

MEMORANDUM**TO: MAGIC Files****August 12, 2003****FROM: Mary P. McShane****RE: Proposed Concord-Sudbury Bikeway****1. Introduction**

This memorandum summarizes data-gathering and analysis activities performed in support of the proposed Concord-Sudbury Bikeway project, a proposed re-use of an EOTC-owned railroad right-of-way. The section currently being examined extends from Route 2 west of the Concord Rotary in Concord, to Route 20 in Sudbury, a distance of approximately 8 miles.

The railroad right-of-way is a portion of the former Lowell Secondary line, which extended from Lowell to Framingham, and was in active rail use up until the early 1980s. After service was discontinued, the line was divided into two sections, to be developed separately as trails. The northerly section of the line, between Lowell and Westford, is about 7.5 miles in length. As of this writing, design on that section has been completed and it has been advertised for construction. Construction bids are currently scheduled to be opened on November 25, 2003. Progress on the section between Concord and Sudbury has lagged behind the northerly section until now.

The present memorandum represents a brief update of the Lowell-Sudbury Bicycle Path Feasibility Study of 1987, produced jointly by CTPS, the Metropolitan Area Planning Council, and the Northern Middlesex Area Commission, as it pertains to the section in Concord and Sudbury. The intent of the memorandum is to present current information on traffic volumes and the incidence of crashes on the roadways which intersect the right-of-way in the two towns.

2. Traffic Volumes

The CTPS traffic count database was searched to identify locations for which traffic count data are available on streets at or close to the point of intersection with the right-of-way. Most of the counts obtained were from the MassHighway database, including special counts and one permanent count station (on Route 2 east of the Rotary). A trail would be expected to experience peak activity on weekend days in non-winter months. Unfortunately, most of the traffic counts obtained had been conducted on weekdays, since weekday peak-hour conditions are typically the times of greatest traffic demands.

Hourly traffic demand on weekend days tends to be lower; but is frequently more continuous than weekday traffic, with high levels often extending throughout the afternoon hours. This is especially true in areas of high commercial activity, such as near shopping centers or in dense downtown areas. Only the Main Street area in West Concord Village and Route 20 in Sudbury near Sudbury Farms come close to this description within this corridor.

3. Crash Data

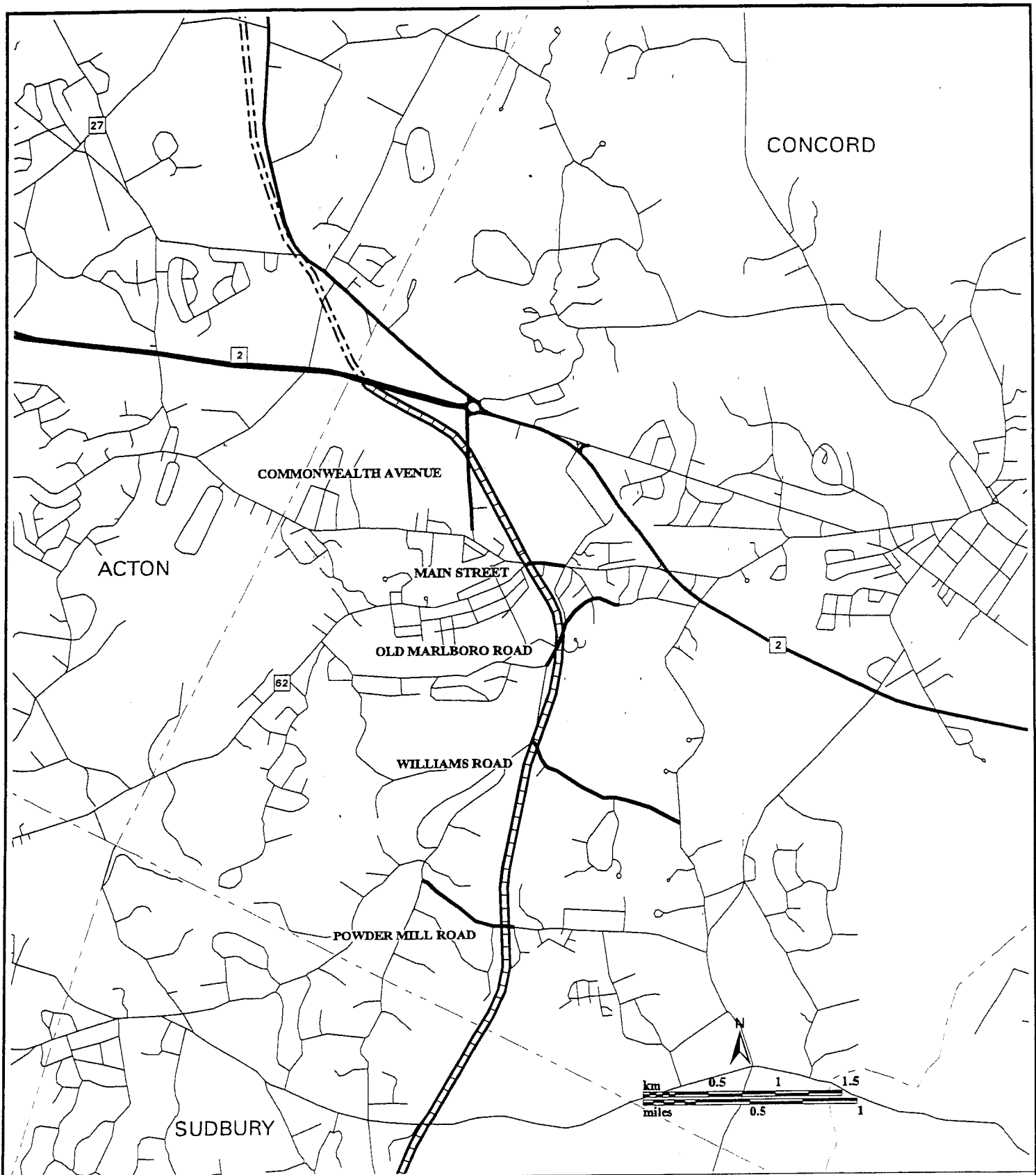
Information about the roadway crash history of roadway locations adjacent to the rail corridor was also obtained, from two sources:

- a. Massachusetts Registry of Motor Vehicles crash records: these records are based on reports filed by local police departments and persons involved in vehicle crashes. They provide useful summary information on types, times, and general conditions of crashes, although the format allows limited inferences to be drawn on the specific causes and contributing factors associated with individual accidents. These data were searched to identify all crashes reported on streets intersecting the right-of-way. The five latest years for which data are available (1995 through 1999) were included in the search. Summary information for each location is summarized as that location is discussed below.
- b. Police Department reports: these are the individual reports stored in local Police Departments. Each Department typically has its own filing system for storing and accessing these reports by location and/or date. The Concord Police Department was visited on March 28, 2003. Attempts to visit the Sudbury Police Department to perform similar crash data analysis were unsuccessful, but the Sudbury Traffic Safety Officer reviewed an earlier draft of this memorandum; his comments are appended. Review of the individual crash reports is desirable because these contain much more specific information on the circumstances surrounding each event; and allow more informed inferences to be made regarding the causes and potential remedies for particular locations.

4. Intersecting Streets

Figures 1 and 2 show the area of the right-of-way, and identify the intersecting streets, which are listed in **Table 1**.

Of these roadways, the one which represents the greatest obstacle is Route 2 in Concord, which is essentially a limited-access roadway in this section, with 2 lanes in each direction and 6- to 10-foot shoulders on the right side only. Because of its high volumes and high speeds, it is unlikely that Route 2 could be modified to incorporate an at-grade trail crossing. Therefore, it must be assumed *either* that the northern terminus of a north-south trail will stop short of Route 2; *or* that a solution involving grade separation can be incorporated into long-term plans for an upgrade to this section of Route 2.



