18	3	*50.25*	24	19	6	2.7	10	*62.2*	18	4	3.3	*25.25*	33	11	14	*57.7*	**195.4**	Unsatisfactory	19	12
21	53	33	30	15	*130.8*	25	16	11	4.5	8.8	*64*	29	17	16	*62.3*	38	30	18	*85.6*	**342.7**	Excellent	2	30
22	42	28	30	14	*113.9*	21	23	12	2.7	6	*64.2*	24	19	16	*58.75*	34	30	27	*91*	**327.8**	Acceptable	0	20
23	42	28	32	14	*115.4*	21	26	12	2.7	6	*67.8*	24	19	16	*58.75*	34	30	23	*86.5*	**328.4**	Acceptable	0	20
24	53	28	30	14	*124.4*	21	23	12	3.6	6	*65.1*	24	19	16	*58.75*	38	30	27	*95*	**343.2**	Excellent	0	24
25	42	28	30	14	*113.9*	21	23	12	2.7	6	*64.2*	24	19	16	*58.75*	34	30	24	*88*	**324.8**	Acceptable	0	19
26	42	28	30	14	*113.9*	21	23	12	2.7	6	*64.2*	24	19	16	*58.75*	34	30	26	*89.5*	**326.3**	Acceptable	0	20
27	42	28	32	14	*115.4*	19	19	12	2.7	6	*58.8*	24	19	16	*58.75*	23	30	20	*72.3*	**305.2**	Marginal	3	15
28	42	28	32	14	*115.4*	23	26	12	2.7	6	*69.6*	24	19	16	*58.75*	23	30	20	*72.3*	**316**	Acceptable	3	18
29	42	28	30	14	*113.9*	23	26	12	2.7	6	*69.6*	24	19	16	*58.75*	23	30	20	*72.3*	**314.5**	Acceptable	3	18

	Safety Weighted Score					Practicality Weighted Score						UX Weighted Score				Cons. Weighted Score				Overall Suitability		Score Incidence	
Seg.	1.a	1.b	1.c	1.d	*Tot G1*	2.a	2.b	2.c	2.d	2.e	*Tot G2*	3.a	3.b	3.c	*Tot G3*	4.a	4.b	4.c	*Tot G4*	TOTAL	Suitability	"1"	"5"
30	11	20	15	3	*48.3*	27	28	6	0.9	10	*72.4*	17	4	3.3	*24.05*	40	20	20	*79.9*	**224.65**	Unsatisfactory	18	19
31	44	33	24	9	*109.4*	29	30	12	3.6	10	*84.7*	20	13	13	*46.65*	40	25	27	*92.2*	**332.98**	Acceptable	0	23
32	35	26	23	9	*91.8*	30	30	7.5	2.7	10	*80.2*	17	16	9.8	*42.8*	38	30	24	*92*	**306.8**	Acceptable	0	22
33	50	26	26	15	*116.6*	21	25	12	3.6	7.2	*68.7*	20	19	13	*51.9*	34	30	29	*92.5*	**329.65**	Acceptable	0	24
34	35	26	23	9	*91.8*	30	30	7.5	2.7	10	*80.2*	17	16	9.8	*42.8*	38	30	24	*92*	**306.8**	Acceptable	0	22
35	50	26	26	15	*116.6*	23	26	12	1.8	6.4	*69.4*	20	19	13	*51.9*	34	30	29	*92.5*	**330.35**	Acceptable	0	25
36	35	26	23	9	*91.8*	30	30	7.5	2.7	10	*80.2*	17	16	9.8	*42.8*	38	30	24	*92*	**306.8**	Acceptable	0	22
37	50	26	26	15	*116.6*	21	25	12	3.6	7.2	*68.7*	20	19	13	*51.9*	34	30	29	*92.5*	**329.65**	Acceptable	0	24
38	47	31	30	12	*119.3*	25	26	12	3.6	10	*77.2*	19	17	13	*49.45*	25	30	30	*85.2*	**331.18**	Acceptable	1	20
39	47	31	30	12	*119.3*	25	26	12	3.6	10	*77.2*	19	17	13	*49.45*	25	30	30	*85.2*	**331.18**	Acceptable	1	20
40	47	31	30	12	*119.3*	25	26	12	3.6	10	*77.2*	19	17	13	*49.45*	38	30	30	*98*	**343.98**	Excellent	0	21
