Transportation Elements Assessment
Town of Milton, Delaware

Pavement
Sidewalks
Safety Elements
ADA Consistency
Signage
Stormwater Drainage

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1. Introduction

During the summer of 2009, the Delaware T^2 Center collected extensive data and completed analyses related to transportation infrastructure in the Town of Milton, Delaware. This report presents those data, the analyses, and resulting recommendations.

1.1. Who/What is the Delaware T^2 Center?

The Delaware Technology Transfer (T^2) Center is one of 58 throughout the U.S., Puerto Rico, and seven Native American tribal regions. Funded by the Federal Highway Administration (FHWA) and the Delaware Department of Transportation (DelDOT), the T^2 Center assists local governments with transportation technology transfer through training, newsletters, technical briefs, presentations, and one-on-one assistance.

We are no substitute for consulting engineers that you may hire from time to time for detailed evaluations, feasibility studies, technical design, construction management, and the like. Rather, our primary role is to raise awareness of regulations, liability issues, and available technologies, materials, and trends so that local governments can avail themselves of the broadest palette of alternatives to accomplish their transportation goals and defeat their related challenges.[1]

1.2. Origin of this Assessment

Subsequent to a Municipal Clerks Training presentation regarding the Engineering Circuit Rider program in late 2008, Julie Powers (Town of Milton) contacted Matt Carter (Delaware T^2 Center's Municipal Engineering Circuit Rider and Safety Circuit Rider) to inquire further about the ways in which the T^2 Center could assist the Town of Milton. She arranged a meeting with George Dickerson (Town Manager), Stephanie Coulbourne (Town Clerk), herself, and Matt on April 15, 2009. At that meeting, Matt discussed the Delaware T^2 Center in general, the Milton representatives briefed Matt on various transportation challenges they faced, and the group explored how the resources of the T^2 Center might be applied.

Following the April 15 meeting, Matt met with Larry Klepner (Program Coordinator, Delaware T^2 Center) and Dr. Ardeshir Faghri (Director, Delaware Center for Transportation) and it was agreed that T^2 Center funds, together with supplemental funds through the Safety Circuit Rider program, could be appropriately applied to assist the Town of Milton through infrastructure inventory, pavement and pedestrian safety improvement recommendations, and strategies for upgrade of signage and sidewalk ADA[2] consistency. Subsequent discussions with our partners at FHWA and DelDOT resulted in further agreement on the use of funds consistent with our mission to assist local governments.

[1] For more information related to the T^2 Center, see our Tech Topics in the Appendix.
[2] Americans with Disabilities Act

1.3. Engineering Interns

The Delaware T^2 Center then solicited applications for engineering students, completed interviews, and selected two undergraduates to complete research and studies in various Delaware municipalities, including Milton. Bob McGurk and Kate Smagala, both entering their third year of engineering at the University of Delaware, were selected and have been essential contributors to all aspects of the project in Milton.

Figure 1 Kate Smagala and Bob McGurk collecting field data in Milton

1.4. Transportation Infrastructure Assessment

The T^2 Center began collecting infrastructure data in mid June 2009 and continued into early August, spending more than 15 days in the field. Whereas many infrastructure surveys or asset management studies are largely completed as "windshield surveys," this data collection was significantly more detailed and each of the Milton-maintained streets was physically walked, end to end by one or more members of the team.

Data compilation, reduction, and analyses followed in the office, together with quality assurance/quality control (QA/QC) reviews to ensure a high degree of data validity. Data evaluation tools were developed by the team for the analyses in this report and, ultimately, for use by Milton officials over time for a variety of purposes, including strategic planning.

The team presented an interim summary of findings to Milton officials in September 2009 and gathered additional information, questions, and particular areas of interest that enabled the completion of this final report.

2. Scope of study

The scope of this study or assessment was directed primarily toward motorist and pedestrian safety, pavement management, sidewalk ADA consistency, stormwater drainage, and street signage. [3]

2.1. Pavement condition.

This included a walking inspection of all streets owned and maintained by the City of Milton, as reflected in the Municipal Street Aid Fund listing (70 streets, totaling approximately 9.57 miles).

[3] See Appendix D for data collection sheets and details on the methodologies used in data collection.

