

HUDSON FJORD HIKE/BIKE TRAIL CAPITAL IMPROVEMENTS FEASIBILITY STUDY

Site Address: SR-9D and Hudson Highlands State Park

INTRODUCTION AND BACKGROUND

The Town of Philipstown proposes the construction of an inter-municipal multi-use recreational path system on the shoulders of a 2.0-mile segment of New York State Route 9D (SR-9D), comprising the existing 1.57-mile-long Hudson Fjord Bike/Hike Trail established by the Philipstown Town Board within the Town of Philipstown together with a 0.43-mile-long northward extension in the Town of Fishkill.

The proposed multi-use recreational path system that is the subject of the present study – namely, the Hudson Fjord Hike/Bike Trail Capital improvement Feasibility Study (HFB/HTCIFS) – will provide:

- Safe access to and convenient connections among six roadside trailheads of popular hiking trails in the Hudson Highlands State Park by means of a continuous corridor on the shoulders of SR-9D that is closed to motor vehicles whether moving or parked, such that foot/bicycle/shuttle bus access to the trailheads would be enabled from the Metro-North train stations at Cold Spring and at Breakneck Ridge, as alternatives to car-dependent access;
- Enlarged and improved parking facilities at opposite ends of the multi-use path system adequate to put an end to the dangerous spillover parking along the highway shoulders;
- Safe physical access to the Hudson River at one point; and
- Close visual engagement with the Hudson River along its entire length.

Apart from a modest incline at its northern end, the 2.0-mile-long HFB/HTCIFS section is almost perfectly flat, close to river (generally less than 150 feet from the river's edge), and straight (deviating only slightly from a northwest-to-southeast line)—affording motorists long forward sight lines to bicyclists and pedestrians on the highway shoulders. The stretch of SR-9D was formerly part of State Bike Route 9; and would be eligible for re-designation as such when the current program of road repairs on 9D in the City of Beacon and the widening of the bike lanes as considered in the present study are completed.

The subject stretch of 9D is magnificently scenic, hugging as it does the shoreline of the highest and steepest portion of the Hudson Fjord, which is the gorge cut by mile-thick ice sheets when the granite barrier of the Hudson Highlands was overtopped by advancing continental glaciers. In the age of Hudson River sloops and steamers, this imposing reach of the river framed by Storm King, Breakneck, Crow's Nest, and Bull Hill was called by the mariners and their passengers the Wey-Gat or North Gate. The subject stretch of 9D perfectly conforms to the criterion of eligibility for Greenway Trail designation that scenic values and recreational opportunities with the viewshed of the Hudson River be maximized. At its meeting of October 10, 2006, the Greenway Joint Board accordingly granted the Hudson Fjord Bike/Hike Trail conditional Greenway Trail designation, with the express understanding that full Greenway Trail designation

would be conferred once the measures conducive to biker/pedestrian safety and wayfinding put forward by the Town of Philipstown/Philipstown Greenway Committee will have been planned and implemented in conjunction with the NYS Department of Transportation and the Office of Parks, Recreation and Historic Preservation.

The subject stretch of 9D is already heavily used in all seasons for recreational purposes, but under conditions that are unsafe, unregulated and inconvenient. The safety concerns shared by the Greenway Joint Board, the Town of Philipstown/ Philipstown Greenway Committee, the New York State Department of Transportation (NYSDOT), the Office of Parks, Recreation, and Historic Preservation (OPRHP), the Little Stony Point Citizens Association, the Village of Cold Spring, the Town of Fishkill and the Putnam County Planning Department arise from the narrowness of the 9D shoulders and the inadequacy of existing parking facilities to accommodate the heavy recreational use of the six Hudson Highlands State Park trails that head on 9D. On a site visit on October 30, 2006, the NYSDOT Region 8 Bicycle and Pedestrian Program Coordinator—assisted by members of the Philipstown Greenway Committee, the manager of Hudson Highlands State Park, a trustee of the Village of Cold Spring, and the Little Stony Point caretaker—determined that the average width of the asphalt shoulder on both sides of the subject stretch of 9D is only 2 feet, which is less than half the minimum 5-foot width for an approved bicycle lane, accounting for the withdrawal of the State Bike Route 9 status which this stretch of 9D formerly enjoyed. The NYSDOT Program Coordinator also determined that existing parking facilities are inadequate to prevent overflow parking on the shoulders of 9D, further imperiling hikers and bikers endeavoring to travel on the shoulders. According to NYSDOT data, collected in May 2005, vehicle traffic volume is: average daily traffic volume approximates 5000 (total northbound and southbound), for the subject stretch of the SR-9D. Traffic mix consists of automobiles, – 53.25%, trucks and buses – 42.61%, and heavy vehicles – 4.14%.

The present feasibility study has two objectives.

The first objective is to evaluate the physical constraints on the feasibility of construction the following three capital improvements to the Hudson Fjord Bike/Hike Trail and the subject stretch of SR-9D:

- (1) MULTI-USE PATH SYSTEM (all in conformity with Guide for the Development of Bicycle Facilities (AASHTO, 1999) and Designing Sidewalks and Trails for Access (Federal Highway Administration, 2001);

EITHER Alternative A:

Segregated shared-use (bicycle/pedestrian/wheelchair/line skater) path (at least 10 feet wide), including (a) the 1.0-mile stretch on the east side of 9D between the Washburn trailhead parking area and Brook trailhead (subject to the constraints of the line of utility poles 12 feet east of the solid line and the presence in places of a drainage ditch); and (b) the 1.0-mile stretch on the west side of 9D between the point opposite the Brook trailhead and the path to the Breakneck Station footbridge;

OR Alternative B:

Widening both asphalt shoulders to the standard width for bicycle lanes (5 feet) on the 2.0-mile stretch of 9D between the Little Stony Point footbridge and the Breakneck Station footbridge, and building a segregated pedestrian-only path (3 feet wide) on the east side of SR-9D between the Washburn trailhead parking area and Brook trailhead, and on the west side of 9D between the point opposite the Brook trailhead and the path to the Breakneck Station footbridge;

(2) PARKING LOTS AND CROSSWALK:

Enlargement and improvement—in conformity with NYSDOT safety recommendations and OPRHP visual impact considerations—of the two parking lots proposed above to be the sole legal parking areas for park recreation lists on the stretch of 9D between Little Stony Point and Breakneck Station: viz., the Washburn trailhead parking area on the east side of 9D, opposite Little Stony Point; and the Breakneck parking area on the west side of 9D, 900 feet north of the Breakneck Ridge trailhead. Also a crosswalk from the Washburn trailhead parking lot to the Little Stony Point trailhead, together with improvement of sight lines, relocation of the parking lot entrance and installation of route signing and traffic calming measures;

(3) WHEELCHAIR ACCESS:

Modifications of the Little Stony Point entrance area and footbridge to conform to ADA standards for wheelchair access.

The second objective of the present study is to estimate the cost to design, construct and maintain each of the capital improvements listed above.

COMMUNITY INPUT AND SUPPORT

Project support from the local trail-user groups and other non-government groups was generated through the following activities: presentations to the Philipstown Town Board and Fishkill Town Board in public session, reported in the paper of record; newspaper articles and advertisements, online postings, and public speeches in connection with the 1st Annual Hudson Highlands Greenway Triathlon, conducted on the Hudson Fjord Hike/Bike Trail on September 25, 2006; press release by Greenway Conservancy announcing conditional Greenway designation of the Hudson Fjord Hike/Bike Trail.

MANAGEMENT AND MAINTENANCE PLANNING

The Hudson Fjord Bike/Hike Trail capital improvement project has received the support, encouragement and preliminary grant funding or pledges of eventual assistance from the following municipal, county and state government and planning agencies, public officials and private non-profit organizations: Philipstown Town Board, the NYS Greenway Conservancy, the Fishkill Town Board, NYS Department of Transportation; Putnam County Planning Department; the Dutchess County Department of Planning and Development, the Office of Parks, Recreation and Historic Preservation, U.S. Congressman John Hall, State Senator Vincent Leibell, County

Legislator and Hudson River Navigator Vincent Tamagna, the Village of Cold Spring, the New York/New Jersey Trail Conference, the Western Putnam Economic Development Council and Little Stony Point Citizens Association.

Ongoing maintenance of the 9D is currently the responsibility of the New York State Department of Transportation (NYS DOT). Additional maintenance cost maybe incurred, depending on the preferred trail design alternative chosen and the level of maintenance agreed to by various stakeholders. Both design alternatives assume the base level of maintenance, which consist of a series of early spring and summer maintenance sweeps. The maintenance could also include also such maintenance practices as inspections of bikeways and walkways for surface irregularities, inspections of the signage, providing extra sweeping in the fall in areas where leaves accumulate in the bike lanes, providing surface repairs, retracing pavement markings every spring, replacing signage, when damaged, maintaining clearances by clearing brush, mowing grass where appropriate, etc. The level of maintenance and management plans should be provided in the final design stage to identify maintenance responsibilities and to assure uniform maintenance and upkeep.