41	47	31	30	12	*119.3*	25	26	12	3.6	10	*77.2*	24	17	13	*54.25*	38	30	30	*98*	**348.78**	Excellent	0	21
42	47	31	30	12	*119.3*	25	26	12	3.6	10	*77.2*	24	17	13	*54.25*	38	30	30	*98*	**348.78**	Excellent	0	21
43	25	29	20	6	*78.98*	26	26	6	2.7	10	*70.6*	16	8	4.8	*28.35*	40	20	21	*80.8*	**258.73**	Marginal	2	18
44	25	29	20	6	*78.98*	26	26	6	2.7	10	*70.6*	16	8	4.8	*28.35*	40	20	21	*80.8*	**258.73**	Marginal	2	18
45	25	29	20	6	*78.98*	26	26	6	2.7	10	*70.6*	16	8	4.8	*28.35*	40	20	21	*80.8*	**258.73**	Marginal	2	18
46	25	29	20	6	*78.98*	26	26	6	2.7	10	*70.6*	16	8	4.8	*28.35*	40	20	21	*80.8*	**258.73**	Marginal	2	18
47	17	25	14	7.5	*63.53*	26	17	9	2.7	6.4	*61.6*	16	6.8	3.3	*25.6*	31	8.4	20	*58.7*	**209.43**	Unsatisfactory	12	10
48	21	20	17	6	*63.75*	30	30	7.5	2.7	7.2	*77.4*	14	9.3	3.3	*26.9*	40	13	20	*72.7*	**240.75**	Unsatisfactory	6	17
49	21	20	17	6	*63.75*	30	30	7.5	2.7	10	*80.2*	14	8	3.3	*25.65*	38	13	20	*70.7*	**240.3**	Unsatisfactory	6	18
50	21	20	20	6	*66.75*	30	30	6	2.7	10	*78.7*	14	9.3	3.3	*26.9*	40	13	20	*72.7*	**245.05**	Marginal	6	19
51	21	23	18	6	*67.95*	30	30	6	2.7	10	*78.7*	16	9.3	4.8	*29.6*	40	17	20	*76.9*	**253.15**	Marginal	2	19
52	53	38	35	15	*140.3*	19	23	15	4.5	6	*67.2*	30	16	3.3	*49.5*	32	28	21	*80.6*	**337.55**	Acceptable	7	34
53	39	31	27	9	*105.5*	27	26	12	3.6	10	*79*	28	15	15	*56.6*	36	28	18	*81.6*	**322.65**	Acceptable	2	20
54	40	13	29	15	*96*	19	23	15	1.8	4	*62.5*	13	12	4.8	*29.95*	32	30	18	*80*	**268.45**	Marginal	9	22
55	28	38	32	14	*111.6*	26	25	12	4.5	10	*77.2*	23	17	13	*52.8*	36	30	24	*90*	**331.6**	Acceptable	0	26
56	28	31	29	12	*98.93*	27	26	12	3.6	10	*79*	22	15	9.8	*46.1*	38	26	21	*84.8*	**308.83**	Acceptable	0	16
57	53	34	30	15	*131.3*	28	30	12	3.6	10	*83.8*	24	19	16	*59*	25	30	23	*77.3*	**351.35**	Excellent	3	31
58	51	34	27	15	*126.7*	25	30	14	3.6	8.8	*81.1*	23	20	16	*59.05*	25	30	24	*78.8*	**345.63**	Excellent	3	30
59	53	34	33	15	*134.3*	25	30	14	3.6	8.8	*81.1*	23	20	16	*59.05*	25	30	24	*78.8*	**353.2**	Excellent	3	33
60	53	34	33	15	*134.3*	25	30	14	3.6	8.8	*81.1*	23	20	16	*59.05*	25	30	24	*78.8*	**353.2**	Excellent	3	33
61	53	34	32	15	*132.8*	25	30	14	3.6	8.8	*81.1*	23	20	16	*59.05*	25	30	24	*78.8*	**351.7**	Excellent	3	32
62	53	31	32	15	*129.6*	19	23	15	1.8	7.6	*66.1*	30	20	9.8	*59.75*	8	30	24	*62*	**317.45**	Acceptable	8	32
63	49	15	26	15	*105.2*	21	25	12	1.8	5.2	*64.6*	13	20	16	*49.45*	10	30	17	*56.5*	**275.7**	Marginal	5	21