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Framingham-Lowell Railroad ROW



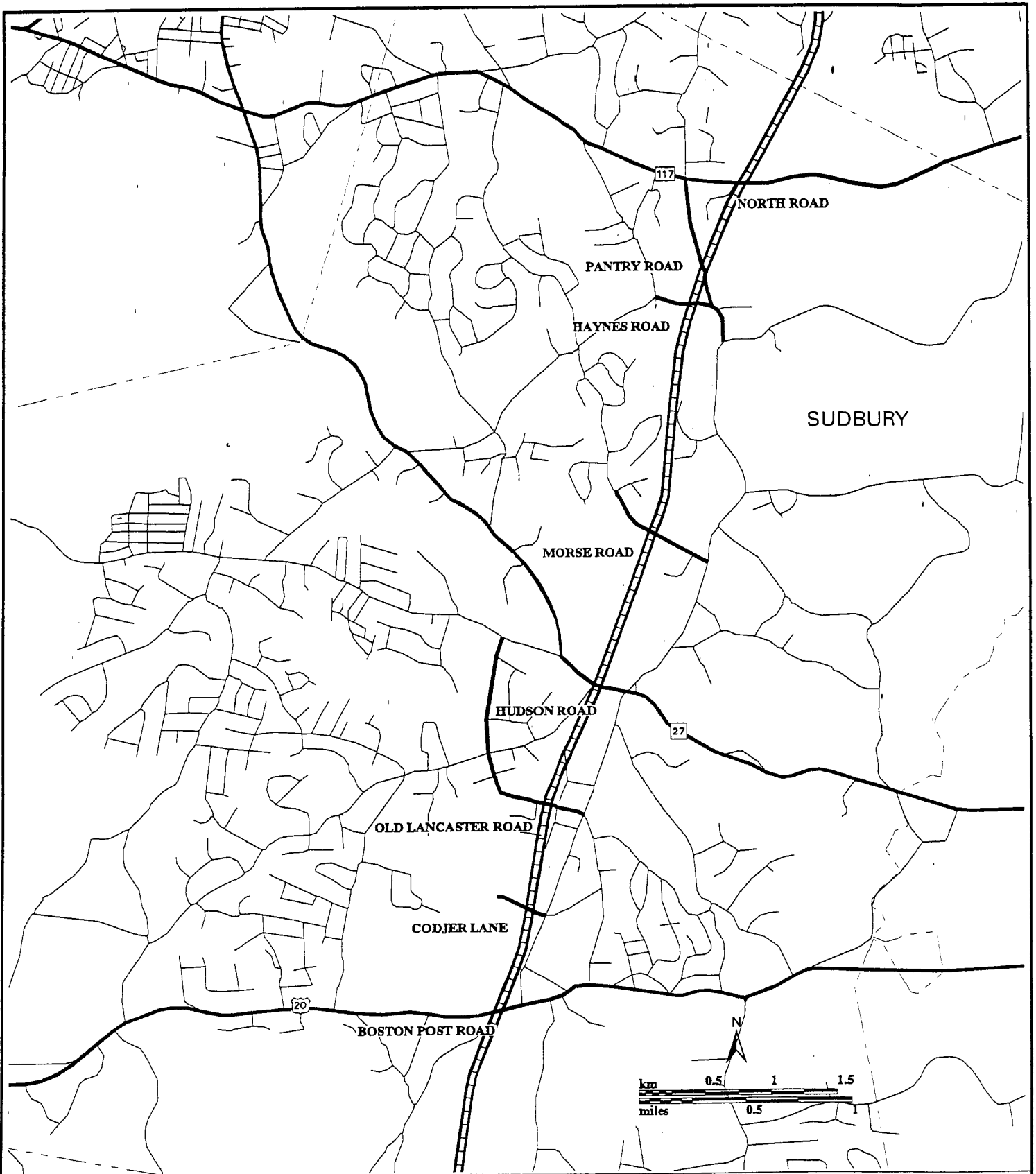
-  Concord-Sudbury portion
-  Other ROW segments

Figure 1
Framingham & Lowell ROW—
Intersecting Streets (Concord)



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Framingham-Lowell Railroad ROW
 ———— Concord-Sudbury portion
 ===== Other ROW segments

Figure 2
Framingham & Lowell ROW—
Intersecting Streets (Sudbury)

Route 20 in Sudbury is also a complicated crossing because of high volumes, traffic congestion and driveway activity, and a history of crashes. A traffic signal with a pedestrian button has recently been installed at Nobscot Road immediately adjacent to the crossing. This signal could easily be used by trail users, by deviating slightly from the right-of-way, using the sidewalks which already exist on both sides of Route 20.

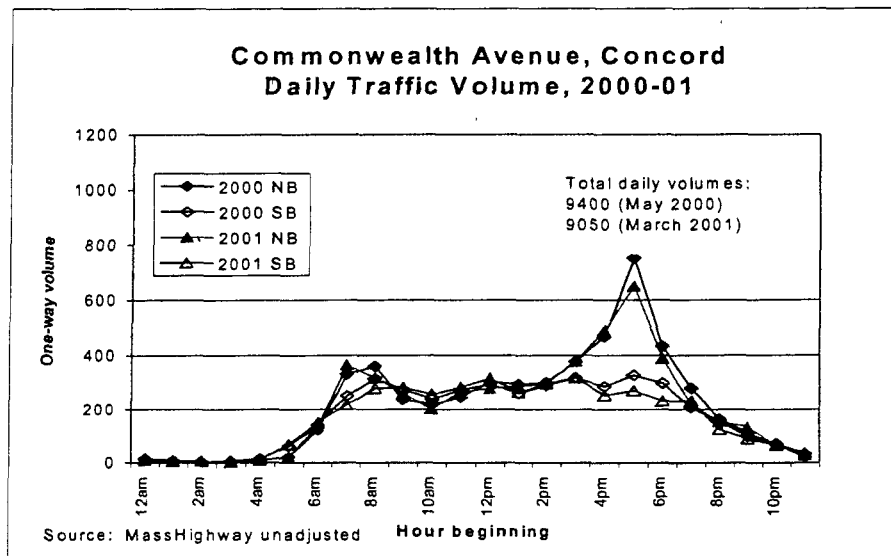
Table 1
Roadways Crossed by Concord-Sudbury Right-of-Way

	Administrative System (Jurisdiction)	Functional Classification	No. of Travel Lanes	Posted Speed Limit, mph
CONCORD				
Route 2	MassHighway	Urban extension of rural principal arterial	4	45
Common- wealth Ave	Town	Urban collector	2	30
Main St	Town	Urban extension of rural minor arterial	2	25
Old Marlboro Rd	Town	Urban collector	2	30
Williams Rd	Town	Local	2	30
Powder Mill Rd	Town	Local	2	20
SUDBURY				
North Rd	Town	Urban minor arterial	2	40
Pantry Rd	Town	Urban collector	2	30
Haynes Rd	Town	Urban collector	2	25
Morse Rd	Town	Local	2	25
Hudson Rd	Town	Other urban principal arterial	2	30
Old Lancaster Rd	Town	Urban collector	2	30
Codjer Lane	Town	Local	2	25
Boston Post Road (Route 20)	MassHighway	Urban extension of rural minor arterial	2	35

Between Route 2 and Route 20, other roadways which intersect the proposed trail are listed below.