CONNECTIONS

The multi-use recreational path system, which is the lead item of the Hudson Fjord Hike/Bike Trail Capital Improvements Feasibility Study, will connect six trailheads located at regular intervals on both sides of the 2.0 mile-long subject stretch of SR-9D. These six trailheads are the primary access points to the six most popular and heavily-used trails in Hudson Highlands State Park, three of which are designated NYS Greenway Trails:

Wilkinson Memorial Trail (Greenway Riverside Trial): the east side of the SR-9D intersects the yellow-blazed Wilkinson Memorial Trail head equidistant between the large Breakneck parking area and the pedestrian overpass to the Breakneck Metro-North Train Station.

Breakneck Ridge Trail (Greenway Riverside Trail): the west side of SR-9D intersects the white-blazed Breakneck Ridge Trail head at the small Breakneck Point parking area at the north end of the Breakneck Tunnel on the Putnam County / Dutchess County boundary. The Breakneck Ridge Trail has been rated “#1 of the Top 100 Trails in North America” by trail.com every year from 2002 to 2006. It has also been rated “#1 Classic Northeast Us Trail” by *AMC Outdoors* magazine in 2006.

Brook Trail (Hudson Highlands State Park): the east side of SR-9D intersects the red-blazed Brook Trail head 0.38 mile south of the Putnam County / Dutchess County boundary.

Cornish Trail (Hudson Highlands State Park): the east side of SR-9D intersects the blue-blazed Cornish Trail head 630 feet north of the intersection of Morris Avenue (SR-9D) and Fair Street (CR-17).

Washburn Trail (Greenway Riverside Trail): the east side of SR-9D intersects the white-blazed Washburn Trail head 630 feet north of the intersection of Morris Avenue (SR-9D) and Fair Street (CR-17).

Little Stony Point Trail (Greenway Riverside Trail): the west side of SR-9D intersects the Little Stony Point Trail head 630 feet north of the intersection of Morris Avenue (SR-9D) and Fair Street (CR-17).

CULTURAL AND HISTORIC HERITAGE CONSIDERATIONS

The Hudson Fjord Bike/Hike Trail traverses the HH-26 subunit (Hudson Highlands State Park) of the Hudson Highlands Scenic Area of Statewide Significance. It is moreover the signature Hudson River landscape represented by the painters of the Hudson River School. It is also celebrated in the stories of Washington Irving (e.g., Bull Hill is featured in *Dolph Heyliger*, 1822), the poems of George P. Morris and William Cullen Bryant, and the journalism of Nathaniel Parker Willis. The 2.0 mile-long subject search stretch of SR-9D provides visual and physical access to the following features of cultural significance in the HH-26 subunit of the Hudson Highlands Scenic Area of Statewide Significance.

- **Breakneck Point Siphon Station:** sits atop the east shaft of the Hudson River crossing of the Catskill Aqueduct. This 14 foot diameter pressure tunnel plunges 1,144 vertical feet vertically beneath the Breakneck Point siphon station before taking a right-angle turn to traverse the granite basement below the Hudson River. The Hudson River crossing of the Catskill Aqueduct was drilled between 1907 and 1912. The Breakneck Point siphon station was erected in 1913. The first water supply from the Catskill Aqueduct reached New York City in 1916. The Catskill Aqueduct today delivers 40 percent of New York City's water supply. The pressure tunnel beneath the Breakneck Point siphon station ascends eastward through the granite of Breakneck Ridge to an elevation of 395 feet before leveling out in a grade tunnel passing through the heart of the mountain. From the Breakneck Siphon Station, hikers may look out on the portion of Henry Hudson's "River of Mountains" at "the edge of the mountains, or the northernmost of the mountains, which look as if some metal or mineral were in them, for the trees that grow on them are all blasted," where the Halve Maen traded peaceably with the Delaware Munsee Indians while riding at anchor from September 29 till October 1, 1609 waiting for a southeast gale to subside.
- **Breakneck Tunnel, Route 9D** (at north end of Hudson Fjord Bike/Hike Trail): 582-ft-long concrete two-lane tunnel built in 1932. Average daily traffic: 5,280 vehicles (1998). Prior to the opening of the Breakneck 9D Tunnel in 1932, the stretch of riverside road including what is now Route 9D between Breakneck and Cold Spring and Fair Street in Cold Spring was called River Road or "The Flats". Prior to the building of the Hudson River Railroad through Breakneck Point in 1848-49, the River Road wound over Breakneck Point on its way to Fishkill Landing (incorporated into Beacon in 1913). The River Road from Cold Spring to Breakneck was laid out in April 1823.
- **Breakneck Tunnels, Metro-North** (at north end of Hudson Fjord Bike/Hike Trail): twin tunnels built in 1848-49 for the Hudson River Railroad. It was the most difficult section of the Hudson River Railroad to construct because the Storm King granite is so resistant here that workman could drill only one or two feet per day, requiring H. D. Ward & Co. 17 months to complete the tunnel.

- **Breakneck Quarry** (at north end of Hudson Fjord Bike/Hike Trail): Beginning in the 1830s, Blunt's Quarry, the Highland Granite Company (owned by Howard and Haldane), and the Harlem High Bridge Company quarried Storm King granite from the south face of Breakneck Ridge to supply material for the Old Croton Aqueduct (built 1837-48) and numerous breakwaters and forts on the Delaware and Chesapeake bays. Near the top of the south face of Breakneck, a rock mass bearing a famous resemblance, as viewed from passing boats, to a human profile—variously called Turk's Head, Anthony's Face, and Upper Anthony's Nose—was a noted tourist attraction until 1846, when Captain Deering Ayers dynamited it, bringing down 10,000 tons of granite with a single blast. Quarrying on the southern face of Breakneck did not persist into the twentieth century, owing to concerns for the structural integrity of the Catskill Aqueduct at the Hudson River crossing. In 1938, the Hudson River Conservation Society purchased 250 acres of potential quarry on the north face of Breakneck and donated them to the State under the Mailler Law. In 1961-62, Central Hudson negotiated an option on 670 acres of Breakneck Mountain and drew up plans to build a 600,000-kilowatt pumped storage power plant on it, comparable in design to the 1,000,000-kilowatt plant that Con Ed proposed to build on Storm King. In 1967, Laurance S. Rockefeller purchased these 670 acres from Central Hudson on behalf of New York State with matching funds from the Rockefeller family's Jackson Hole Preserve. In 1970, the State's properties on Breakneck were joined to those on North Sugarloaf, Mount Taurus, Little Stony Point, and Pollepel Island to create the new Hudson Highlands State Park.
- **Cornish Estate** (accessed via the concrete-surfaced Cornish Trail aka Lake Surprise Road aka Dairy Farm Road, which heads on the east side of Route 9D, 630 feet north of the intersection of Morris Avenue/NY-9D and Fair Street/CR-17): ruined granite mansion and model dairy farm built in the Breakneck Brook valley in the 1920s by James W. Eaton for Edward G. Cornish, chairman of the National Lead Company. The farm was vacated and boarded up in the 1930s and the mansion burned down in 1956. The 600 acres of the Cornish Estate were protected from quarrying by deed restrictions negotiated with the Cornish family by the Hudson River Conservation Society in 1938.
- **Mount Taurus (Bull Hill) Quarry** (accessed via the Washburn Greenway Trail, which heads on the east side of Route 9D, 630 feet north of the intersection of Morris Avenue/NY-9D and Fair Street/CR-17): In 1931, the Hudson River Stone Company bought from Southard and Stern of Cold Spring 1,000 acres on Mount Taurus extending from the river to the summit and began quarrying Storm King granite at a rate unprecedented in the history of the Hudson Highlands. In 1936, residents of the Hudson Valley formed the Hudson River Conservation Society, electing William C. Osborn as its president, to oppose the Mount Taurus quarry, but the organization failed to shut down the operation, which continued until 1966. In 1967-68, the Taconic State Park Commission purchased Mount Taurus, Breakneck, Little Stony Point, North Sugarloaf, Mount Taurus, and Pollepel Island with state and private funds, and in 1970 amalgamated them as Hudson Highlands State Park.