64	44	33	32	12	*120.4*	30	28	15	4.5	10	*87.7*	26	20	16	*62.65*	16	30	20	*65.5*	**336.23**	Acceptable	4	30
65	37	28	29	12	*105.7*	26	26	12	2.7	6.4	*73.3*	14	18	6.3	*38.15*	10	30	14	*53.5*	**270.63**	Marginal	5	14

	Safety Weighted Score					Practicality Weighted Score						UX Weighted Score				Cons. Weighted Score				Overall Suitability		Score Incidence	
Seg.	1.a	1.b	1.c	1.d	*Tot G1*	2.a	2.b	2.c	2.d	2.e	*Tot G2*	3.a	3.b	3.c	*Tot G3*	4.a	4.b	4.c	*Tot G4*	TOTAL	Suitability	"1"	"5"
66	49	26	18	15	*108*	15	16	7.5	1.8	6	*45.9*	24	20	8	*52*	23	30	24	*76.8*	**282.7**	Marginal	8	21
67	28	33	29	15	*104.6*	25	26	15	3.6	10	*79.9*	26	19	13	*57.9*	12	30	18	*60*	**302.43**	Marginal	4	22
68	37	26	30	11	*102.9*	22	26	14	3.6	7.2	*72.6*	23	20	13	*55.8*	12	28	24	*63.6*	**294.9**	Marginal	4	17
69	39	18	21	6	*83.85*	23	26	12	2.7	8	*72.2*	23	19	6.5	*48.05*	8	30	20	*57.5*	**261.6**	Marginal	5	17
70	37	23	24	6	*89.78*	22	26	12	2.7	8	*71.3*	23	18	3.3	*43.55*	10	30	18	*58*	**262.63**	Marginal	6	15
71	28	20	23	11	*81.6*	24	25	12	1.8	4	*66.4*	11	19	9.5	*39.05*	8	30	17	*54.5*	**241.55**	Unsatisfactory	7	16
72	39	23	24	6	*91.35*	26	30	12	2.7	8	*78.5*	23	19	6.5	*48.05*	8	30	21	*59*	**276.9**	Marginal	5	19
73	51	28	33	15	*127.3*	26	26	14	3.6	10	*79.6*	26	19	13	*58.15*	16	30	24	*70*	**335.03**	Acceptable	4	28
74	51	28	35	15	*128.8*	26	26	14	3.6	10	*79.6*	26	19	13	*58.15*	16	30	24	*70*	**336.53**	Acceptable	4	29
75	51	28	35	15	*128.8*	26	26	14	3.6	10	*79.6*	26	19	13	*58.15*	16	30	24	*70*	**336.53**	Acceptable	4	29
76	45	18	24	11	*97.65*	25	26	11	0.9	5.2	*67.6*	22	15	6.5	*42.85*	34	30	29	*92.5*	**300.6**	Marginal	1	20
77	44	23	30	9	*105.1*	25	26	12	1.8	7.6	*72.4*	24	16	6.5	*46.5*	34	30	24	*88*	**311.98**	Acceptable	0	22
78	45	23	26	9	*102.2*	25	26	12	1.8	10	*74.8*	24	16	16	*56.25*	34	30	24	*88*	**321.2**	Acceptable	0	26
79	45	30	32	9	*115.8*	28	26	12	2.7	10	*79.3*	28	16	9.8	*53.35*	34	30	24	*88*	**336.45**	Acceptable	0	28
80	45	18	26	7.5	*96.15*	26	26	12	1.8	10	*75.7*	23	16	6.5	*45.3*	34	30	24	*88*	**305.15**	Marginal	0	22
81	45	31	27	12	*114.8*	29	26	9	3.6	8.8	*76.9*	18	11	3.3	*31.75*	34	30	21	*85*	**308.4**	Acceptable	2	19
82	45	28	23	12	*107.6*	27	26	9	3.6	8.8	*74.8*	18	13	6.5	*37.75*	34	30	23	*86.5*	**306.6**	Acceptable	0	17
83	41	23	23	11	*97.43*	25	25	7.5	1.8	4	*62.5*	17	9	3.3	*29.05*	36	26	29	*90.3*	**279.28**	Marginal	3	17
84	31	23	21	15	*89.93*	29	28	11	3.6	10	*81.4*	24	12	9.8	*45.75*	40	26	24	*89.8*	**306.88**	Acceptable	0	21