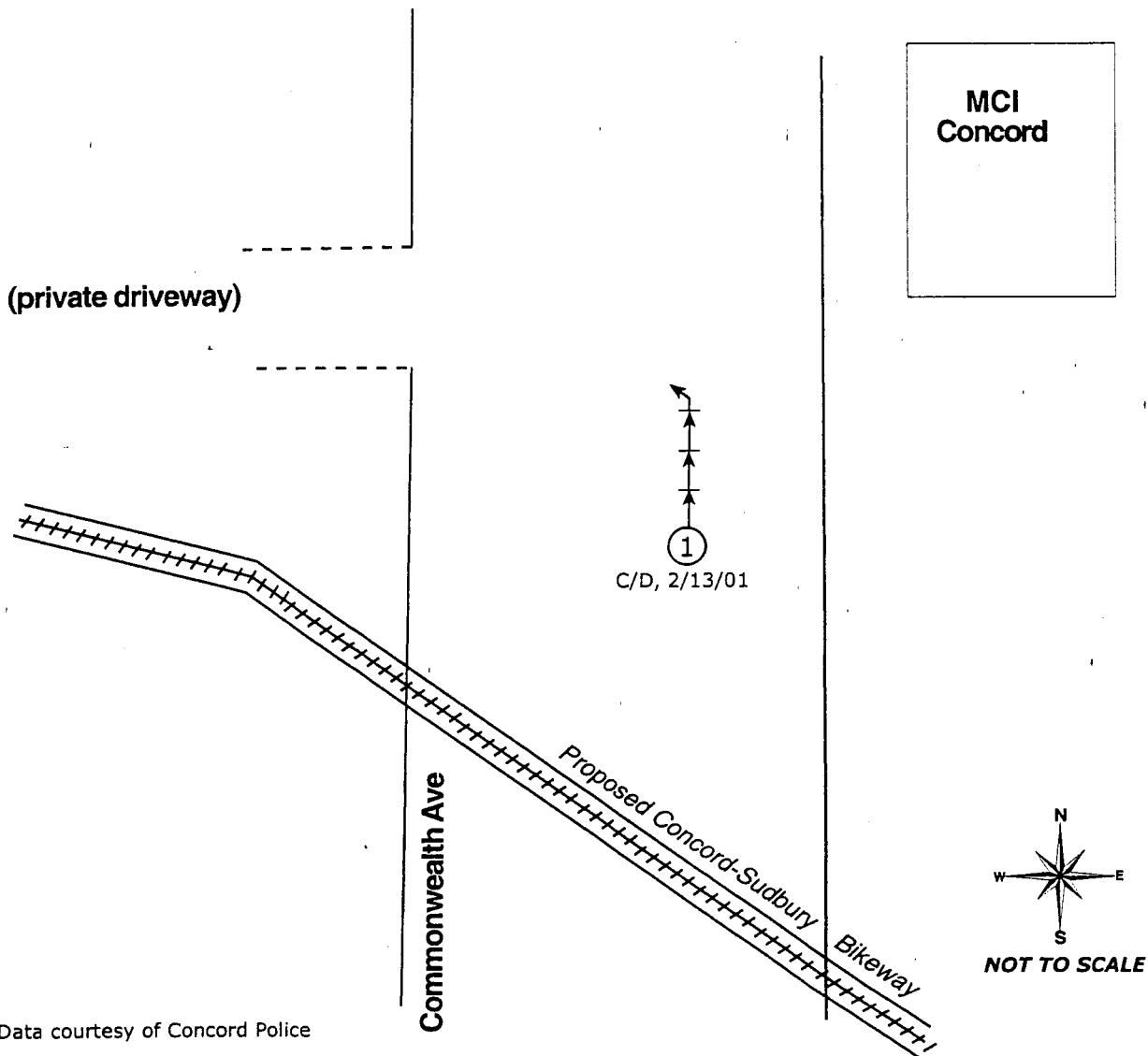
- a. Commonwealth Avenue, Concord. This street connects the Concord Rotary with the West Concord Village area. On the section north of Laws Brook Road, there are no shoulders and no defined on-street parking—residents park by straddling the edge of the travel lane and the slightly elevated sidewalk area. The travel lanes appear to be about 15 feet wide. The abutting land uses in this section are primarily single-family homes, as far north as the railroad right-of-way. Just northeast of the right-of-way, the street abuts the Massachusetts Correctional Facility, with parking and ancillary buildings on the northwest side of the street. The horizontal alignment of Commonwealth Avenue is tangent, with no curves; although the railroad right-of-way crosses at an angle, there are no obvious sight distance problems which might represent potential hazards to trail users. The only exception is the short cul-de-sac residential driveway abutting Warner's Pond and meeting Commonwealth Avenue at the railroad crossing, but this is not busy enough to represent an issue. There are no traffic signals between Laws Brook Road and the Rotary. The speed limit is 30 mph in this section.

Traffic volumes: MassHighway traffic counts were performed on Commonwealth Avenue, Concord in May 2000 and March 2001. The graph below illustrates the daily variations observed during these counts: high northbound volumes are noteworthy in the evening peak hour, with a slight morning peak in the same direction; at non-peak times, volumes are fairly steady, at about 300 vehicles per hour in each direction. The total daily volume in both directions is about 9,000-9,500 vehicles.



Crash data: Police data for this location identified only one accident over the three-year period 1999 to 2002, directly adjacent to the railroad right-of-way—a multiple-vehicle rear-end collision which occurred in 2001 (see Figure 3). The State Registry data can't easily be focused to consider only the immediate vicinity of the right-of-way.

Figure 3
Collision Diagram
Commonwealth Ave S of Rotary
Concord



SYMBOLS	TYPES OF COLLISIONS	ROAD SURFACE/LIGHTING
Moving Vehicle Backing Vehicle Pedestrian Parked Vehicle Injury Fatality Fixed Object Out of Control Number of Accidents	Head On Angle Rear End Sideswipe Broadside	C Dry, Clear W Wet S Snowy, Icy O Other D Daylight N Dark/No Lights L Dark/Lighted
		CTPS

However, *all* crashes occurring on this section of Commonwealth Avenue and *not* ascribed to a particular intersection were obtained from the database, and are summarized in **Table 2**. The street is approximately 3,100 feet in length, so many of these are probably located some distance away from the right-of-way.

Most crashes for which information is available involved turning or parking vehicles: either rear-end collisions when one vehicle had stopped to turn, or angle collisions between through and turning or parking vehicles. This suggests at least that ample warning signs be placed some distance in advance of a trail crossing in both directions; and possibly that additional control might be warranted here to accommodate trail users.

TABLE 2
Commonwealth Avenue, Concord
5-Year Vehicle Crash Summary

	Type of Crash				TOTAL
	Unknown	Rear-End	Angle	Head-on	
1995	3	5	4		12
1996	2	5	3		10
1997	2	1	6		9
1998	1	3	4	1	9
1999	1	3	4		8
TOTAL	9	17	21	1	48

- b. Main Street, Concord. The point where the right-of-way crosses Main Street is just east of the intersection of Main Street and Commonwealth Avenue, and about 50 feet west of the entrance to the West Concord Plaza shopping center. This is one of the busiest commercial locations in Concord, on both weekdays and weekends. Main Street through this area is narrow because two lanes are provided on the westbound approach to Commonwealth Avenue. There is no on-street parking in front of West Concord Plaza and the fire station, but Commonwealth Avenue west of the intersection has on-street metered parking on both sides of the street. There appears to be frequent turnover at these parking spaces. In addition, the presence in close succession of driveways serving the shopping center, the West Concord fire station, Westgate Park and other uses complicates operations in this short stretch of roadway. The intersection of Main Street and Commonwealth Avenue is signalized, with sidewalks and pedestrian crosswalks on all approaches; and pedestrian activity appears to be quite busy here.

At present, the former rail right-of-way is not marked on the street or within the area it traverses between the principal West Concord commuter rail lot and the south side of Main Street. However, its path can be followed: through the commuter rail lot, across the most easterly pedestrian crossing of the commuter rail track, through the small park area between the Club Car Café and the Shopping Plaza parking lot, across Main Street

at the cross-walk, and in between the Exxon station and the Hamwey & Sons carpet store on the south side of Main Street. The traffic light at the Commonwealth Avenue/Main Street intersection is already equipped with a pedestrian call button, so that only minimal additional traffic control would be required.

Traffic volumes: There are no traffic counts in existing databases for this location.

Crash data: Figure 4 displays the results of analysis of data obtained from Concord Police records for this location. As the diagram makes clear, there is a great deal of activity in this location, offering many opportunities for vehicle conflicts with pedestrians, cyclists, and other vehicles. The single location where many of these conflicts occur is at the entrance to the West Concord Plaza. At this location, a total of eight incidents were recorded in police files over a 3-year period, including one collision between a vehicle exiting the Plaza driveway and a cyclist traveling the wrong way on Main Street. West of this location, about where the right-of-way crosses Main Street almost within the intersection with Commonwealth, there are fewer incidents; and those that were recorded appeared to involve rear-end collisions at the traffic signal.