- **Little Stony Point Quarry** (accessed via the Little Stony Point Greenway Trail, which heads on the west side of Route 9D, 630 feet north of the intersection of Morris Avenue/NY-9D and Fair Street/CR-17): the northwestern end of the Little Stony Point peninsula is composed of Storm King granite that was quarried beginning in the 1840s by Alexander Anderson & Co. The Hudson River Stone Company resumed quarrying operations on Little Stony Point in the 1930s, enabled by 20 acres of river fill from its Mount Taurus (Bull Hill) quarry operations begun in 1931. A legal action brought by the Hudson River Conservation Society in 1939 obliged the Hudson River Stone Company to remove the river fill, with the result that quarry operations on Little Stony Point ceased in 1944. In 1967 the Georgia Pacific Company purchased Little Stony Point with the intention of building a wallboard manufacturing plant receiving gypsum shipped from South America. The Hudson River Valley Commission, which had in 1966 recommended the creation of a state park on the east side of the Hudson fjord to be centered on Breakneck Ridge, persuaded Governor Nelson Rockefeller to intervene, and Georgia Pacific relocated its gypsum plant to Buchanan. In 1967, Laurance S. Rockefeller purchased Little Stony Point on behalf of New York State with matching funds from the Rockefeller family's Jackson Hole Preserve. In 1970, Little Stony Point was joined to Breakneck, North Sugarloaf, Mount Taurus, and Pollepel Island to make the new Hudson Highlands State Park.
- **Undercliff** (on the east side of Route 9D, 600 feet upslope to the east): site of the Doric-columnaded house of the summer estate of General George P. Morris (1802-64): poet, song-writer (e.g., "Woodman, Spare That Tree"), and co-publisher with Nathaniel Parker Willis of the daily New York newspaper, *Evening Mirror*. Undercliff was the subject of William Henry Bartlett's sepia wash "Undercliff, near Cold-Spring (The Seat of General P. Morris)" reproduced as a steel engraving in Nathaniel Parker Willis *American Scenery* (1840); and also of an engraving by Benson J. Lossing in *The Hudson* (1866).

NATURAL RESOURCES AND ENVIRONMENTAL EDUCATION

Improved access to this stretch of the Greenway Trail network and the Hudson Highlands State Park will allow exposure to this environment to users of all ages. This exposure is invaluable to ongoing environmental education, regardless of user age. Execution of the project will ensure increased usage of this area that has seen such significant philanthropic investment for the purpose of preserving these precious resources for future generations. It will simultaneously offer the important economic, environmental, and social benefits that come from increased bicycle and pedestrian activity.

TRAIL ACCESS AND TRAIL SHARING OPPORTUNITIES

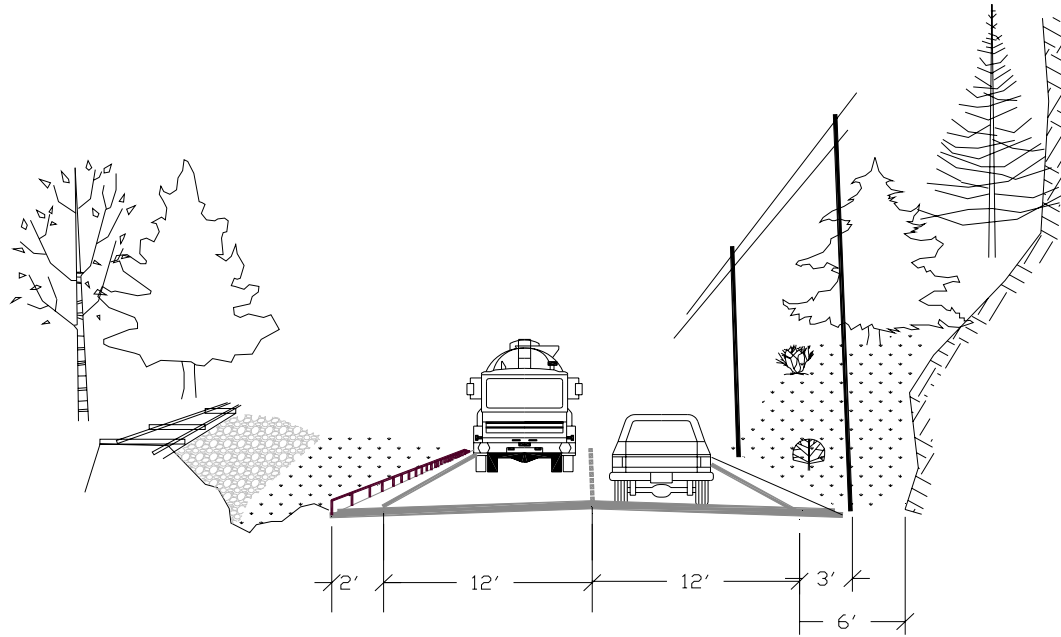
The Hudson Highlands Greenway Triathlon on Sept 24, 2006 and September 16, 2007 included the entire Hudson Fjord Bike/Hike Trail. It is intended to accommodate multi-use recreational trail activities, including bikeway, hiking, running, line-skating and cross country skiing.

Existing and potential users of the Hudson Fjord Bike/Hike Trail are local residents on foot or bike from the Town of Philipstown, Town of Fishkill, Village of Cold Spring, Village of Nelsonville, hamlet of Dutchess Junction, City of Beacon, Hudson Valley residents with access to the Metro-North line between New York City and Poughkeepsie and New York State residents with cars or bicycles. Bicyclists may transport their bicycles on Metro-North passenger trains to the Cold Spring which is 0.7 miles from the southern end of the 2.0 mile-long subject stretch of SR-9D, or to the Breakneck Station, which is at the northern end of the subject stretch.

CONCEPT DESIGN

1. Characteristics and Features of the HFB/HTCFIS stretch of SR-9D:

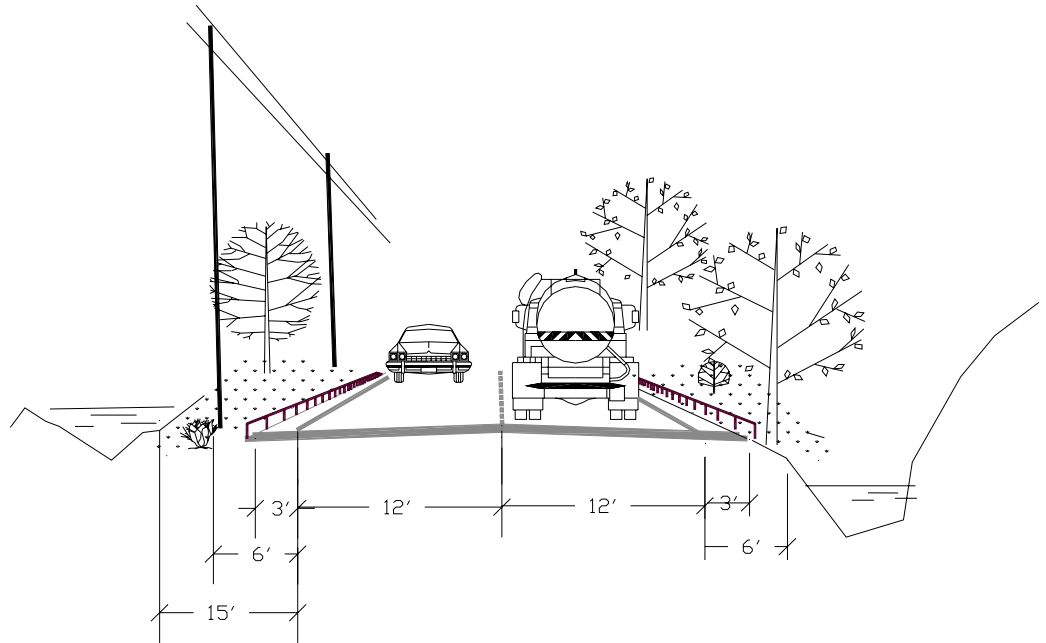
- Southern end point: SR-9D at the Washburn trailhead parking area, 680 feet north of the junction of Morris Avenue (NY-9D) and Fair Street (CR-17), at the Village of Cold Spring boundary, in Putnam County;
Northern point end: SR-9D at the Breakneck Station footbridge, 0.43 miles north of Breakneck Tunnel, in Fishkill, Dutchess County;
- Overall length: 2 miles;
- No intersections with other roadways;
- Road width 24ft;
- Vehicle speed 55mph;
- According to NYSDOT traffic count data, done in May 2005, vehicle traffic volume info: average daily traffic value approximates 5000 (total northbound and southbound), for the subject stretch of the 9D. Traffic mix consists of automobiles – 53.25%, trucks and busses – 42.61%, heavy vehicles – 4.14%.
- Few typical cross-sections described herein identifies various obstructions:
 - a) Starting at the Washburn parking area going north towards the Brook trailhead the easterly shoulder has such natural features, as steep rock slopes, as close to the edge of the road as 6 feet in some areas. Shoulder width on the roadway is 2 feet on both sides, and 2 – 4 feet to the safety guardrails and utility poles. See Cross-Section 1.