85	41	23	21	11	*95.93*	25	25	7.5	1.8	4	*62.5*	17	9	3.3	*29.05*	36	26	29	*90.3*	**277.78**	Marginal	3	17
86	28	23	17	14	*80.78*	23	23	7.5	2.7	4.8	*61.2*	16	12	6.5	*34.1*	32	28	18	*77.6*	**253.68**	Marginal	5	14
87	26	21	15	6	*67.95*	24	25	6	1.8	8.8	*64.9*	13	9.3	13	*35.45*	38	30	26	*93.5*	**261.8**	Marginal	2	16
88	18	23	17	6	*63.3*	26	28	4.5	2.7	10	*71.8*	12	9.3	6.5	*27.75*	40	17	21	*78.4*	**241.25**	Unsatisfactory	4	17
89	18	23	17	6	*63.3*	26	28	4.5	2.7	10	*71.8*	12	9.3	6.5	*27.75*	40	17	21	*78.4*	**241.25**	Unsatisfactory	4	17
90	23	28	23	12	*85.95*	30	30	12	4.5	10	*86.5*	19	11	3.3	*32.95*	40	19	26	*84.7*	**290.1**	Marginal	2	25
91	28	28	27	9	*92.18*	28	30	9	4.5	10	*81.7*	24	11	6.5	*41*	40	22	21	*82.6*	**297.48**	Marginal	0	24
92	53	36	27	15	*130.5*	27	26	12	3.6	10	*79.3*	28	20	16	*63.85*	14	30	17	*60.5*	**334.15**	Acceptable	4	30
93	53	33	35	15	*135.3*	27	30	15	3.6	10	*85.3*	26	19	16	*61.4*	12	30	20	*61.5*	**343.5**	Excellent	4	33
94	53	33	35	15	*135.3*	24	26	15	3.6	10	*79.3*	26	19	16	*61.4*	25	30	24	*78.8*	**354.8**	Excellent	3	33
95	44	23	20	15	*101*	23	26	15	3.6	4.8	*72.6*	17	20	6.5	*43.3*	32	30	27	*89*	**305.93**	Marginal	1	22
96	47	23	24	15	*109.2*	26	26	15	2.7	6	*76.5*	23	17	11	*51.3*	36	30	30	*96*	**333**	Acceptable	0	26
97	47	28	33	15	*123.6*	25	26	12	2.7	8.4	*74.7*	18	16	11	*45.25*	38	30	21	*89*	**332.55**	Acceptable	1	23
98	47	28	33	15	*123.6*	25	26	12	2.7	8.4	*74.7*	18	16	11	*45.25*	38	30	21	*89*	**332.55**	Acceptable	1	23
99	21	26	23	7.5	*76.65*	26	30	15	0.9	10	*82.3*	13	16	9.8	*38.95*	36	26	24	*86.4*	**284.3**	Marginal	2	20
100	25	23	17	9	*72.68*	26	30	7.5	1.8	6	*71.7*	12	14	3.3	*28.75*	40	26	18	*84.4*	**257.53**	Marginal	5	16

	Safety Weighted Score					Practicality Weighted Score						UX Weighted Score				Cons. Weighted Score				Overall Suitability		Score Incidence	
Seg.	1.a	1.b	1.c	1.d	*Tot G1*	2.a	2.b	2.c	2.d	2.e	*Tot G2*	3.a	3.b	3.c	*Tot G3*	4.a	4.b	4.c	*Tot G4*	**TOTAL**	**Suitability**	"1"	"5"
101	24	23	21	7.5	*75.15*	29	30	7.5	3.6	6	*76.2*	16	14	9.8	*38.85*	40	26	24	*90.4*	**280.6**	Marginal	0	17
102	28	18	21	9	*75.83*	30	30	11	1.8	10	*82.3*	14	11	6.5	*31.65*	40	26	26	*91.9*	**281.68**	Marginal	1	20
103	42	33	33	9	*116.9*	26	26	14	3.6	8	*77.9*	28	18	13	*58.1*	14	30	23	*66.5*	**319.35**	Acceptable	4	25
104	51	31	29	15	*125.5*	28	28	7.5	4.5	10	*78.4*	25	9.3	8	*42.45*	40	30	21	*91*	**337.33**	Acceptable	0	30
105	34	31	27	9	*100.7*	28	28	7.5	3.6	10	*77.5*	25	9.3	8	*42.45*	40	30	21	*91*	**311.6**	Acceptable	0	23