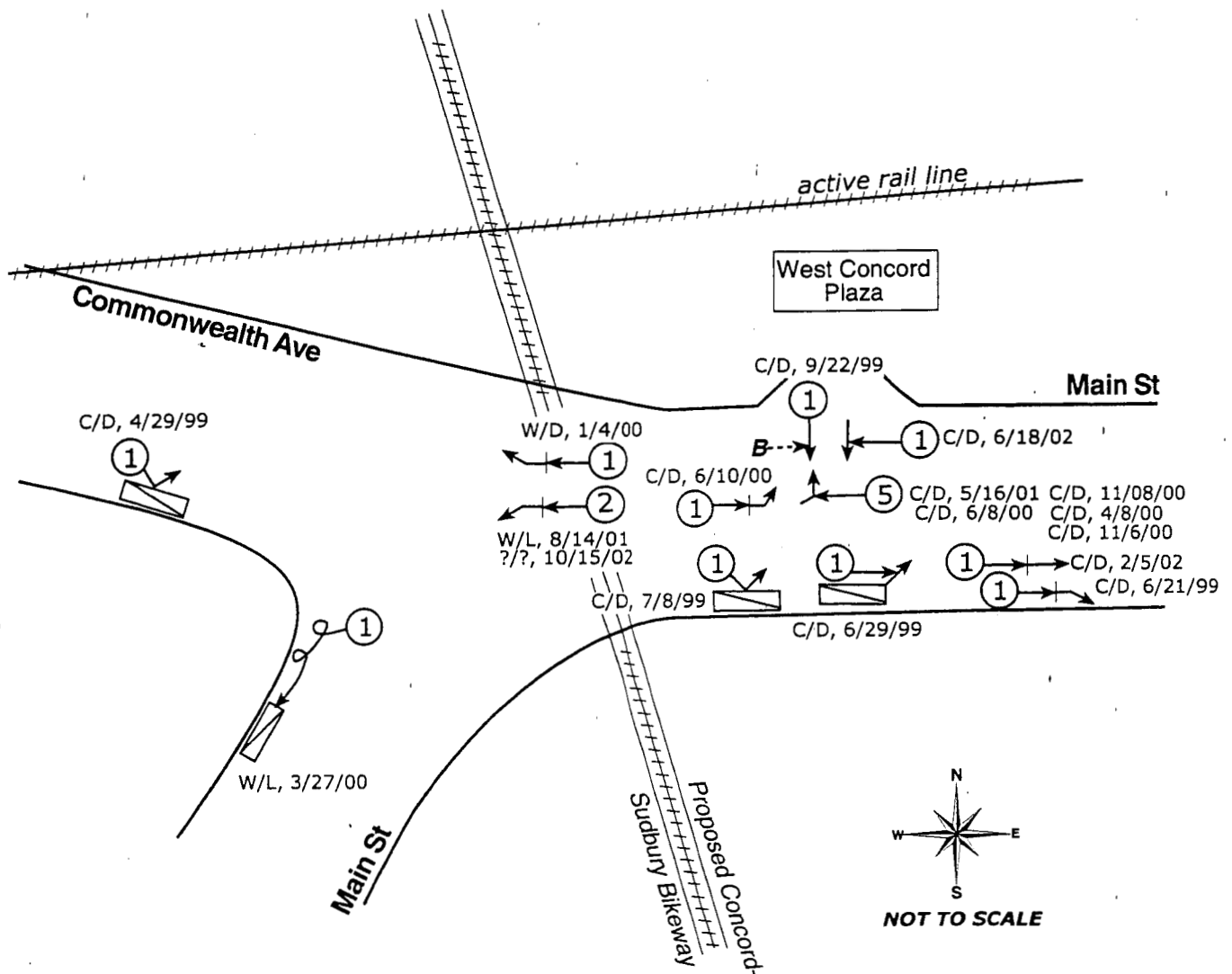
Data were also obtained from the State Crash database for the years 1995 through 1999 for the intersection of Commonwealth Avenue and Main Street, and for the entrance to the West Concord Plaza. As discussed above, these data are more difficult to pinpoint to exact locations and causes than are the police forms. However, they do provide an overview of the kinds and severity of crashes in the vicinity. Table 3 summarizes the findings of that data review.

TABLE 3
Commonwealth Avenue at Main Street, Concord
5-Year Vehicle Crash Summary

	Type of Crash				TOTAL
	Unknown	Rear-End	Angle	Head-on	
1995		2	2	1	5
1996	1	1			2
1997		3	4	1	8
1998	1	5	7		13
1999	2	7	6		15
TOTAL	4	18	19	2	43

- c. Of the 43 incidents in the database, seven involved collisions with parked vehicles, one involved a pedestrian, and one a bicycle (as mentioned above). Eight occurred on wet

Figure 4
Collision Diagram
Main St at Commonwealth Ave
(West Concord)



Data courtesy of Concord Police

B--> = bicycle, riding against traffic

SYMBOLS	TYPES OF COLLISIONS	ROAD SURFACE/LIGHTING
<p>← Moving Vehicle</p> <p>←>>> Backing Vehicle</p> <p>- - - - - Pedestrian</p> <p>▢ Parked Vehicle</p> <p>● Injury</p> <p>● Fatality</p> <p>□ Fixed Object</p> <p>ll Out of Control</p> <p># Number of Accidents</p>	<p>↔ Head On</p> <p>↘ Angle</p> <p>← Rear End</p> <p>↗ Sideswipe</p> <p>⊥ Broadside</p>	<p>C Dry, Clear</p> <p>W Wet</p> <p>S Snowy, Icy</p> <p>O Other</p> <p>D Daylight</p> <p>N Dark/No Lights</p> <p>L Dark/Lighted</p>
		CTPS

roadway surface, so that they may have involved skidding. In this busy area, with heavily-used on-street parking, frequent pedestrian activity, and no room to alter the roadway profile, there is little that can be done to reduce such conflicts.

Old Marlboro Road, Concord. The right-of-way crosses Old Marlboro Road on a sharp angle at a point just south of the road's intersection with Cottage Street. The crossing is adjacent to the driveway of South Meadow Ridge, a residential development located on the crest of a hill, with a long driveway connecting to Old Marlboro Road. On the south side of the road, the right-of-way skirts the base of the hill and continues southward across a private unpaved road that appears to provide access to the Concord Country Club. Old Marlboro Road in this area is a 2-lane suburban arterial street, with narrow shoulders, no parking, and relatively few intersecting streets. There are intermittent sidewalks on the west side of Old Marlboro Road as far south as Harrington Road. The street has horizontal curves both north and south of the crossing. This fact, combined with the density of vegetation and the gradual upward slope of the terrain from north to south, suggests that ensuring adequate sight distance for oncoming vehicles would be a primary objective in the design of a future trail crossing here. Old Marlboro Road is posted for 35 mph speeds south of Harrington Road, and 25 mph near Cottage Road.

Traffic volumes: There are no traffic counts in existing databases for this location.

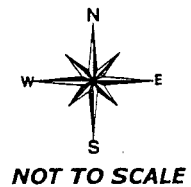
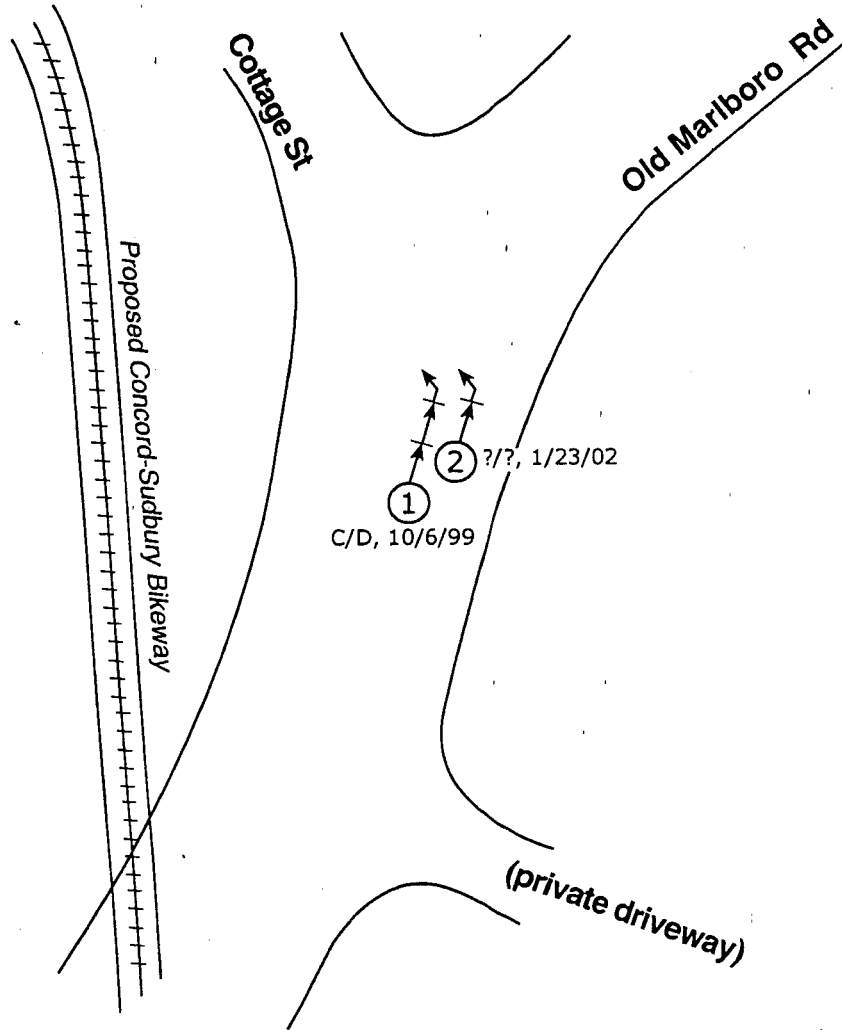
Crash data: Police records for this location showed a total of three crashes in this area during the period 1999 through 2002 (**Figure 5**). All three were rear-end collisions in which vehicles waiting to turn left onto Cottage Street were struck from behind by through vehicles; one such rear-end crash involved three vehicles. The most likely factors associated with these collisions were high speeds and limited sight distance because of the roadway curve. There is a "Blind Driveway" warning sign facing northbound Old Marlboro Road drivers just before Cottage Road. While three crashes in a period of 3 years do not in themselves present a major safety issue, the types of crashes suggest the desirability of paying attention to both roadway speeds and sight distance in design of a trail crossing.