Cross Section 1

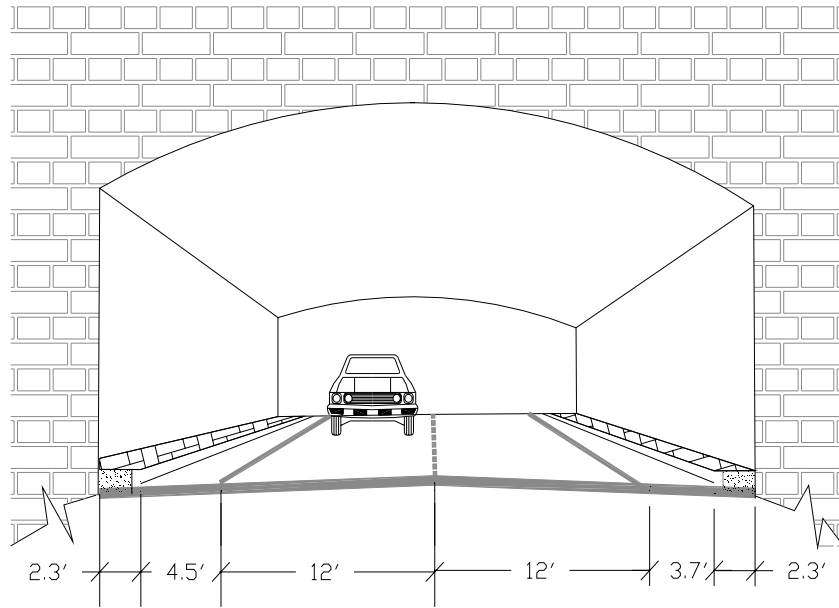
- b) Right before the Brook trailhead, the utility poles cross to the west side and the distance from the roadway to the rocky hillside increases. On the west side, between the railroad tracks and the roadway, there is a marsh.

After the Brook trailhead, going towards the Breakneck Point tunnel the shoulder width on the roadway is 1-2 feet, and 3 – 7 feet to safety guardrails, utility poles and other roadside barriers. Close to the tunnel, on the eastern shoulder, there is a sharp drop in grade, approximately 30 feet down to the water channel. West off the roadway, there is another marsh, see Cross-Section 2.



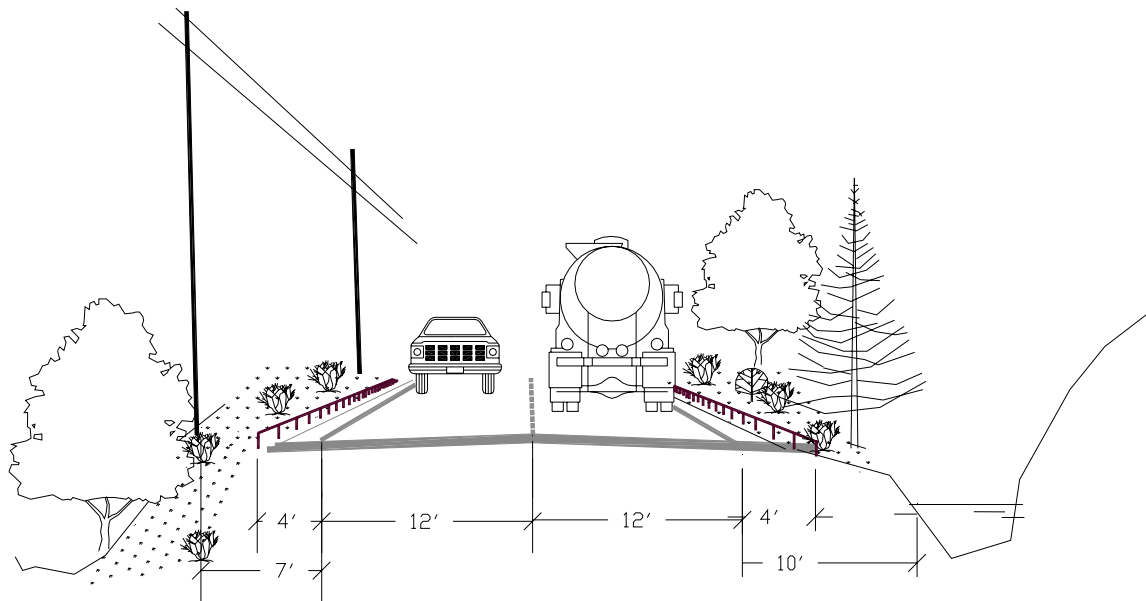
Cross-Section 2

- c) Shoulder width in the Breakneck tunnel: 2.3feet with a raised walk on both sides; on the west side there is 4.5 feet between the sidewalk curb and the white line; on the east side the distance is 3.7 feet; see Cross-Section 3.



Cross-Section 3

- d) After the Breakneck tunnel going north, towards the Breakneck station, pavement extends approximately 1-2 feet on the shoulder, abutted further by the safety guardrails. Utility poles are located for the most part west off the road. Right before the Breakneck Station on the eastern side of the road there is a marsh in close proximity to the road. See Cross-Section 4.



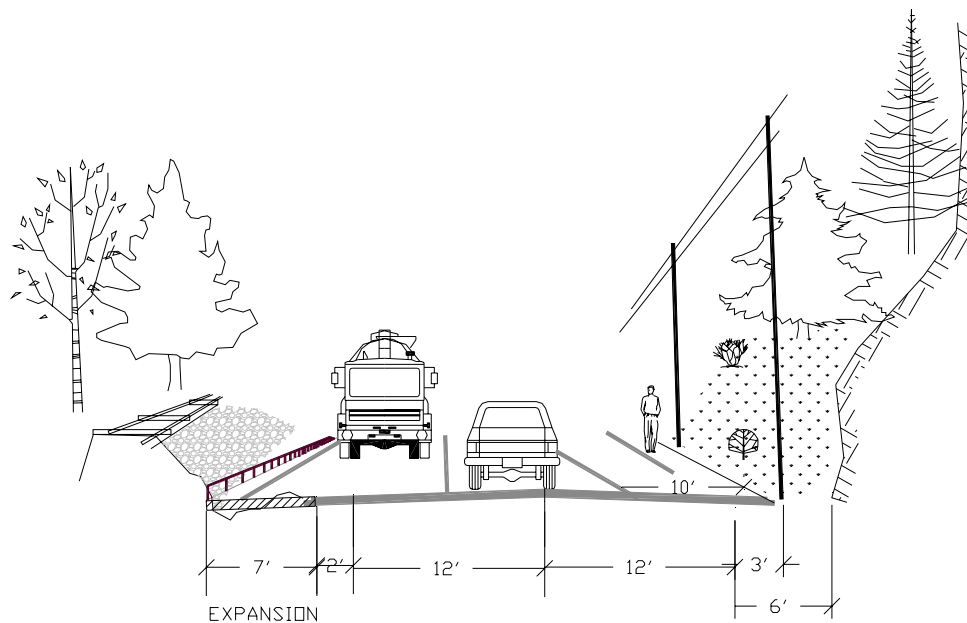
Cross-Section 4

2. Alternatives:

Alternative A: A segregated shared-use (bicycle/pedestrian/wheelchair/line skater) path (at least **10 feet wide**), including (i) the 1.0-mile stretch on the east side of 9D between the Washburn trailhead parking area and Brook trailhead (subject to the constraints of the line of utility poles 12 feet east of the solid line and the presence in places of a drainage ditch); and (ii) the 1.0-mile stretch on the west side of 9D between the point opposite the Brook trailhead and the path to the Breakneck Station footbridge;

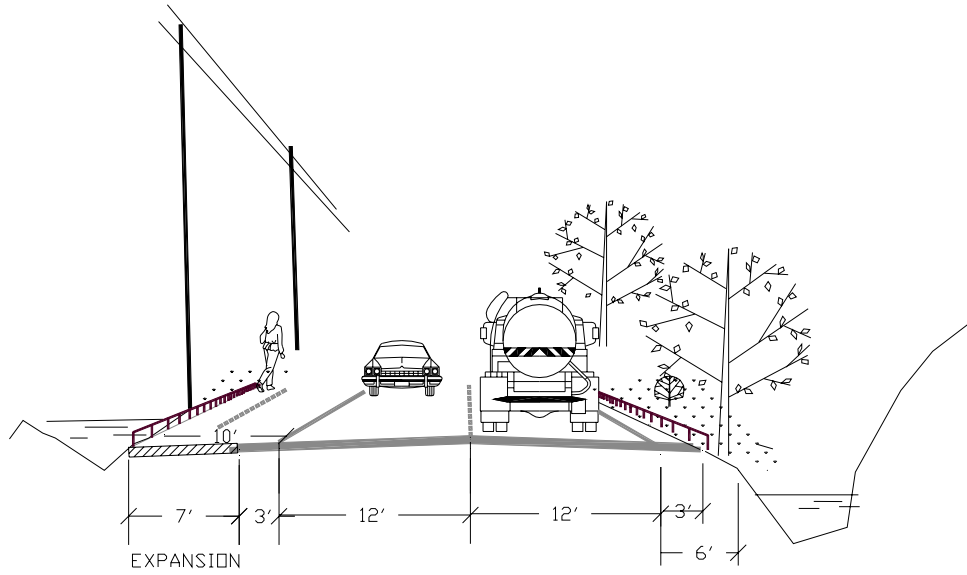
Trail improvements would involve:

- a) Starting at the Washburn parking area going north towards the Brook trailhead, as described previously - Cross-section 1 area, the existing features would not allow for much of an expansion on the eastern side of the road. Expansion of the eastern shoulder would involve not just relocation of the utility poles all the way to the Brook trailhead but also removing significant quantities of rock. Consequently, this would make this project overly expensive and not feasible to achieve. Instead, it would be more economically feasible to expand the western shoulder of the roadway for this particular segment by physically widening the roadway, then shifting existing roadway towards the west approximately 7 feet and re-striping the existing roadway. This would make it possible to allocate biking/hiking trail along the eastern shoulder of the road. The expansion on the westerly side most likely would encroach into the railroad Right-of-ways and would require acquisition of right-of- ways. See Cross-Section 1a below.