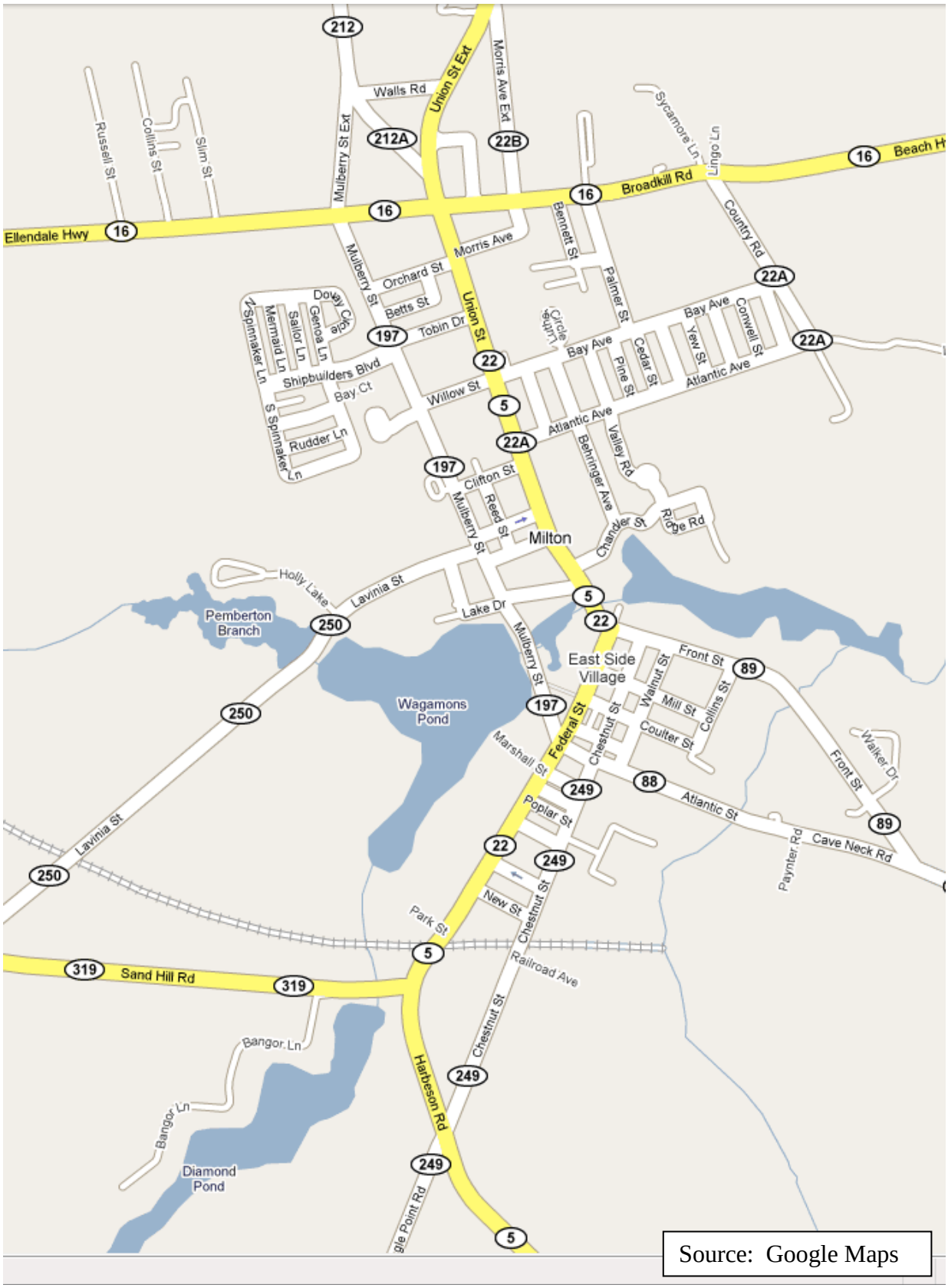


Figure 2 Town of Milton, Delaware

Street widths and lengths were measured using a Stanley "walking wheel" and both longitudinal (running) and cross slopes were measured with an M-D Building Products SmartTool™ (commonly referred to as a "smart level").

The pavement surface conditions were rated using the Pavement Condition Rating (PCR) system, developed by the Ohio Department of Transportation and FHWA and widely used by many jurisdictions to assess their roads and develop pavement restoration and maintenance priorities. Pavement condition rating systems are a means to quantitatively describe the frequency and severity of surface distresses (e.g. alligator cracking, potholes, etc.) that occur in a given section of pavement, providing an analytical tool to prioritize street maintenance.[4]

Figure 3 Pavement deterioration in Conwell Street

2.2. Sidewalks.

The team completed a physical inspection of all continuous sidewalks. Sidewalks that ran along only a portion of a street were generally ignored, assuming that they provided no connectivity and were not, in their current form, an essential transportation element. Particular emphasis was placed during sidewalk inspections on consistency with the Americans with Disabilities Act standards at the federal (U.S. Access Board) and state level (DelDOT).[5]

Widths of sidewalks and ramps were measured within ranges reflective of the standards and guidance[6] produced by the Access Board, DelDOT, and others. Also, cross slopes and longitudinal (running) slopes were measured at the ramps, the landing areas, and the sidewalks themselves using a smart level. [7]

[4] For more on Pavement Condition Ratings, see Appendix A2 and the Methodologies in Appendix D.
[5] See Tech Topics in the Appendix for further information regarding the Americans with Disabilities Act, the U.S. Access Board, the liabilities associated with non-compliance, the standards, and other information.
[6] It is important to discern between what is required as a function of legal standards or case law versus what is desirable or encouraged within documents from some of these same sources, recognizing that the latter of these two may eventually become a requirement as the ADA standards evolve.
[7] Smart levels are now produced by a number of manufacturers and their costs have come down appreciably. As such, they are a convenient tool to measure slopes of sidewalks and ramps; more importantly, the rather tight tolerances within ADA standards are such that a small error in measuring slopes using a traditional level and measuring tape could be very misleading.

Figure 4 Intersection ponding in Main-sail Lane

Evidence of stormwater ponding at sidewalk ramps was noted, together with other elements that might limit the effectiveness of the ramp or sidewalk, particularly for disabled persons. For example, utility poles, sign posts, hydrants or other fixed objects that limited the clear path to less than desired or required widths were noted and/or photographed for further analysis.

The team also reached out to Delaware's Safe Routes to School (SRTS) program through its program coordinator, Sarah Coakley, having learned from Milton officials that Milton Elementary School had received a SRTS grant. Ms. Coakley put the team in contact with the consultant team for Milton Elementary: the Toole Design Group and Parsons Brinkerhoff (PB). The T^2 Center team developed a relationship with Toole and PB representatives, shared photographs, measurements, and sign retroreflectivity data, and then joined the August 5, 2009 site walk led by Toole and PB.[8]

2.3. Storm drainage.

The team looked for areas along streets that suggested inadequate stormwater drainage. Where observed, the team attempted to identify the cause and extent of the problem and then took notes and photographs to document the problem. Particular attention was paid to areas that would potentially impact the pavement condition or ADA consistency and areas of inadequate street cross slope to provide positive drainage and minimize pavement distresses.