The RMV database does not list any incidents at this location for the years 1995 through 1999.

- d. Williams Road, Concord. The right-of-way crosses Williams Road just south of its intersection with Old Marlboro Road, and just north of the intersection of Williams Road and the driveway of a private residence. The horizontal curvature of Old Marlboro Road is considerably more pronounced at this location than is the curvature farther north at South Meadow Ridge, but this should represent less of an issue for trail users making the crossing at Williams Road. The Williams Road approach to Old Marlboro Road is not striped or marked—there is no stop line on Williams Road, for example, although there is a stop sign.¹ This is an issue on a minor suburban roadway only because Old Marlboro Road is sharply curved at this point. Williams Road itself is a residential

¹ Old Marlboro Road in this area has recently been repaved, and it may be intended to add pavement markings in the area of Williams Road.

Figure 5
Collision Diagram
Old Marlborough Rd at Cottage St,
Concord



Data courtesy of Concord Police

SYMBOLS	TYPES OF COLLISIONS	ROAD SURFACE/LIGHTING
Moving Vehicle Backing Vehicle Pedestrian Parked Vehicle Injury Fatality Fixed Object Out of Control Number of Accidents	Head On Angle Rear End Sideswipe Broadside	C Dry, Clear W Wet S Snowy, Icy O Other D Daylight N Dark/No Lights L Dark/Lighted
		CTPS

collector street which connects the arterial streets Old Marlboro Road and Old Road to Nine Acre Corner (ORNAC). Both Old Marlboro Road and Williams Road in this area are posted for 30 mph speeds. The area Williams Road traverses is of low density, so that traffic volumes are low. There are several golf courses in the area, including the Concord Country Club, so that weekend traffic on Williams Road may be similar to that on weekdays.

Traffic volumes: No traffic count data exist for the Old Marlboro Road/Williams Road intersection, or for Williams Road itself. However, for reasons mentioned above, it is unlikely that volume on Williams Road exceeds three or four thousand vehicles per day, typical of suburban collector streets.

Crash data: A total of three crashes were recorded by the Concord Police at this location between 1999 and 2002 (**Figure 6**). All three involved single vehicles going out of control on the curve of Old Marlboro Road. While the crashes didn't directly involve Williams Road or the proposed trail alignment, they signal the existence of speed and sight distance issues on Old Marlboro Road. Because the Williams Road approach essentially flows into Old Marlboro with little channelization or definition, these issues also affect this approach.

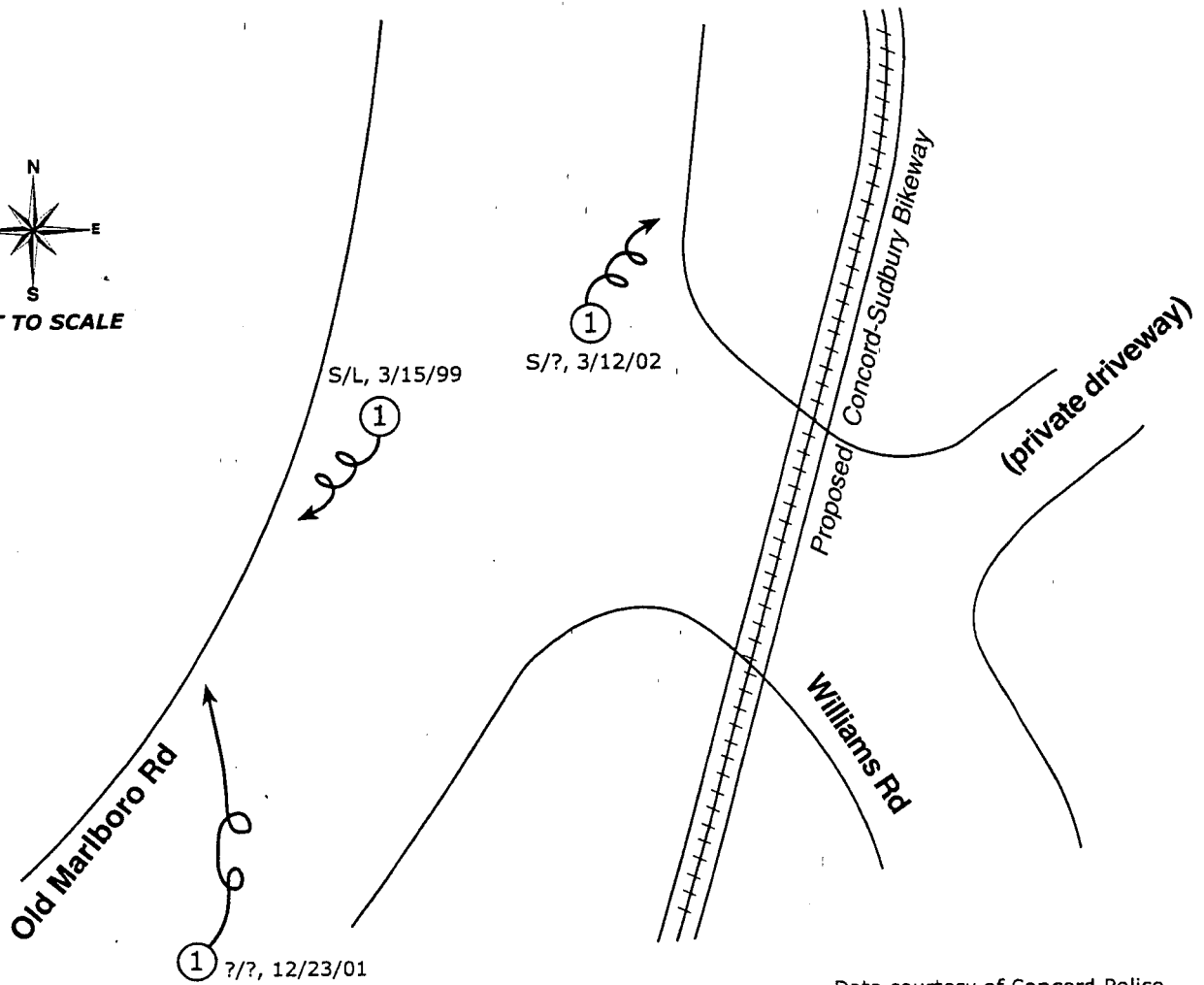
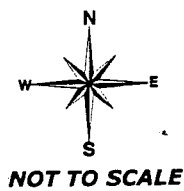
The RMV data show a total of 5 crashes at this location over the period 1995 through 1999. Of these, two involved multiple vehicles, while the other two involved single vehicles losing control and hitting trees or curbing. Two of these collisions happened at dusk or after dark, while two occurred on wet pavement. **Table 4** summarizes the crash types at this location.