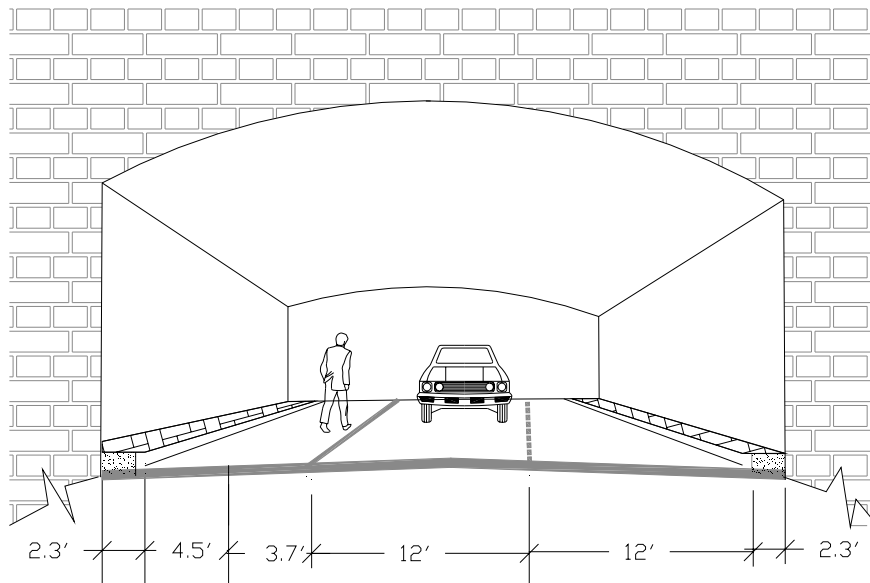
Cross Section 1a

- b) Pedestrian/bicyclist crossing at Brook trailhead (see Crossing at Brook Trailhead section below);
- c) In order to add biking/hiking lane in the segment, from the Brook Trailhead to the Breakneck tunnel (Cross Section 2 area), utility poles and safety guardrails west of the roadway will have to be relocated. In the areas where the water channel is adjacent to the roadway, a retaining wall might be needed. Safety rails should be installed between the trail and adjacent slope and waterway.



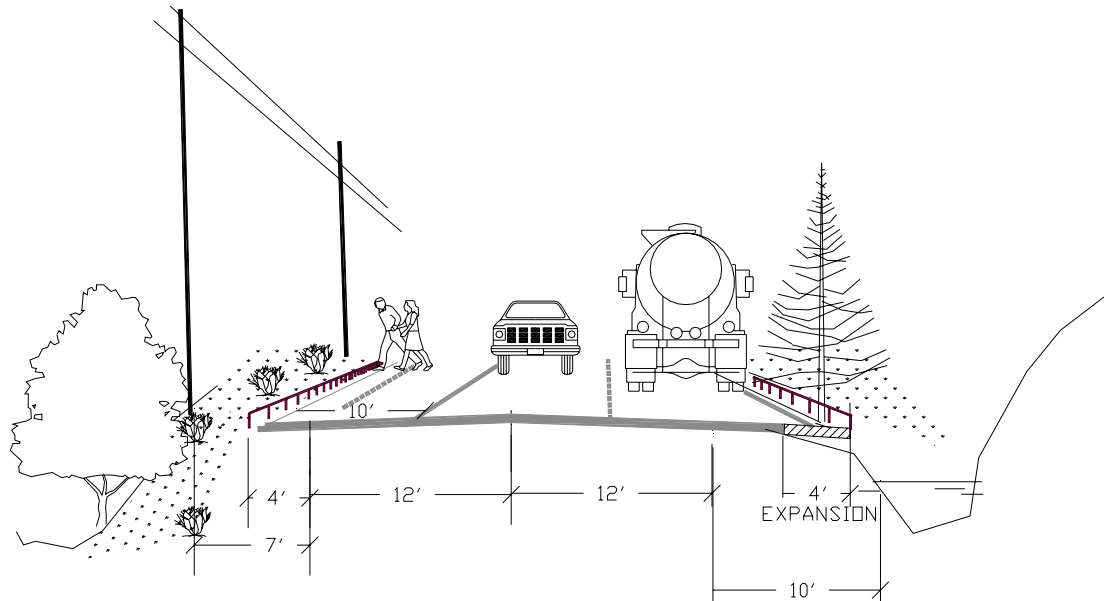
Cross-Section 2a

- d) In the tunnel, the roadway should be shifted and re-stripped to allocate 10' bike/hike line on the west shoulder. See Cross-Section 3a.



Cross-Section 3a

- e) After the Breakneck tunnel going north, towards the Breakneck station, there is approximately 7 feet distance on the western shoulder to the obstructions such as utility poles, highway guardrails, etc. Therefore, it would be more economically feasible to expand the eastern shoulder of the road and to re-stripe existing roadway to allocate biking/hiking trail along the western side of the road. Highway guardrails on the east side will have to be replaced with new. See Cross-Section 4a.



Cross-Section 4a

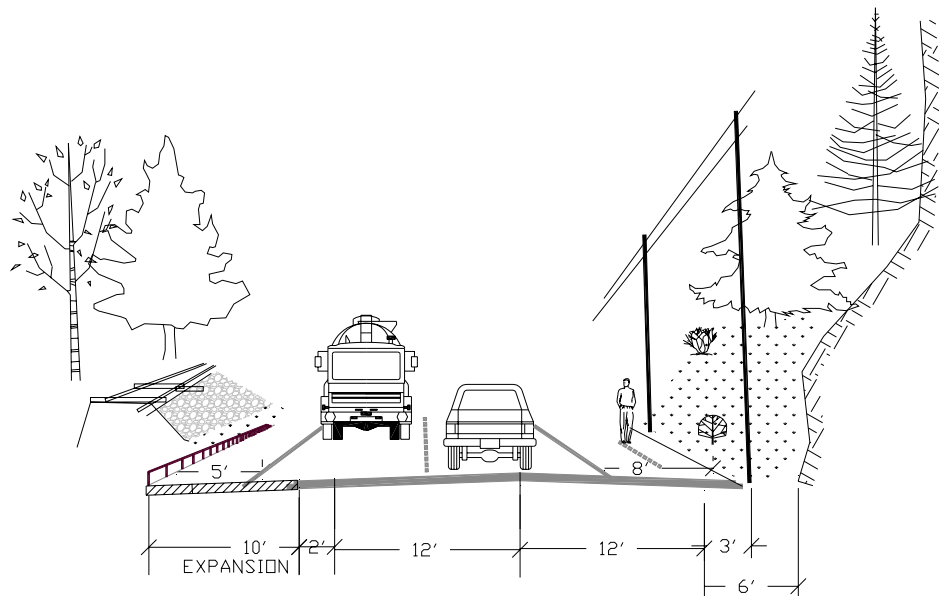
- f) Pavement Design: minor excavation and the addition of 4" of asphalt concrete is enough to provide shoulder bikeways. In the segments, where the main roadway would have to be expanded for motor vehicle usage (not a bikeway shoulder): 12" subbase material NYSDOT type, overlaid by 8" asphalt concrete base course type 1 and asphalt concrete binder course type 3 and 1 1/2" asphalt concrete top course type 7.
- g) Marking and signing of existing and expanded roadway shoulders as bike lanes. Segregating 10-foot trail (bike lane from pedestrian path); a bike lane should be delineated from the motor vehicle travel lanes with a 6-inch solid white line. Also, see Signage and Traffic Calming measures below.
- h) Sloping the pavement surface to one side usually simplifies longitudinal drainage design and surface construction, and is the preferred practice. Generally, surface drainage from the path will be adequately dissipated as it flows down the side slope. However, a shared-use path constructed on the side of a hill might require a drainage ditch on the uphill side to

intercept the hillside drainage. It might be necessary to install catch basins with drains to carry intercepted water under the path.