[8] See SRTS Coordinative Efforts in Appendix E for more information.

2.4. Signage.

Sign inspections and measurements were generally limited to Stop, Speed Limit, Do Not Enter, One Way, Yield, and Wrong Way signs. Measurements were also taken for Pedestrian Crossing signs within the walking perimeter of Milton Elementary School to support the efforts of the SRTS design work being completed there.

Figure 5 Breakaway Anchor at Mainsail Drive

For each sign, its height and width were measured, as well as its height above the pavement elevation, its distance from the pavement edge, and the retroreflectivity of the legend and background colors.[9] Significant physical defects (such as graffiti, bullet holes, washing out, mold, etc.) were also noted, as well as limitations on viewable distances. The presence or absence of breakaway anchors was noted.

Figure 6 Typical barcode used by the team

Retroreflectivity was measured with a RoadVista 922 retroreflectometer. With this instrument the team was able to record multiple readings of a legend (lettering) or background color for each sign, the instrument would average the readings for each set (legend or background), and then store the data. The instrument's internal Geographical Information System (GIS) also records the physical location via latitude and longitude coordinates for later mapping and also reads barcodes that the team placed on the back of signs for cross-reference of data over time.

[9] Retroreflectivity is a measure of a sign's ability to return light in the direction of the light source at night; see related Tech Topic in the Appendix.

3. Findings

The team's data collection efforts are reflected in the Excel spreadsheets shown in Appendix A. The data sheets have been edited down for viewing purposes in this report. Additional fields of data are included in the electronic forms of the spreadsheets that will be delivered to the Town in electronic form for future use, including the collection of additional data over time. Appendix B includes representative photographs on a street by street basis; a more exhaustive set of photographs from the team's data collection efforts is included with the electronic deliverables.

3.1. Pavement.

The collected pavement data is summarized in Appendix A1. For convenience, pavement surface quantities have been calculated for each street and are included as Appendix A2. The predominant pavement distresses are shown on a street by street

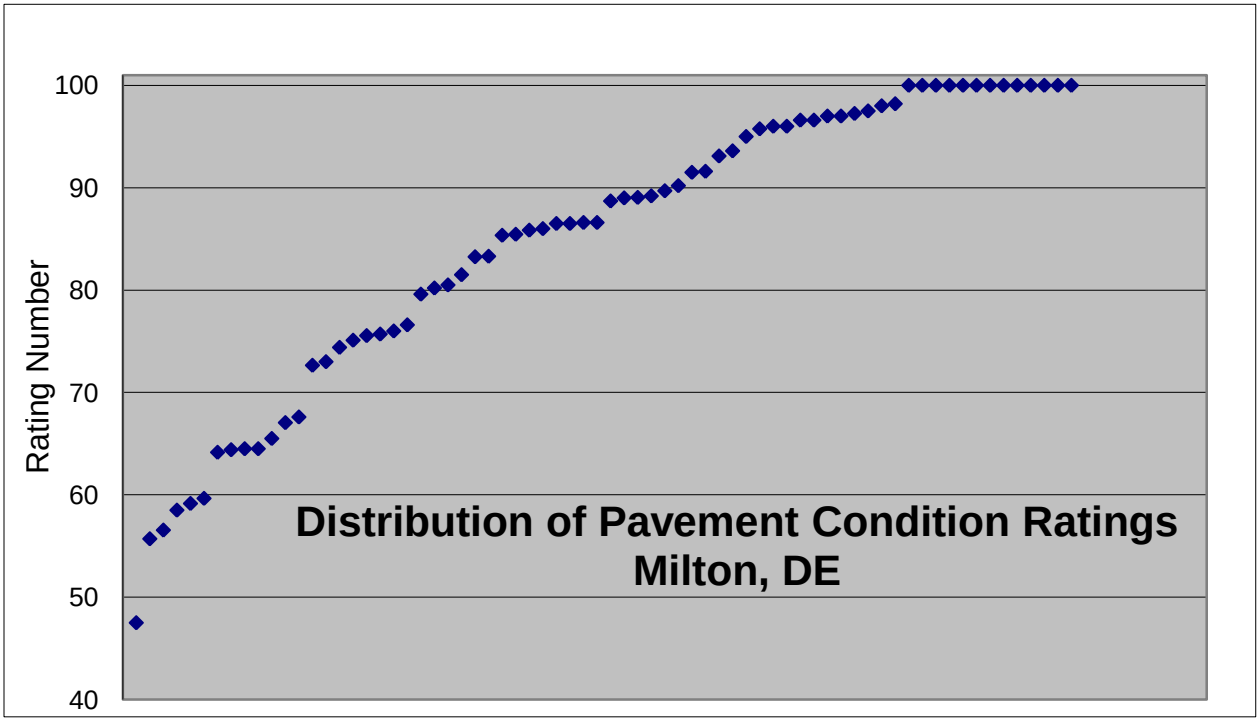


Figure 7 Milton PCR Distribution

basis in another spread sheet located in Appendix A3, the Pavement Condition Ratings (PCR). System-wide, Milton's streets consist of 9.57 linear miles, with approximately 142,000 square yards of pavement (1.3 million square feet or 29.4 acres).