TABLE 4
Old Marlboro Road at Williams Road, Concord
5-Year Vehicle Crash Summary

	Type of Crash				TOTAL
	Unknown	Rear-End	Angle	Head-on	
1995			1	1	2
1996	1				1
1999			1	1	2
TOTAL	1		2	2	5

- e. Powder Mill Road, Concord. This location is not an at-grade crossing: Powder Mill Road crosses over the right-of-way on a bridge. Two short residential streets flank the right-of-way on the south side of the road: Mitchell Road/White Avenue and Stone Root Lane. It is not clear if access to the trail could be provided at this location; it may be easier to do this via Plainfield and Dover Roads and the town-owned land south of White

Figure 6
Collision Diagram
Old Marlborough Rd at Williams St
Concord



Data courtesy of Concord Police

SYMBOLS	TYPES OF COLLISIONS	ROAD SURFACE/LIGHTING
Moving Vehicle Backing Vehicle Pedestrian Parked Vehicle Injury Fatality Fixed Object Out of Control Number of Accidents	Head On Angle Rear End Sideswipe Broadside	C Dry, Clear W Wet S Snowy, Icy O Other D Daylight N Dark/No Lights L Dark/Lighted
		CTPS

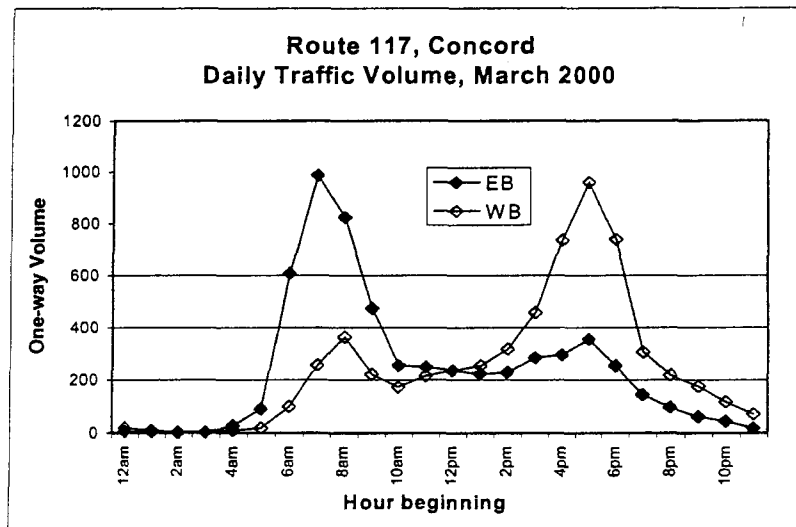
Pond. Powder Mill Road itself is a narrow, primarily residential street with no shoulders, posted for 30 mph along most of its length, except near the bridge over the railroad right-of-way (20 mph). It has no sidewalks west of the bridge, but a sidewalk exists across the bridge on the north side and beyond. Like Williams Road, it carries limited traffic, principally providing access for local residences and schools, as well as access to White Pond.

Traffic volumes: There are no traffic counts in existing databases for this location.

Crash data: No records of crashes on Powder Mill Road were found either in the Concord Police files or in the RMV database.

- f. North Road, Sudbury. The most northerly crossing in Sudbury is of North Road, which is Route 117. Route 117 is a town-owned roadway which serves as an important east-west arterial serving towns in this area. It has no shoulders or sidewalks, and there are trees and telephone poles very close to the paved way, with sloping terrain on both sides of the roadway. The speed limit on Route 117 at this location is 40 mph. A private road has been constructed immediately adjacent to the right-of-way north of North Road; it crosses the track, which is still partly in place, approximately 1,200 feet north of North Road, to provide access to land owned by the "Fairview Development Corporation." On the southern side of the road, the right-of-way again traverses wooded areas (the Davis Farm conservation land) as far as the next intersection.

Traffic volumes: There are no counts available to us for Route 117 in Sudbury; but a MassHighway count location on Route 117 in Concord over the Sudbury River is approximately 2 miles east of the railroad right-of-way crossing. Volumes here are likely to be similar to those at the more westerly location, or possibly a bit higher. The graph below illustrates the strongly directional nature of traffic volumes on Route 117: almost 80 percent of the volume in the morning peak hour is headed eastward, while 74 percent of the evening peak hour volume is traveling west. It also illustrates that this is



predominantly a commuter route: traffic volumes fall to relatively low levels outside of peak commuting hour, and the daily peak hour (5:00 to 6:00 pm) represents 11 percent of total daily volume.² The total daily volume is about 11,700 at the Concord location.

As mentioned above, weekend traffic count data is particularly difficult to find in existing sources. However, the ATR count performed by MassHighway at the Route 117 Concord location included a Saturday morning. That partial-day count appeared to exhibit the same tendency toward a short, sharp AM eastbound peak hour as did weekday traffic, with an hourly volume of 1,000+ vehicles recorded in the eastbound direction. Whether this was an anomaly, or represented typical Saturday morning conditions, is unknown. Also, no afternoon data exists, so it is not clear that the high westbound PM peak hour traffic phenomenon also repeats on Saturdays at this location.

Crash data: Because no crash records could be tied to the location on North Road where the proposed trail crosses, RMV data were queried to identify records on North Road for which no cross-street was identified. This obviously over-represents the likely experience of incidents in the vicinity of the crossing, but may give a sense of how many and what kinds of vehicle crashes typically occur on the road. In addition, the intersection of North Road with nearby Pantry Road was also queried.

Of the 33 incidents recorded on North Road itself between 1995 and 1999, 15 involved collisions between motor vehicles in transit. Most of the remainder, however, were collisions with fixed objects adjacent to the road, or represented vehicles which simply went off the road or overturned. It is possible that high speeds were associated with some portion of these latter incidents, particularly because over one-third of them involved injuries in addition to property damage. In addition, about one-third of the incidents occurred in wet or snowy weather, suggesting that skidding may have contributed to the damage. The narrowness of the pavement and the lack of horizontal clearance on both sides of the roadway are undoubtedly also contributing factors.

At the intersection of North and Pantry Roads, two of the 20 incidents recorded were rear-end collisions; the remainder were all angle collisions between motor vehicles. None involved pedestrians or cyclists. Vehicles involved in these incidents typically were turning right or left, were stopped at stop signs or starting up after having stopped. Without further information on sight distances and traffic control, it is difficult to establish likely contributing factors to these incidents; but high speeds are probably involved in some or all of them. About half appear to involve vehicles heading in the eastward direction, impacting vehicles heading northward or westward. Here too, wet roadway conditions appear to have contributed to about one-third of the reported crashes.

- g. Pantry Road and Haynes Road, Sudbury. These are two crossings located within 500 feet of each other. Both streets are 2-lane suburban streets: Pantry Road in Sudbury is

² This compares with typical peak-hour factors between 5 and 8 percent on roadways with more constant traffic flows throughout the day. Such roads usually have schools, shopping areas, and other activities which tend to generate traffic at non-peak hours.

the extension of Old Marlboro Road in Concord, and shares the characteristics of that roadway: no sidewalks, no or narrow shoulders, with trees and telephone poles very close to the paved way. Haynes Road is a short residential street which also provides access to the Haynes Elementary School. The posted speed limits on the two streets are 30 and 25 mph. Neither street appears to present problems for future crossings of a trail.

Traffic volumes: There are no traffic counts in existing databases for these locations.

Crash data: The RMV database was queried to obtain crashes on Pantry Road, on Haynes Road, and at the intersection of Pantry and Haynes. No particular geometry or operational problems could be identified from the additional information regarding these incidents (i.e., weather, speed, geometry or other issues). **Table 5** summarizes the crash incidence for these locations. Note again that the data for Pantry Road and Haynes Road represent any locations along either street where no cross-street or landmark was identified—they do not represent just the crossing area itself.

TABLE 5
Pantry Road/Haynes Road Area, Sudbury
5-Year Vehicle Crash Summary (1995-1999)

	Type of Crash				TOTAL
	Unknown	Rear-End	Angle	Head-on	
Pantry Rd	5		3	1	9
Haynes Rd	7		1	1	9
Intersection of Pantry at Haynes	2	5	1	3	11
TOTAL	14	5	5	5	29

- h. **Morse Road.** Like Haynes Road, Morse Road is a short street with no sidewalks or shoulders, essentially providing access to local residents. Because of the proximity of the General Nixon School, as well as the Lincoln-Sudbury High School and Great Meadows National Wildlife Refuge, all on the east side of Concord Road, this location may become an important point of access to a future trail.

Traffic volumes: There are no traffic counts in existing databases for this location. Because of the nature of the road, it is anticipated that volumes will be typical of those for residential collector roadways, not exceeding about 6 to 8 thousand vehicles per day.