- **Alternative B:** Widening both asphalt shoulders to the standard width for bicycle lanes (**5 feet**) on the 2.0-mile stretch of 9D between the Little Stony Point footbridge and the Breakneck Station footbridge, and building a segregated pedestrian-only path (**3 feet wide**) on the east side of 9D between the Washburn trailhead parking area and Brook trailhead, and on the west side of 9D between the point opposite the Brook trailhead and the path to the Breakneck Station footbridge;

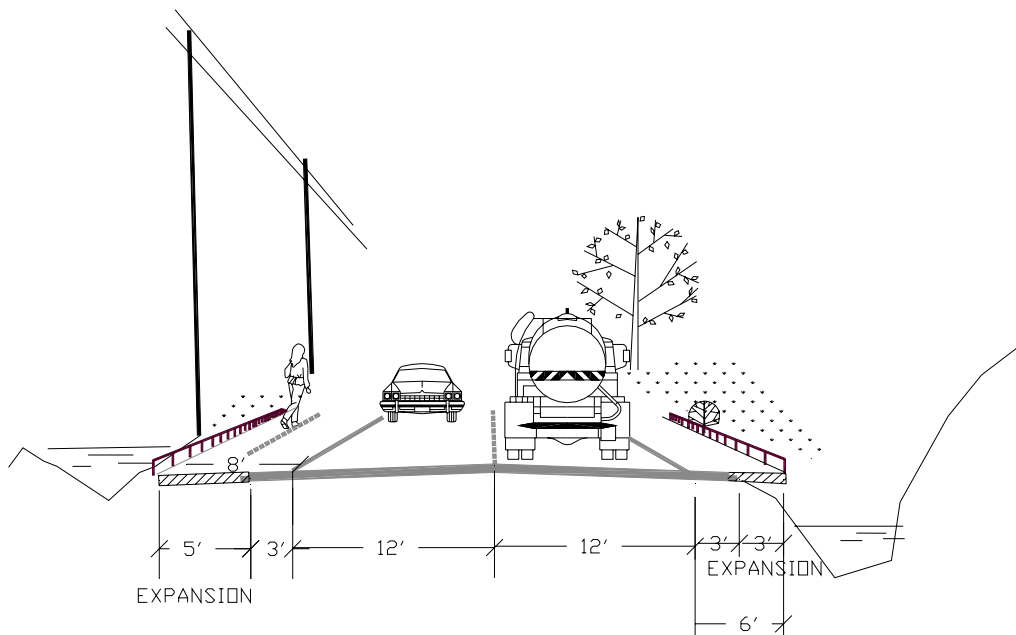
Trail improvements would involve:

- a) Starting at the Washburn parking area going north towards the Brook trailhead, as described previously - Cross-section 1 area, the existing features would not allow for much of an expansion on the eastern side of the road. Expansion of the eastern shoulder would involve not just relocation of the utility poles all the way to the Brook trailhead but also removing significant amounts of rock. Subsequently, this would make this project overly expensive and not feasible to achieve. Instead, it would be more economically feasible to expand the western shoulder of the roadway for this particular segment by physically widening the roadway, then to shifting existing roadway towards the west approximately 6 feet and re-striping the existing roadway. This would allow the allocation of space for biking/hiking trails along the eastern and western shoulder of the road. The expansion on the westerly side most likely would encroach into the RR right-of-way and would require acquisition of right-of-ways. See Cross-Section 1B below.



Cross Section 1b

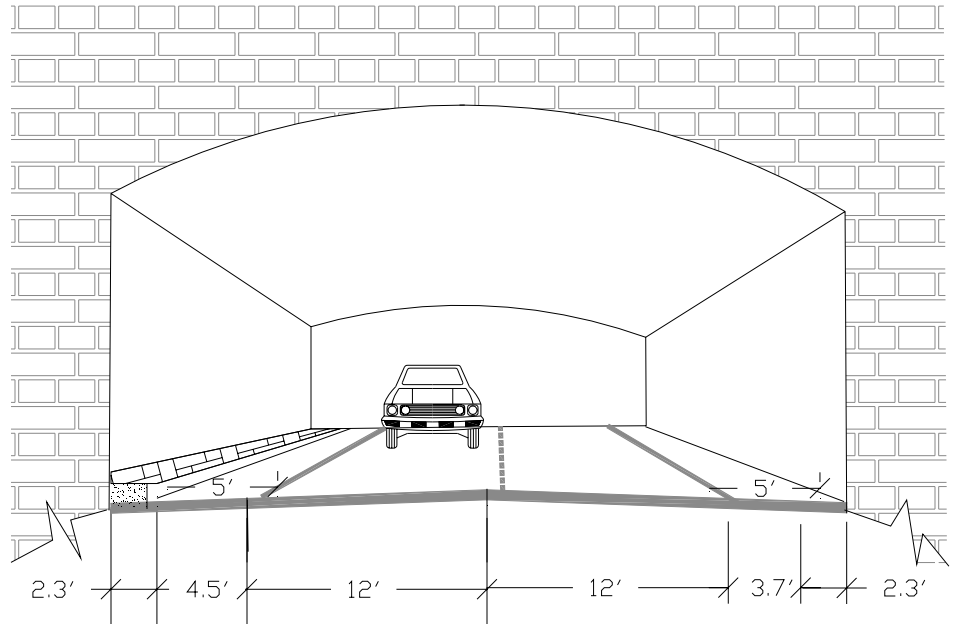
- b) Pedestrian crossing at Brook trailhead (see Crossing at Brook Trailhead section below);
- c) In order to add a biking/hiking lane in the segment, from the Brook Trailhead to the Breakneck tunnel (Cross section 2b area), utility poles and safety guardrails west of the roadway will have to be relocated and the shoulder expanded 5 feet. The eastern shoulder should be expanded approximately 3 feet that to add a bicycle lane and safety guardrails will require relocation. In the areas where the water channel is adjacent to the roadway, retaining walls might be needed. Safety rails should be installed between the trail and adjacent slope and waterway.



Cross-Section 2b

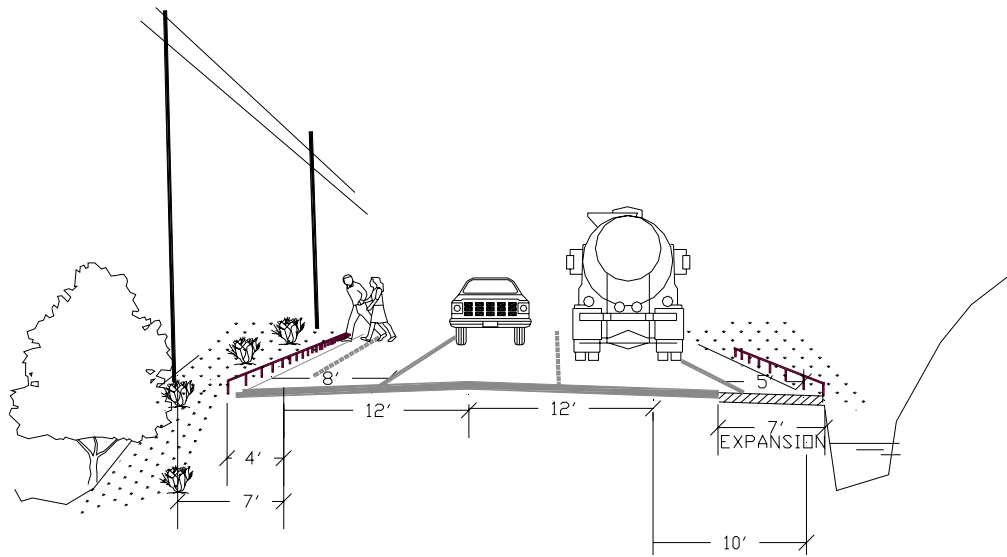
- d) Bike/hike width in the tunnel: Recommended AASHTO minimums, when motor vehicle speeds exceed 50mph and truck traffic present is - **5 feet of bike lane** (against the curb). Presently, in the tunnel the eastern road shoulder width is 3.7 feet and the western shoulder is 4.5 feet against the curb. Therefore, allocating two 5 foot lanes on both sides would require to remove the 2.3 feet of raised walkway with a curb on the east side. Then, to shift and re-stripe the entire roadway 0.5 foot to the east, thus providing the adequate bike lane on the west shoulder. To allocate 13 feet for bike/hike usage in the tunnel is not feasible, about 0.7 ft. short for the pedestrian walkway. In any case, this alternative should be a

subject of motor vehicle speed reduction through the tunnel. The signage should be provided warning about the path narrowing. Also, see Signage and Traffic Calming measures section. See Cross Section 3b.



Cross-Section 3b

- e) After the Breakneck tunnel going north, towards the Breakneck station, there is approximately 7 feet distance on the western shoulder to the obstructions such as utility poles, highway guardrails, etc., therefore, it would be more economically feasible to expand the eastern shoulder of the road and to re-stripe existing roadway to allocate biking/hiking trail along the western side of the road. Highway guardrails on the east side will have to be relocated further. See Cross-Section 4B below.