A majority of Milton's streets are short (on the order of 600 feet) and may be characterized as "side streets" (e.g., Sussex Street, Spruce Street, and Sand Street). Paved widths generally vary from 12' to 40' with some notable exceptions; e.g., Yew Street measures nearly 47', while B Street (which perhaps should be characterized as

an alley) is 9'. Both open section and curb and gutter (closed section) street design are evident, perhaps evenly split.

Drainage conditions for most streets are generally good. However, the existing cross slopes for a number of streets are less than 1%. Behringer Avenue and Chandler Street are both examples that have adequate drainage despite very moderate cross and longitudinal slopes.

Pavement condition ratings, using the PCR system, ranged from a low of 47.5 to ratings of 100 for several streets. Figure 7 shows the system-wide distribution of pavement ratings and illustrates that the range of street conditions are somewhat uniformly represented.

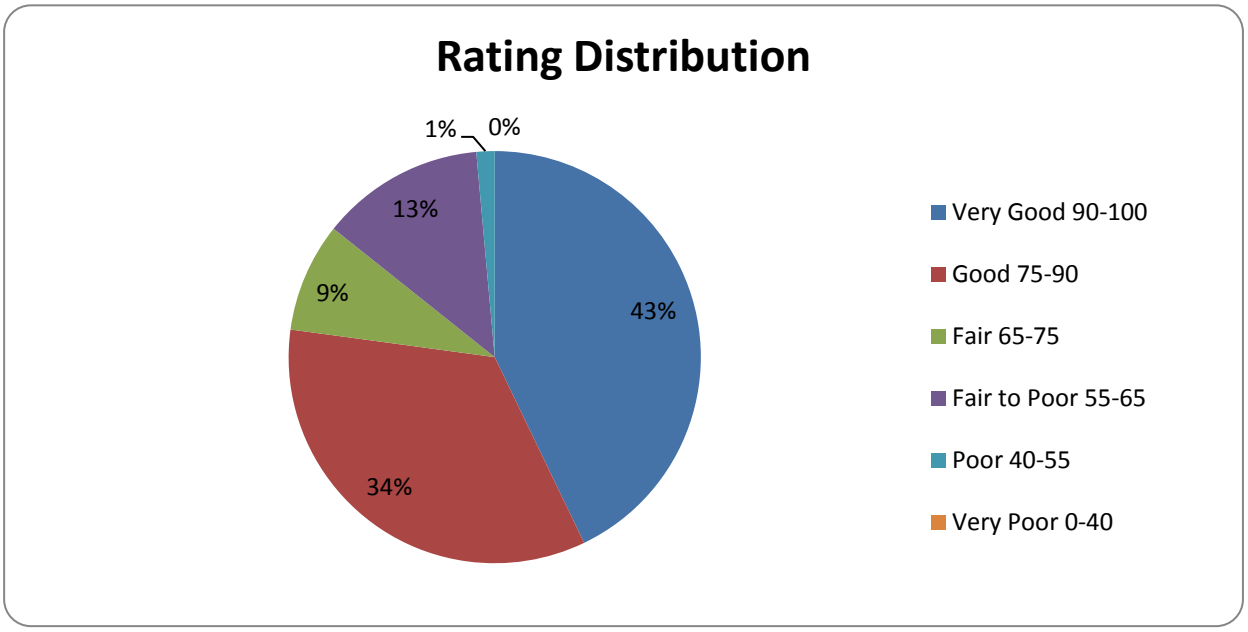


Figure 8 PCR Rating Distribution

Similarly, Figure 8 shows the majority of streets are between 75 and 100 on the pavement condition rating scale. The relatively high rating that many of these streets have is not surprising, given that many of these streets are relatively new or have been recently repaved.

Figure 9 Sussex Street

Sussex Street, for example, has been repaved in the last few years, has cross slopes in the 1%-3% range, and has a pavement condition rating of 100, meaning that no substantive surface distresses are evident at this time.

Tilney Street has a PCR of 95 with cross slopes between 1% and 3%. The predominant distress found was patching with some random cracking.

With a lower PCR rating of 86, Bay Court has cross slopes between 1% and 3% but longitudinal slopes typically below 1%, with only fair drainage characteristics. The major distresses along this road are block and transverse cracking as well as alligator cracking, perhaps due to the moderate longitudinal slopes.

Figure 10 Tilney Street

A still more severe example is Tobin Drive with a PCR of 67.6. Both cross slopes and longitudinal slopes were measured to be less than 1%. In fact, the section nearest Union Street is sloped inward at places towards the centerline, which exacerbates crack formation and

,

Figure 11 Bay Court

alligator cracking, longitudinal joint cracking, and block and transverse cracking are major distresses for Tobin Drive along with patching and potholes.

New Street is a rarity of sorts for Milton maintained streets in that it is a significant industrial street. While the cross slopes typically exceed 3%, the longitudinal slopes are generally less than 1%, resulting in compromised drainage as evidenced by the several distress categories. These include alligator cracking, settlement, potholes, and edge cracking, resulting in a PCR of 64.

Generally speaking, more of Milton's streets are in good condition than those that are not, reflective of a balanced street maintenance program.

Figure 12 Tobin Drive

Figure 13 New Street

3.2. Sidewalks.

The collected sidewalk and ramp data is located in Appendix A4. Of the many standards, guidelines, and requirements related to sidewalks and curb ramps, perhaps the most sensitive are cross slope (2%), ramp longitudinal slope (8.33%), width clear of obstruction (36"), and truncated domes. Milton has few ramps that meet all of these, but many that come very close.[10]

Using these leading criteria, of the 121 ramps measured in Milton, only one failed to meet the minimum 36" ADAAG[11] obstruction requirements, but 12 failed to meet the 48" DelDOT obstruction standard for new construction or alterations. 56 ramps included cross slopes of greater than 2.5% and 28 ramps included longitudinal slopes of greater than 8.33%.