Crash data: Because the grade crossing is located somewhat away from the intersection with Concord Road, only crashes listed as occurring on Morse Road with no cross-street

were tabulated. As with other such tabulations, the data thus obtained represent the entirety of Morse Road, not just the crossing location. The crashes reported during the 5-year period were all angle crashes, and a large number of them (11 out of 20) involved single vehicles which ran off the road, hitting a fixed object. This is most likely attributable to the sharp curves which occur at several points on the road, including a reverse curve which begins just west of the grade crossing. As with locations in Concord, sight distance is likely to be an issue here. A future at-grade trail crossing will need to be provided with advance signing, particularly for eastbound vehicles in the vicinity of Hilltop Road. Table 6 summarizes the crash data for this location.

TABLE 6
Morse Road, Sudbury
5-Year Vehicle Crash Summary (1995-1999)

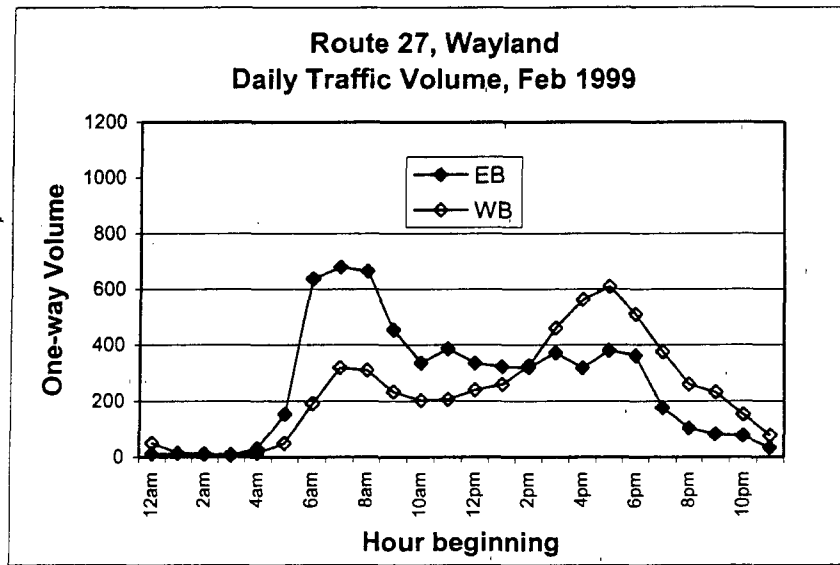
	Type of Crash				TOTAL
	Unknown	Rear-End	Angle	Head-on	
1995	2		1		3
1996	3		2		5
1997			1		1
1998	3		1		4
1999	5		2		7
TOTAL	13		7		20

- i. Hudson Road. Hudson Road is Route 27, a major arterial street connecting Sudbury and Wayland with Route 20 and the regional road network. Hudson Road has 2 lanes, narrow shoulders, and is posted at 30 mph near the crossing. There are limited sidewalks only on the south side. The railroad right-of-way crosses Hudson Road immediately east of the intersection of Route 27 and Peakham Road, adjacent to the exit driveway from a small retail area (Village Green Shops). It is also about 1,000 feet west of the Hudson Road/Concord Road signalized intersection, where the Sudbury Town Hall is located. The principal issues associated with a crossing at Hudson Road are likely to be traffic speeds on Hudson Road and the avoidance of conflicts with vehicles turning right from Peakham Road or exiting the shopping center. This is another location where it might be worth investigating deviating from the right-of-way. Consolidating trail user movements into traffic movements from the Village Green driveway or Peakham Road, would minimize the number of adjacent crossing points on Hudson Road and allow for safer operation.

Traffic volumes: There are no traffic counts on Route 27 in Sudbury or Maynard. The closest count is north of Route 126 in Wayland. Volumes on Route 27 fluctuate a great deal depending on location and the presence of feeder routes. The location north of Route 126 in Wayland (Average 1999 Daily Traffic volume: 11,600) is likely to be more representative of conditions in Sudbury than are other count locations south of

Route 126 (Average 1999 Daily Traffic volume: 25,000), or south of Route 20 (Average 1999 Daily Traffic volume: 16,400).

The graph below shows the daily fluctuation in weekday traffic volumes at the Wayland location. Route 27 at this location serves commuter traffic which creates noticeable peaks in the morning (eastbound direction) and evening (westbound direction). This is also true of the crossing location in Sudbury. Beyond the commuter peaks, volumes in each direction did not exceed 400 vehicles per hour in 1999.

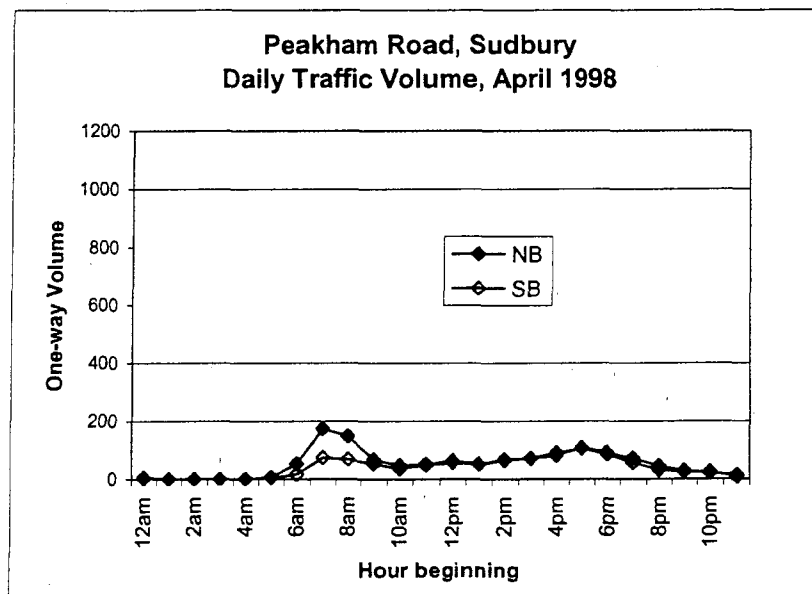


Crash data: There are no crashes listed in the database for Hudson Road, except at the intersection with Old Lancaster Road, an unsignalized intersection about 1 mile west of the crossing. At Old Lancaster Road, 12 incidents were recorded during the 5-year period examined, of which 5 were rear-end collisions; the remainder were angle collisions. Almost all incidents involved two motor vehicles, and no pedestrians or cyclists were involved in any of them.

- j. Old Lancaster Road. Old Lancaster Road is primarily a residential street with no sidewalks or shoulders, which connects Union Avenue/Concord Road with Hudson Road. Posted speed limit on the street is 30 mph. The railroad right-of-way crosses Old Lancaster Road approximately 1,000 feet west of Union Avenue/Concord Road, close to several homes and sheltered on both sides by trees. The horizontal alignment of Old Lancaster Road in this area is fairly straight, so that sight distance should not be a major issue here as long as the crossing is properly signed. Old Lancaster Road does have a sharp horizontal curve about 1,000 feet west of the crossing, in the vicinity of the Town Engineering Department; in addition, Old Lancaster Road is not aligned as a through street at its intersection with Union Avenue/Concord Road. West of the crossing and the curve, Old Lancaster Road meets Peakham Road in a 4-way stop-sign-controlled intersection which has limited sight distance.

Traffic volumes: No traffic count data is available for Old Lancaster Road. However MassHighway has a count location on Peakham Road north of Austin Road, where conditions are similar to those on Old Lancaster Road. The Peakham Road location was counted in 1998 (Average Daily Traffic: 2,100) and 2001 (Average Daily Traffic: 1,500). The graph below shows the daily fluctuation in the 1998 volume: volumes stay below 200 vehicles per hour in each direction for most of the day at this location. This is most likely true of Old Lancaster Road as well.

Crash data: As discussed above, Old Lancaster Road in the immediate area of the right-of-way crossing does not have sharp curves, and the view of the right-of-way is not completely obscured by trees. Consequently, use of the right-of-way as a trail should not generate safety concerns, as long as the approach is adequately signed.



Review of the RMV crash database for Old Lancaster Road did unearth a total of 47 crash incidents over the 5-year period; however, almost all of these occurred at nearby intersections, with few, if any, located near the grade crossing.³ Table 7 presents the total numbers of crash incidents at different locations on Old Lancaster Road.

- k. Codjer Lane. At one time, Codjer Lane was reportedly a through street connecting with Horse Pond Road. In recent years, however, the portion west of the right-of-way has served effectively as a driveway for the Cavicchio Greenhouse property, while the remainder of the street provides residential access for a small number of houses.