Cross-Section 4b

- f) Pavement Design: minor excavation and the addition of 4" of asphalt concrete is enough to provide shoulder bikeways. In the segments, where the main roadway would have to be expanded for motor vehicle usage (not a bikeway shoulder): 12" subbase material NYSDOT type, overlaid by 8" asphalt concrete base course type 1 and asphalt concrete binder course type 3 and 1 ½ " asphalt concrete top course type 7.
- g) Marking and signing of existing and expanded roadway shoulders as bike lanes. Segregating 8-foot trail (bike lane from pedestrian path); a bike lane should be delineated from the motor vehicle travel lanes with a 6-inch solid white line. Also, see Signage and Traffic Calming measures below.
- h) Sloping the pavement surface to one side usually simplifies longitudinal drainage design and surface construction, and is the preferred practice. Generally, surface drainage from the path will be adequately dissipated as it flows down the side slope. However, a shared-use path constructed on the side of a hill might require a drainage ditch on the uphill side to intercept the hillside drainage. It might be necessary to install catch basins with drains to carry intercepted water under the path.

CROSSING AT BROOK TRAILHEAD AND WASHBURN TRAILHEAD

Bikeways should allow cyclists to proceed through intersections in a manner that is as direct, predictable and safe as possible.

- A regulatory traffic control device should be installed at all path-roadway intersections, as per Guide for the Development of Bicycle Facilities, AASHTO, 1999 (Detector loop in the path pavement activating the signal for bicyclists or manually-operated signal for bicyclists and pedestrians);
- Refuge islands (6ftx6f) should be considered for path-roadway intersection because of high volumes of roadway traffic and speeds create unacceptable conditions for path users; or/and raised platform crosswalks, which can be useful to define roadway space for non-motorized users and stress the need for motorists to yield to that space;
- Pavement markings at a crossing should accomplish two things: channel the users to cross at a clearly defined location and provide a clear message to motorists that this particular section of the road must be shared with other users;
- The sight distance requirements:
 - a) At the Washburn trailhead to continue on 5' bicycle lane on other side of 9D or/and for access of Little Stony Point footbridge and vice versa, the sight distance is approximately 730 feet to the southerly direction (650 ft required) and 630 feet (630 ft required) to the northerly direction. Some clearing of the trees might be required;
 - b) At the Brook trailhead to continue on 8' pedestrian/bicycle lane on the western shoulder of 9D and vice versa, the sight distance is approximately 620 feet to the southerly and northerly direction (required 620 ft). Some clearing of the trees might be required.
- Speed reduction: Effectively reducing the speed limit creates a more comfortable and safer environment for bicycling and pedestrians. Based on conversations with NYS DOT this might not be feasible.

AUTOMOBILE PARKING

1. The following existing parking areas are considered for improvement:

Washburn-Cornish parking area: on the east side of Route 9D, 630 feet north of the intersection of Morris Avenue (NY-9D) and Fair Street (CR-17), opposite from the Little Stony Point footbridge and at the Washburn and Cornish trail heads.

Presently is used as dirt surface parking area, 110 ft x 53 feet = 0.13 acre;

Little Stony Point parking area: on the west side of Route 9D, 630 feet north of the intersection of Morris Avenue (NY-9D) and Fair Street (CR-17), at the Little Stony Point Trail head.

Presently is used as asphalt/dirt parking area for approximately 4 vehicles to be parked perpendicular to the road.

Breakneck parking area: on the west side of Route 9D 960 feet north of the Breakneck Tunnel and 900 feet north of the Breakneck Ridge trailhead. Presently is used as gravel/asphalt parking area, 200 ft x 72 ft = 0.33 acre.

2. Parking Areas improvements would involve the following:

- a) It is feasible to expand Washburn-Cornish parking area to provide 45 spaces with 0.32-acre gravel surface.
Pavement design will require: excavation, providing compacted sub-grade and the addition of 6” of compacted road gravel.
- b) It is feasible to expand Little Stony Point parking area to 0.035-acre asphalt surface, to provide 9 regular or 5 handicap parking spaces.
Pavement design will require: minor excavation, providing 6” compacted Type I sub-base and the addition of a 2” asphalt concrete type 7 top course.
- c) It is feasible to improve Breakneck Point parking area by repaving with asphalt surface, and utilizing parking stripes or stalls. Thus, 43 parking spaces would be provided and paved area would remain the same as existing (no impervious surface increase).
- d) It is not recommended to relocate the entrance off 9D to the Washburn parking area more towards south, because of the site distance limitations.
- e) Washburn and Breakneck and Little Stony Point parking areas modifications will involve NYS Department of Transportation, Metro North RR (Metropolitan Transportation Authority), NYS Department of Parks and Recreation Coordination.

SIGNAGE

The following type of signage should be installed:

1. Installation of route signing and traffic calming signage:
 - a) For the trail user- stop signs, stop bar pavement markings, yield signs, caution signs or other devices should be used as applicable;

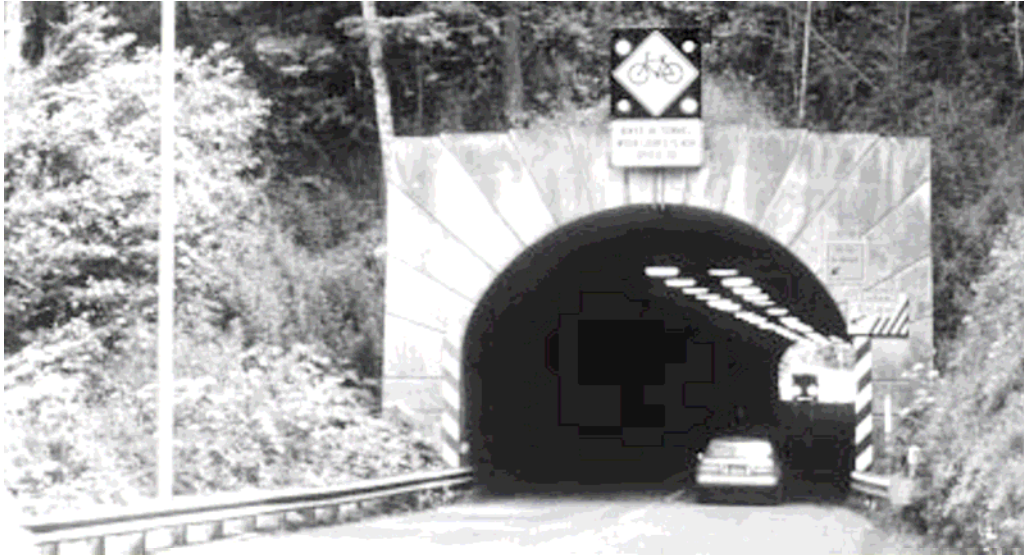


- b) For a roadway user, a clear message must be presented in a location, where that user will see it. Traditional treatments have included the bicycle crossing sign (WII-I), the pedestrian crossing sign (WIIA-2), the traditional pedestrian crosswalk lines, or "Zebra-style" colored pavement crosswalks; or flashing yellow lights at the crosswalk.



2. Parking at all the other trailheads and on the shoulders of the subject stretch of 9D should be prohibited by signage.

3. In the Breakneck tunnel high traffic volumes and speeds may intimidate people who want to bike or walk; Pedestrian/bicycle signals and illumination should be used.



TRAFFIC CALMING MEASURES

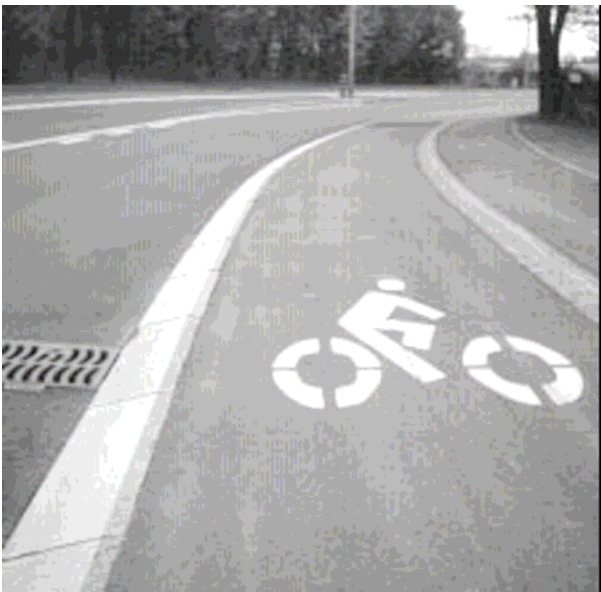
Traffic calming is a way to design streets/roads, using physical measures, to encourage people to drive more slowly. The design of the roadway results in the desired effect, without relying on compliance with traffic control devices such as signals, signs, and without enforcement. While elements such as landscaping and lighting do not force a change in driver behavior, they can provide the visual cues that encourage people to drive more slowly.