Figure 14 Federal Street and Church Street

The presence of utility poles and other obstructions in the ramp area can pose an additional challenge for disabled pedestrians. The ramp shown here at Federal Street and Church Street is a common condition in municipal environments like Milton and there are often no simple relocation alternatives, making it all the more important that the ramps' cross and longitudinal slopes accommodate navigation by disabled persons. Here the longitudinal slope is mild but the cross slope exceeds 3%. Compounding the problem here, a surveyor's benchmark has been placed on the utility pole in the pathway of pedestrians. When an obstruction such as this utility pole is not readily

[10] See the Tech Topics attached as Appendix C of this report for more information on sidewalks, the Americans with Disabilities Act, and related requirements and guidelines.
[11] Americans with Disabilities Act Accessibility Guidelines.

relocated, making the cross and longitudinal slopes consistent with ADAAG guidelines and avoiding unnecessary obstructions such as a surveyor's benchmark, will makes it easier for handicap persons to navigate around the obstruction.

Figure 15 Reed Street and Broad Street

At the intersection of Reed Street and Broad Street the ramp system actually resembles a driveway entrance design and, coupled with the 13% cross slope, it can propel a disabled pedestrian (either in a wheel chair or crutches/walker) directly into the Broad Street travel way. This can affect pedestrians traveling along either Broad Street or Reed Street and reduce safety for both pedestrians and motorists.

Figure 16 Along Chestnut Street

Even when sidewalks have adequate widths, cross slopes, and other physical features, they are often encumbered by temporary obstructions. These can be trash cans, parked cars, vegetative encroachment, etc. These ad hoc and/or intermittent obstructions minimize the effectiveness of what may already be a limited sidewalk system.

In some instances along Chestnut Street (for example, at Sand Street), the curb ramps are nonexistent and the sidewalk is challenging even for able-bodied pedestrians.

Figure 17 Sand Street at Chestnut Street

The Safe Routes to School project may result in physical construction and/or upgrades of pedestrian facilities within an area loosely bounded by Federal Street and Chestnut Street, Atlantic Street to the north and Cannary Village to the south. The team interacted with DelDOT's SRTS coordinator (Sarah Coakley), Katie Mencarini of Toole Design Group, Allen Atkins (Public Works Superintendent), and school board stakeholders to foster communication between the school and Milton officials. The SRTS work has just gotten underway this summer and the improvements that may follow are only now beginning to be formulated. However, the program moves quickly and early action items may move forward as early as September 2009. A detailed summary of SRTS interaction is included as Appendix E.

3.3. Signage.

The collected sign data is located in Appendices A5-A7. Also see the Appendix for Tech Topics dealing with signage, retroreflectivity, and related issues.

The complete set of data showed that based on retroreflectivity levels, 96 signs out of 170 are compliant with the current MUTCD requirements. These measurements were based on five different types of signs: Do Not Enter, One Way, Speed Limit, Stop, and Yield. Stop signs are the most dominate in the town (there are 116). Of the 74 total signs that are not compliant with the MUTCD's retroreflectivity levels, 43 of them are Stop signs. Twenty of 28 One Way signs in Milton are not in compliance with retroreflectivity levels and these signs, together with Do Not Enter signs (7 of 9 are non compliant), can mean the difference in avoiding head on collisions at narrow intersections. The team found that most south facing signs do not meet the retroreflectivity levels, such as along Bay Avenue. Out of 116 Stop signs measured, three failed because of inadequate contrast ratio, as did one of the nine Do Not Enter signs; while there are only a few signs with this problem, it is a critical safety issue for the ability of older drivers to see signs at night.

Figure 18 Cracked Speed Limit sign on Atlantic Ave

Retroreflectivity is important for drivers at night, but other factors such as sight distance, sheeting condition, placement, and the height of a sign play a contributing factor in whether or not a sign is effective.

The Speed Limit sign found on Atlantic Avenue is very old, cracked, and rusted. It is an example of the signs that do not meet retroreflectivity levels. Although this sign is clearly degraded and needs to be replaced, there are other signs around the town that look like they are in good condition in the day light, but cannot be seen at night because they do not meet retroreflectivity levels.

Sign mounting heights are generally good, with 45 signs mounted over the required seven feet, only 15 below the required five feet for rural areas, and 110 between 5' and 7'.[12] The majority of signs are not on posts with yielding or breakaway sign support as now required in the MUTCD. All inspected signs met the minimum size requirements of the MUTCD. Most signs had more than adequate observational sight distances, with a notable exception of One Way signs, because of their location, orientation, and intended viewer. Encroaching vegetation (i.e. tree limbs and bushes) were a particular problem for Street Name signs and One Way signs.[13]

Yew Street is an example of a few signs found around Milton that is placed directly in the roadway, creating potential safety issues. In the case of this Stop sign on Yew Street, it is evident that the sign was placed there to be seen from further away because it would be hidden by some vegetation if placed in the grass behind the curb. The lack of

[12] Generally, signs in this range were found to be mounted closer to 7' than 5'.
[13] When One Way signs and Street Name signs are difficult to locate, unfamiliar motorists will often times stop abruptly in search of specific streets or routes and can create rear end collisions.

any lateral offset is compounded by the short sign height as well as the lack of a breakaway support.