106	53	34	32	15	*132.8*	24	28	14	4.5	10	*79.9*	26	20	13	*59.4*	40	30	26	*95.5*	**367.55**	Excellent	0	32
107	53	34	32	15	*132.8*	24	28	14	4.5	10	*79.9*	26	20	13	*59.4*	40	30	26	*95.5*	**367.55**	Excellent	0	32
108	53	34	32	15	*132.8*	24	28	14	4.5	10	*79.9*	26	20	13	*59.4*	40	30	26	*95.5*	**367.55**	Excellent	0	32
109	15	33	17	6	*70.58*	28	30	4.5	2.7	8	*73.4*	9.6	6.5	3.3	*19.35*	40	24	24	*88*	**251.33**	Marginal	11	18
110	42	28	30	14	*113.9*	21	23	12	2.7	6	*64.2*	24	19	16	*58.75*	34	30	26	*89.5*	**326.3**	Acceptable	0	20
111	42	28	33	14	*116.9*	21	23	12	2.7	6	*64.2*	24	19	16	*58.75*	34	30	26	*89.5*	**329.3**	Acceptable	0	21
112	49	31	29	15	*123.9*	30	26	9	1.8	10	*77.2*	22	16	13	*50.6*	40	30	30	*100*	**351.7**	Excellent	0	31
113	49	31	29	15	*123.9*	30	26	9	1.8	10	*77.2*	22	16	13	*50.6*	40	30	30	*100*	**351.7**	Excellent	0	31
114	51	36	27	15	*128.9*	25	23	12	3.6	10	*73.3*	26	20	16	*62.65*	38	30	23	*90.5*	**355.38**	Excellent	0	29
115	28	38	30	14	*110.1*	26	25	12	4.5	10	*77.2*	23	17	13	*52.8*	36	30	24	*90*	**330.1**	Acceptable	0	26

Table H2. *Route suitability scores*

				Score Breakdown						# of "1"	
Route	**Sequence**	**Length (mi)**	**TOT Score**	**G1**	**G2**	**G3**	**G4**	**G5**	**Purp. User**	**scores**	**Suitability**
A	[1-2-3-4-5-6-7-8-9-109-10-11-12-13-14-47]	4.667	**353**	98.3	84.2	60.1	84.7	25.6	146.1	145	Marginal
B	[1-2-3-16-39-38-113-112-33-35-37-96-100-101-58-59-60-61]	7.073	**396**	126.7	79.3	74.3	88.9	26.6	148.9	25	Acceptable
C	[1-2-3-4-18-42-110-111-22-23-24-25-26-27-28-29]	4.439	**433**	130.8	82.0	87.1	88.6	44.2	191.5	14	Excellent
D	[1-2-3-4-21-43-44-45-46-7-8-9-109-10-11-12-13-14]	4.721	**358**	102.0	83.7	59.4	86.2	26.6	147.1	123	Marginal
E	[1-2-3-4-18-42-43-44-45-46-7-8-9-109-10-11-12-13-14]	4.745	**358**	102.3	84.0	59.4	85.8	26.6	147.3	126	Marginal
F	[1-2-3-4-17-41-42-43-44-45-46-7-8-9-109-10-11-12-13-14]	4.989	**362**	103.3	84.6	60.1	87.3	26.6	147.9	121	Marginal
G	[1-2-3-4-17-41-42-43-44-45-52-55-56-57-58-59-60-61]	5.037	**424**	130.5	88.0	82.7	88.0	35.2	176.9	28	Excellent
H	[1-2-3-4-17-40-39-64-65-80-23-86-10-11-12-13-14]	6.126	**375**	110.2	80.7	69.8	83.8	31.0	153.8	74	Marginal
I	[1-2-3-4-17-40-39-64-65-80-81-82-83-85-109-10-11-12-13-14]	6.300	**373**	110.1	81.5	65.7	84.9	31.0	150.7	88	Marginal
J	[1-2-3-4-17-40-39-64-65-79-114-92-100-101-58-59-60-61]	6.110	**411**	127.9	84.0	79.0	83.9	36.6	168.8	31	Acceptable