The following roadway treatments should be considered:

- Speed tables are road humps that are flat on top and are rounded mounds, approximately three inches high and 10 to 12 feet long. They effectively slow down traffic to 15-20 mph without making drivers uncomfortable. They are the same width as the street and rise to meet the grade of the sidewalk/trail, providing safe and comfortable crossings for walkers and wheelchairs. One benefit of speed tables is that people cross at the point where drivers decrease speed.
- Landscaping: the careful use of landscaping along a street can provide separation between motorists and bicyclist/pedestrians, reduce the visual width of the roadway (which can help to reduce vehicle speeds), and provide a more pleasant street environment for all. Although, due to the narrowness of the road this measure would be feasible only going north after the Brook Trailhead on one side of the road. The separation from motor vehicle traffic can reduce some maintenance requirements, such as sweeping the debris that accumulates on roads.
- Specific Paving Treatments (change in pavement color or/or texture).



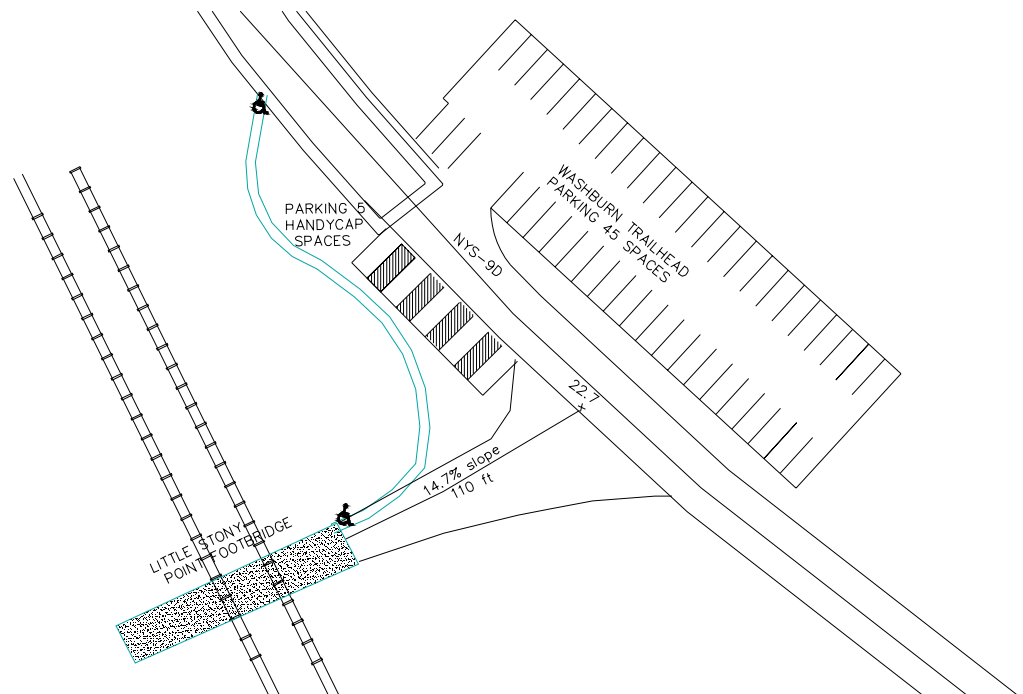
- Differentially raised bike lanes and pedestrian lanes offer multiple advantages; (a) the safety, convenience and lateral flexibility of riding on marginal portion of the roadway; (b) the psychologically separated, but kinetically permeable barrier, (c) a mountable curb allowing cyclists to enter or leave the lane as needed in order to avoid obstruction or surface irregularities in the bike lane or to overtake other bicycles or line-skaters; (d) motorists know they are straying from the travel lanes when they feel the slight bump created by the mountable curb; and (e) bicyclists are confined to the bike lane, leaving the higher and narrower sidewalk uniquely for pedestrians; (f) motorists cannot ignore the fact that they are obstruction a recreational path if they park on the shoulder.



WHEELCHAIR ACCESS

Modifications of the Little Stony Point entrance area and footbridge over the railroad tracks to conform to ADA standards for wheelchair access.

1. The following general requirements according to ADAAG (Americans with Disabilities Act Accessibility Guidelines):
 - a) **WIDTH:** ADA requires a minimum passage of 1 m (3 ft).
The Little Stony Point footbridge is 23.4' wide. The road leading to the bridge is approx 24' wide, restricted to just pedestrian access, that allow police and emergency vehicle access. Thus, existing road is adequate with regards to width requirement.
 - b) **GRADES:** The maximum grade of ramps and separated pathways is 5%. A maximum grade of 12:1(8.33%) is acceptable for a rise of no more than 0.75 m (2.5 ft) if a level landing at least 1.5 m (5 ft) long is provided at each end. The overall grade achieved by this design is 7.1%. It may be preferable to extend the ramp length to achieve a constant 5% grade.
110 feet road leading to the footbridge is sloping up at the approx 14.8% slope. In order to provide handicap access to the footbridge, a minimum 230-foot ramp at 7.1% would be required and it would require 10 feet of fill in some areas. See the picture below.



- c) **CROSS-SLOPE:** The maximum allowable cross-slope for a walkway is 2%. At driveways, curb cuts and road approaches (in crosswalks, marked or unmarked), a 1 m (3 ft) minimum wide area must be maintained at 2%.

2. Pavement design: 4 feet wide concrete or asphalt sidewalk with suitable slopes for wheelchair access need to be constructed leading to the footbridge.
3. The existing parking area at the 9D shoulder, adjacent to the entrance to Little Stony Point footbridge should be modified to accommodate handicap parking.
4. All modifications are a subject to right-of way acquisition and will involve coordination with NYS Department of Transportation, Metropolitan Transportation Authority (NYS RR) and NYS Department of Parks and Recreation.

CAPITAL COST

See Alternative A and Alternative B.

CONCLUSION

The current pedestrian/bicycle facilities at the roadway edge are inadequate, unsafe and need to be allocated sufficient space. Expanding the roadway will put them into MN RR right-of-ways and in conflict with other demands such as parking, utility poles and signs. The improvement to the bike/hike trail will attract more cyclists and pedestrians to use this trail. Therefore, the key components to successful trail include:

- Getting approvals from Metropolitan Transportation Authority to use MN RR right-of-ways;
- Incorporating in the design traffic calming measures; Well-designed road crossings, with measures such as bike and pedestrian activated signals, median refuges and warning signs for both motor vehicles and path users;
- Improving, expanding existing parking lots and prohibiting parking in other locations.
- Good design, by providing adequate width and sight distance, and avoiding problems such as poor drainage; and
- Proper maintenance, with regular sweeping and repairs. The separation from motor vehicle traffic can reduce some maintenance requirements, such as sweeping the debris that accumulates on roads.
- One more recommendation for pedestrian/bicyclist safety could be reduced speed limits and increased enforcement. Effectively reducing running (actual) speeds to less than 40 MPH creates a more comfortable environment for bicycling and pedestrians, although based on the conversations with NYS DOT it might not be feasible to expect. In any case, both alternatives (in particular alternative b) should be a subject of motor vehicle speed reduction at least through the tunnel passage.

Alternative (a) and (b) comparison:

Benefits associated with Alternative A (one 10 ft trail):

- Lower Cost (\$1,412,000 per mile for total of \$2.823 million);
- Greatest opportunity for "boardwalk" feeling (if wide enough for all users);
- Security/safety, especially passing through the tunnel.

Issues associated with having one path:

- Much greater frequency of conflicts between slow and fast moving users;
- A path wide enough for effective user separation may present disproportionately structural issues.

Benefits associated with Alternative B (two trails 5ft and 8 ft):

- Symmetry may have structural, aesthetic and construction advantages;
- Having two paths affords greater choice of views for path users;
- Redundancy — access is still available even if one path is closed.
- Most importantly, continuity of throughfare for bicyclists entering the HFB/HTCIFS corridor from the unimproved SR-9D roadway to the north or south, who under Alternative A would in most cases decline to dismount on the “wrong” side of the road, and instead simply remain as usual on the narrow unimproved shoulder on the right or “correct” side of the roadway.

Issues associated with having two trails:

- Higher Cost (\$1,669,000 per mile for total of \$3.337 million);
- 13 feet expansion of roadway will not be feasible from construction standpoint in some areas, for example passing through the tunnel; thus trail narrowing in some areas will be inevitable.

Based on our investigation we conclude that it is feasible to expand Washburn-Cornish, Little Stony Point and Breakneck Point parking areas and to install a crosswalk from the Washburn trailhead parking lot to the Little Stony Point trailhead, and at the Brook trailhead for the hike/bike trail to continue on the other side of the 9D.

Handicap access of Little Stony Point Bridge would be challenging from construction stand point, since the existing slope is too steep for wheelchair access as per ADA standards, thus, in order to make it wheelchair accessible the ramp will have to be constructed, which would have to be raised/sloped to 10 feet off the ground in some areas.