Signs can be hidden by many obstacles such as trees, other vegetation, fences, houses, cars, etc., further contributing to safety concerns for motorists and pedestrians. Some examples were found in Milton, such as the picture to the right. This One Way sign can be detected only when it is likely too late to avoid a possible collision.

Figure 19 Sign in road on Yew Street

In addition to the Excel spreadsheets in Appendix A4, the team developed overlay files for Google Earth that allow visual browsing of sign locations, along with information about each individual sign. Other layers provide photographs of physical sign damage locations. These are considered layers in Google Earth that are easily transferable files containing all relevant sign data.[14]

Figure 20 Can you spot the One Way sign?

[14] Google Earth can be downloaded for free. See Tech Topics for further information and step by step instructions.

3.4. Maintenance Agreements Between DelDOT and the Town

In the course of this work, the Team has collected from DelDOT sixteen agreements with the Town, dating to 1923, that outline maintenance responsibilities subsequent to DelDOT construction projects within both state-maintained and municipally-maintained streets. The scanned documents total 117 pages and so are not appended to this report; instead, the agreements are included with the electronic deliverables for this report. A summary of the sixteen agreements is included as Appendix F. We cannot be

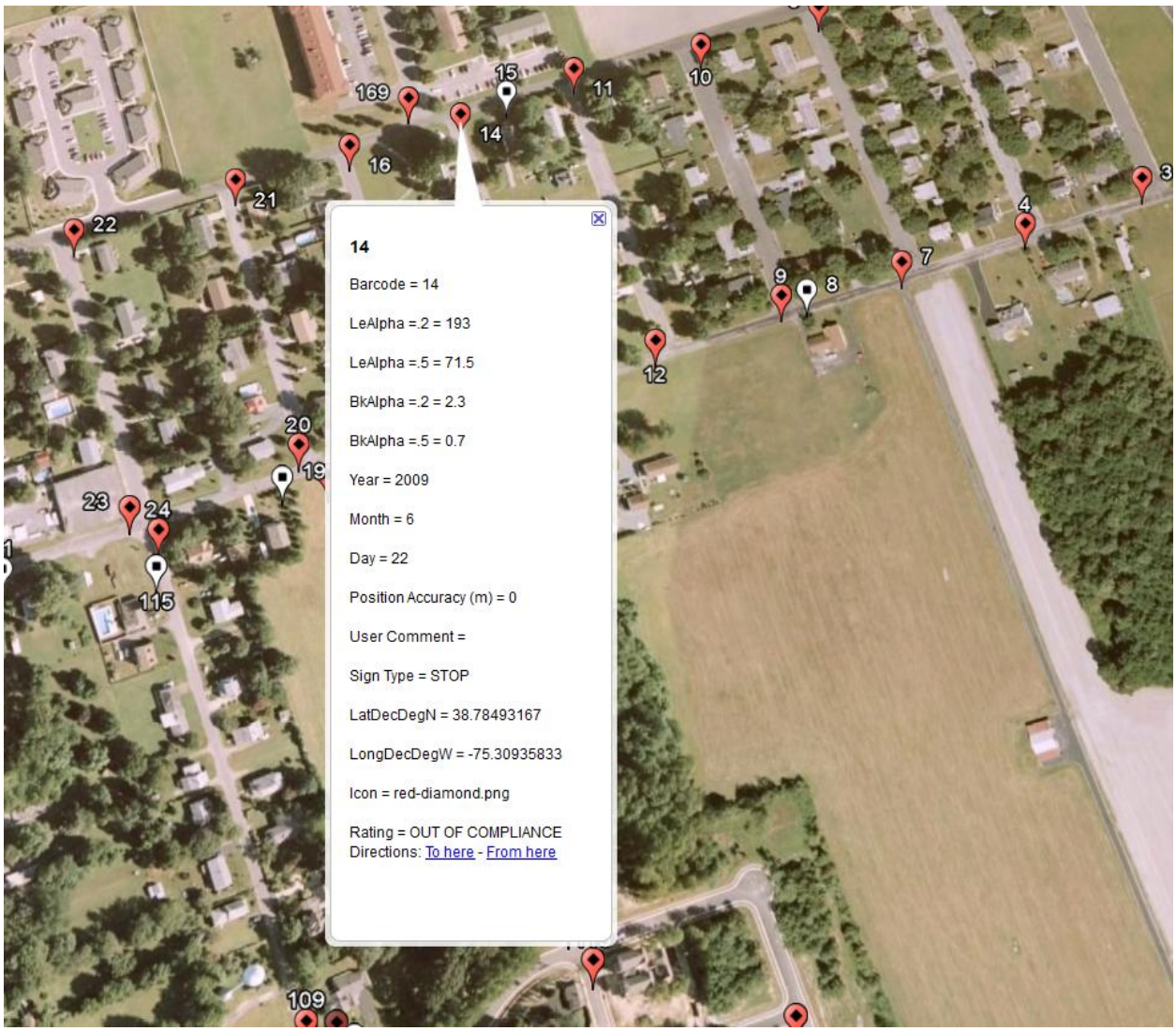


Figure 21 Google Earth overlay of sign locations and information

sure that these sixteen agreements are inclusive; indeed, we suspect that there may be some over time that were not discovered in this document request. However, the agreements generally suggest the following:

- DelDOT, at least formally, retains maintenance responsibility within "state-maintained streets" only within the pavement area itself; i.e., curb to curb.
- Sidewalks, curb ramps, and signage (including retroreflectivity) maintenance appears to be specifically excluded from DelDOT responsibility.
- Some streets within Milton that appear on maps as wholly DelDOT streets (such as a portion of Mulberry Street (see July 27, 1961 agreement, page 14 of the scanned document in the electronic delivery of this report) were transferred in these documents as responsibility of the Town, although these portions do not appear in the Town of Milton's listing for the Municipal Street Aid Fund.