³ For reasons discussed above, it is impossible to say definitively that there were no crashes near the crossing, because RMV data typically do not provide precise enough location identifiers away from intersections and easily-identifiable and citable land uses. However, the number of crashes reported at *any* location on Old Lancaster Road away from intersections is not high.

Consequently, there is no through traffic on the street. Traffic volumes and safety will not be major concerns at this location.

Traffic volumes: There are no traffic counts in existing databases for this location.

TABLE 7
Old Lancaster Road, Sudbury
5-Year Vehicle Crash Summary
at All Reported Locations

	Type of Crash				TOTAL
	Unknown	Rear-End	Angle	Head-on	
Old Lancaster/Colonial Rd	1	0	0	0	1
Old Lancaster/Concord Rd	0	5	6	0	11
Old Lancaster/Goodmans Hill Rd	2	0	0	0	2
Old Lancaster/Hudson Rd	2	5	5	0	12
Old Lancaster/Meadow Dr	1	0	1	0	2
Old Lancaster/Peakham Rd	1	0	3	0	4
Old Lancaster/Pokonoket Rd	1	0	0	0	1
Old Lancaster/Winsor Rd	1	0	0	0	1
Old Lancaster (no cross st.)	9	0	2	2	13

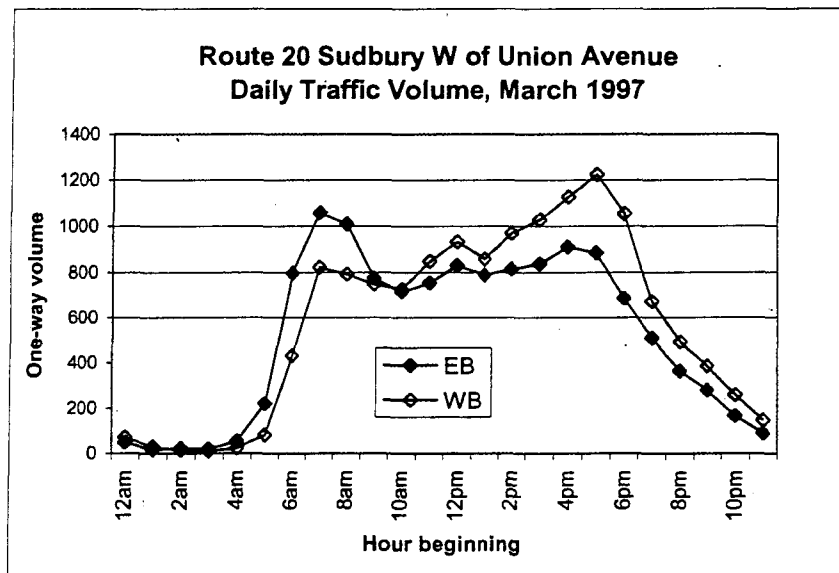
Crash data: The only crash records which appear in the RMV database for Codjer Lane are at its intersections with Union Avenue (a total of 9 reported) and Concord Road (1 reported). Of the Union Avenue crashes, 3 were rear-end collisions and 1 was an angle collision; the rest were not identified. These intersection accidents are most likely associated with limited sight distance from Codjer Lane onto Union Avenue, and relatively high speeds on Union Avenue.

1. Route 20. Route 20 is a major arterial, one lane in each direction in Sudbury, which provides access to the regional roadway network for Sudbury and adjoining towns. The railroad right-of-way crosses Route 20 immediately east of the newly-signalized intersection with Nobscot Road, and just west of the driveway/entrance area of a shopping center on the south side of Route 20 (Sudbury Farms/Friendly's). This location has high traffic volumes and conflicting traffic movements associated with its proximity to both the busy intersection with Nobscot Road and the numerous driveways in the area. These include, in addition to Sudbury Farms/Friendly's, a house and garden store which is included in the new traffic signal, a drive-through bank window, a gas station, and several other uses. Nobscot Road has been realigned to create a T intersection with Route 20, and the Route 20 approaches include turning lanes in both directions. The railroad crossing has a rubberized surface, and cuts across the 3-lane cross-section of Route 20 on the westbound approach.

The Nobscot Road signal is one of 3 traffic signals within one-half mile along Route 20; it was designed to be coordinated with the signal replaced at Route 20 and Union Avenue. The new traffic signal at Nobscot includes pedestrian buttons, and there are new sidewalks on Route 20 on both sides, as well as on Nobscot Road. The preferred way for trail users to cross Route 20 would be to deviate slightly from the railroad right-of-way on the existing sidewalks, and to use the new pedestrian crossing. This may be costly in terms of intersection operations (i.e., reducing Level of Service for vehicles), but will probably be the safest way to operate.

Just north of the Route 20 crossing, the Concord-Sudbury right-of-way crosses the MBTA-owned Central Massachusetts (Mass.) railroad right-of-way, which has also been proposed for use as a trail. CTPS completed a trail feasibility study of the Central Mass. right-of-way in April 1997.

Traffic volumes: Traffic counts were performed on Route 20 in conjunction with the Functional Design Report for the installation of new signals at Nobscot Road and Union Avenue. At this location, the Average Daily Traffic (1997) was 26,400 vehicles. The graph below shows the hourly distribution of volumes at this location. As the diagram suggests, Route 20 experiences high volumes in this location relative to its capacity for a large portion of the day, not just at peak hours. This suggests the importance of Route 20 as a major arterial for general traffic, not just commuter traffic. In addition, because the right-of-way crossing is close to the Sudbury Farms shopping area and Friendly's Restaurant, it is likely that Saturday and Sunday volumes will exhibit the same sort of pattern, with chronically high traffic volumes throughout the daytime.



Crash data: A total of 58 crashes were recorded at the intersection of Route 20 and Nobscot Road in the period 1995 through 1999. Of these, 36 were angle crashes, and 16 were rear-end collisions. The traffic signal installed since that time should help to

reduce the number of such incidents; however, data are not yet available on conditions since the signal was installed.

APPENDIX

Memorandum on Review by
Sudbury Traffic Safety Officer

TELCON MEMO

DATE: 6 August 2003

TIME: 9:30 am

BETWEEN: M. McShane AND Offr. Ronald Conrado, Town of Sudbury Traffic
Safety Officer

PH# 978 443-1042

SUBJECT: Review of Draft Concord-Sudbury Bikeway Memo

Offr. Conrado called to give his comments on the draft memorandum sent to the Sudbury Police Department. The Department had been unable to accommodate my request to do a review of crash records at the intersections along the proposed bikeway, but had agreed to do a preliminary review of the draft memorandum, and note any safety issues relevant to any intersection that were not addressed in the draft.

Offr. Conrado had read the memo, and commented briefly on each intersection:

1. North Road – This is a heavily-trafficked roadway, but mainly for commuter hours in the morning and evening. The crossing location is at the bottom of a hill, but the road is fairly straight. Sight distance should not be a problem as long as the foliage is cut back during the appropriate seasons. Years ago, there used to be a problem location about 200-300 yards east of the crossing (Davis Corner)—a sharp curve; but this location was redesigned, the road curvature realigned, and it hasn't been a problem since.
2. Pantry Road – This location should not be a problem as long as it is properly signed in both directions and foliage is cut back as needed to allow adequate sight distance.
3. Haynes Road – Like Pantry Road, should not be a problem as long as signing is provided and foliage cut back.
4. Morse Road – This is a residential street, which tends to be used as a "cut-through" by people avoiding Concord Road. There are several horizontal curves on the road, which people nevertheless drive at high speeds. Adequate advance signing should be provided for a crossing at this location.
5. Hudson Road – This roadway also carries a lot of traffic, but people tend to slow down a bit here because of the traffic signal at Concord Road and the activities in the town center. The Police haven't experienced a lot of safety problems at this location. The intersection of Peakham and Hudson has had several accidents.

6. Old Lancaster Road – The principal concern voiced with regard to this location was the presence of heavy truck traffic generated by the Town Highway Department, located at the curve on Old Lancaster Road. Again, though, this shouldn't represent a major problem as long as the crossing is signed, and the foliage is cut back somewhat to allow adequate sight distance.
7. Codger Lane – This is a low-volume road, essentially a driveway to the Cavicchio property. It carries a few trucks, but this should not be a problem for a crossing.
8. Route 20 – There is a pedestrian button at the new signal, so that this is an adequate crossing of Route 20. There's not a lot of speed on Route 20 at this location, because traffic is heavy just about all day long.