K	[1-2-3-4-17-40-39-38-113-62-77-78-79-80-81-82-83-85-109-10-11-12-13-14]	7.092	**365**	110.5	77.8	64.5	87.5	24.4	138.8	89	Marginal
L	[1-2-3-4-17-40-39-38-63-69-77-78-79-80-23-86-10-11-12-13-14]	7.242	**362**	107.6	76.7	66.3	84.8	26.4	138.1	77	Marginal
M	[1-2-3-4-17-40-39-38-63-69-77-78-114-92-100-101-58-59-60-61]	7.151	**398**	125.4	79.5	76.6	84.9	32.0	156.0	34	Acceptable
N	[1-2-3-16-39-64-73-74-22-23-24-57-58-59-60-61]	5.169	**432**	137.3	88.7	84.6	82.9	38.6	183.2	31	Excellent
O	[1-2-3-4-21-110-111-22-23-24-25-26-27-28-29]	4.415	**433**	130.6	81.7	87.1	88.9	44.2	191.4	11	Excellent
P	[1-2-3-4-21-110-111-22-80-79-114-92-100-101-58-59-60-61]	5.459	**421**	128.7	83.3	82.7	86.7	40.0	177.1	23	Excellent
Q	[1-2-3-4-17-41-42-110-111-22-23-86-10-11-12-13-14]	5.320	**378**	109.0	80.3	69.3	87.5	32.0	156.9	64	Marginal
Q_2	[1-2-3-4-17-41-42-110-111-22-23-24-25-102-12-13-14]	5.454	**393**	112.3	82.2	72.7	91.0	35.2	161.7	32	Acceptable
R	[1-2-3-4-17-41-42-110-111-22-81-82-83-85-109-10-11-12-13-14]	5.494	**375**	109.1	81.4	66.1	88.6	30.0	153.8	78	Marginal
R_2	[1-2-3-4-17-41-42-110-111-22-81-82-87-10-11-12-13-14]	5.235	**379**	109.5	83.8	67.3	88.8	30.0	156.5	63	Marginal
S	[1-2-15-64-65-79-114-66-67-68-59-60-107-108]	5.091	**394**	126.1	81.0	77.2	74.9	35.2	166.9	43	Acceptable
T	[1-2-15-64-65-79-114-66-67-68-59-60-61]	5.021	**393**	126.0	81.0	77.1	73.2	35.2	166.3	46	Acceptable
U	[1-2-3-4-19-44-53-54-115-55-56-57-58-59-60-61]	4.939	**421**	128.4	88.8	82.8	87.2	34.2	175.4	30	Excellent
V	[1-2-3-4-18-42-110-75-74-22-23-24-57-58-59-60-61]	4.809	**442**	137.1	86.5	88.0	86.5	44.2	191.8	28	Excellent
W	[1-2-3-16-39-64-65-79-114-93-94-58-59-60-61]	5.346	**424**	137.4	87.3	83.9	80.2	35.2	177.8	32	Excellent
X	[1-2-3-4-21-110-111-22-23-24-57-58-59-60-61]	4.575	**443**	136.6	85.8	88.2	88.2	44.2	191.6	17	Excellent
Y	[1-2-3-4-18-42-110-111-22-23-24-57-58-59-60-61]	4.600	**443**	136.8	86.0	88.2	87.9	44.2	191.6	20	Excellent
Z	[1-2-3-4-17-41-42-110-111-22-23-24-57-58-59-60-61]	4.843	**444**	136.3	86.5	87.7	89.2	44.2	191.3	15	Excellent
Spur A	*[47-48-49-50-51]*	*0.886*	***300***	*69.6*	*87.3*	*44.6*	71.5	*27.6*	*120.1*	*32*	*Marginal*
Spur B	*[5-20]*	*0.498*	***304***	*80.0*	*79.5*	*59.7*	69.0	*15.8*	*123.4*	*24*	*Marginal*
Spur C	*[81-82-84]*	*0.668*	***377***	*105.0*	*88.6*	*60.8*	87.4	*34.8*	*154.7*	*2*	*Marginal*
Spur D	*[31-32-33-35-112-62-77-78-79-80-81-82-87]*	*5.562*	***383***	*107.1*	*82.6*	*68.4*	90.1	*34.8*	*147.9*	*12*	*Acceptable*