4. Recommendations

The following recommendations are made, admittedly, with largely an ignorance of the resources available to Milton on an annual basis, particularly in light of the disappearance of the Municipal Street Aid Funding. Any recommendations that follow are made with the understanding that funding, personnel, and equipment may not be sufficient in the immediacy, but with the hope that they can be budgeted for over the longer term.

Many of the recommendations that follow serve more than one purpose. Some may be directed at stretching limited public resources, some are aesthetic in nature, and some are related to tort liability concerns. But nearly all of the recommendations provide some element of increased safety for motorists and pedestrians, including visitors to the Town of Milton.

4.1. Streets

4.1.1. Distressed-Based Recommendations.[15]

4.1.1.1. Alligator cracking. For roads experiencing a high degree of alligator cracking but where structural settlement has not yet developed, a preventative maintenance technique may be appropriate in the short term to preserve the pavement for more extensive restoration later. Alligator cracking is a deteriorating condition because it allows rapid water infiltration into the subbase and subgrade layers and can spread outward and downward at an increasingly rapid rate. The cost for remediation can thus expand exponentially with time. Some streets in Shipbuilders Cove and the Federal/Chestnut area would be good candidates for this type of preservation due to their higher traffic volume. Specifically, New Street, Prettyman Street, South Spinnaker Lane, and Rudder Lane should be considered for near term

[15] See Tech Topics for more information on pavement distresses and preservation techniques.

preservation actions, such as microsurfacing, to defer the longer term need for milling and paving.

4.1.1.2. Longitudinal cracking. Streets with longitudinal joint cracking should be considered for early crack sealing maintenance, particularly due to the ability of Milton Public Works to accomplish this repair work in house. Crack sealing, properly executed, can be a highly effective preventive maintenance technique for simple cracking.

4.1.1.3. Potholes. Potholes must often be addressed, particularly during winter months, with a "throw and go" approach, usually resulting in a predictably short effective life. Potholes, especially reoccurring potholes, should be remedied with effective patching techniques that include saw cutting approximately one foot outside of the distressed area, subgrade repair and compaction if needed, tacking the edges, filling with good quality hot mix asphalt, and compaction of the fresh material to proper standards and grading with the existing roadway. Improper tacking, lack of subgrade repair, and inadequate compaction usually result in a highly fatigued patch that will stress and reopen.

4.1.1.4. Random cracking. In areas where there are sporadic but significant cracks, crack sealing should be considered as an early preventative maintenance. A judgment call will have to be made as to when there are too many cracks in a given section of road for crack sealing to be economically feasible. For example, areas with alligator cracking and/or settlement will not benefit from crack sealing, as the distresses are too advanced. At that point, a more extensive pavement restoration technique should be considered.

4.1.1.5. Distresses that compromise safety. Some pavement distresses are more cosmetic and/or will shorten the useful life of a road, but some distresses pose a greater safety risk to motorists and pedestrians than others. Distresses such as bleeding, potholes, settlement, raveling, and edge drop offs can cause the driver to momentarily lose control of the vehicle, sometimes leading to recovery actions that place the driver and pedestrians at risk of serious injury. If these distresses become severe, they should be placed higher in the priority scale for remediation to avoid the escalating safety liabilities.

4.1.1.6. The Pavement Condition Ratings (PCR) included herein (and as updated over time) can be used as a significant factor in determining which roadways should be addressed first and which can be deferred, perhaps with some more minor preservation treatments.[16] However, the PCR data should not be consulted in a vacuum; other factors, such as average daily traffic (ADT) for the roadway, the speeds the road experience, the relative level of pedestrian and biking activity, and the use of the roadway by visitors (rather than local residents, who better understand the condition of the streets intuitively) are

[16] A Google Earth overlay for browsing PCR values has also been included in the electronic deliverables of this report.

all factors that can and should be used to temper what the PCR data say about a given street's apparent priority.

4.1.2. Street by Street Recommendations.

4.1.2.1. Consider for milling and paving.

- Atlantic Avenue – bleeding
- Main-Sail Lane – lack of surface course coupled with damaged base course
- Portions of South Spinnaker Lane – lack of surface course coupled with damaged base course
- Rudder Lane – extensive alligator cracking
- New Street – variety of severe and extensive distresses

4.1.2.2. Consider for Crack Sealing. Many streets in Milton are crack sealing deficient, meaning cracking distresses could benefit from preventative sealing but they have not been sealed. More extensive pavement remediation can be saved if crack sealing was used more extensively in Milton. Significant examples of these include:

- Broad Street
- Behringer Avenue (from Chandler Street to Atlantic Avenue)
- Chestnut Street
- Remaining portions of South Spinnaker Lane (see milling and paving above)

4.1.2.3. Consider for Slurry Seal or Fog Seal. Low volume roads with largely non-structural distresses can benefit from widespread sealing approaches that can extend the life of the pavement.

- Pine Street
- Ocean Street
- Carey Street

4.1.2.4. Consider for Chip Seal.

- B Street (after some remedial patching)

4.1.2.5. Consider fixing drainage conditions.

- Shipbuilders Cove area
- Conwell Street
- Tobin Drive (correct inverted slope at Union Street end)

This is not an extensive nor an exclusive list and some of these streets may have considerable time before they degrade beyond the benefit these surface treatments can bring. But given our observation of their use, condition, and existing distresses, these would be appropriate treatment methods to consider. Milton's Department of Public Works' personnel will ultimately be the best judge of cost effective remedies and their timing.

4.1.3. Targeted Safety Improvements.

4.1.3.1. Atlantic Avenue rehabilitation. Portions of Atlantic Avenue are excessively cross sloped (greater than 3%) and, together with the excessive surface bleeding through much of its surface, is at higher risk for skidding crashes where the vehicle leaves the roadway, strikes another car head on, or strikes a pedestrian. A more aggressive milling operation that profiles the cross section to a more moderate (2½% to 3%) cross slope, followed by good quality hot mix asphalt will improve vehicular control and safety.

4.1.3.2. Vegetative sight distance limitations. A handful of intersections (e.g., Yew Street at Atlantic Avenue, Waples Place at Orchard Street, Parker Street and Chestnut Street) have severely limited sight distances because of overgrown bushes, trees, or other vegetation. Recognizing that many of these may be private property issues without the benefit of a sight triangle easement, the Town of Milton should periodically (perhaps twice annually) canvas the Town for these issues and appeal to the property owners to allow responsible pruning at the Town's expense.

4.1.3.3. Centerline striping. Consider the application of double yellow centerline striping for some of the wider, boulevard-type streets (e.g., Sussex Street, Conwell Street, Yew Street) to avoid free-wheeling traffic that may confuse other drivers and endanger pedestrians, particularly in these streets where no sidewalks exist. For the widest streets (where parking on both sides of the street is advisable with two adequate travel lanes, say, 36 feet or more), consider adding white edge striping to establish the parking lanes separately from the travel lanes. Centerline striping (and even edge striping) may also be appropriate for streets such as Atlantic Avenue, New Street, Behringer Avenue, and Tobin Avenue because of our perception that these are higher volume streets.

4.1.3.4. Cross walks. Consider painted and signed cross walks in some of the existing and developing higher pedestrian areas, such as along Chestnut Street and (in conjunction with DelDOT) Mulberry Avenue (in vicinity of the fishing pier and park). Some of this work may be completed by the Safe Routes to School program upgrades, so coordination with the design team will help stretch resources to treat the greatest number of critical crossings.

4.1.3.5. Union Street and Federal Street intersection. Depending on the concerns of Town (we, as visitors, have found it contradictory to driver expectancy), ask DelDOT to perform a traffic survey of the intersection at Union and Federal and consider changes to rights of way and signage.

4.1.3.6. Drainage concerns. Few areas within Milton are a significant concern for drainage, at least as it relates to safety. However, portions of the Shipbuilders Cove area suffer from inadequate stormwater drainage systems, often coupled with a lack of surface asphalt which limits the ability of stormwater to enter the already poor drainage system. Some drains still have foam in them from when they were constructed; this should be removed to

allow higher frequency storm flows to enter the inlets. The dewatering pump in South Spinnaker represents an unnecessary cost, noise, and aesthetic drag on the Town if subsurface drainage issues could be resolved and the area paved. The ponding at some intersections can pose a safety problem in the winter when ice is a factor and should be addressed in the near future.

4.1.4. General Roadway Recommendations.

4.1.4.1. New construction. To the extent that the Town has not already adopted aggressive standards for new construction of roadways and equally strong inspection authority and terms of acceptance, these should be developed and implemented to protect the Town from future corrective liabilities. Some example elements that could be particularly protective:

- Consistent cross slopes with future paving (3% is better than 1%).
- Best construction practices for hot mix asphalt, including subgrade and subbase preparations, drainage systems, mix designs, batch plant operations, handling, temperature controls, effective compaction, high quality centerline joints, and tack coat application. Field inspection should be aggressive, including QA/QC on compaction; any compromise on quality will only pose an unnecessarily early remediation of the roadway by the Town.
- New development (residential or commercial) should be approved only in conjunction with a strong public works agreement between the developers and the Town that ensure all elements will be constructed to the required standards, including significant and dependable financial guarantees.

4.1.4.2. Warm Mix Asphalt (WMA)[17]. This developing alternative to traditional hot mix asphalt (HMA) is making its way into Delaware plants and the Town should be aware of it and the differences with traditional HMA. As it becomes a dependable material in Delaware batch plants and the contractors are properly equipped and trained to apply it, there is no reason to avoid it, since the evidence so far suggests that it is a dependable product with significant environmental benefits and potentially lowered costs to the project owner.[18] However, be wary of contactors who will bring WMA to your project site when HMA was specified, or vice versa. Just as you shouldn't accept crusher run when graded aggregate base was specified, you shouldn't accept contractor alternatives that haven't been approved in advance; either the Town is paying for the job or will accept the finished product for perpetual maintenance and you should insist on the products and practices that are called for in the specifications.

[17] See the Delaware T^2 Center Technical Brief on WMA at http://www.ce.udel.edu/dct/t2/links_files/Warm%20Mix%20Asphalt.pdf

[18] WMA has shown promise for lowered VOC and other emissions, less energy use, and extended paving season and geographic reach for a production plant, all while largely using existing equipment.

4.2. Sidewalks

Sidewalks, prior to the ADA era, were constructed and maintained without a great deal of scrutiny; they were easily compromised in many projects. In this era of post ADA, where we have greater sensitivity towards the needs of disabled persons, well constructed and maintained sidewalks and curb ramps have gained importance on a par with pavement condition. A sidewalk upgrade and maintenance program has become increasingly important so as to be responsive to the needs of the disabled community and to minimize legal liabilities associated with inadequate sidewalks and ramps.

4.2.1. Clarify the meaning of the DelDOT/Town agreements with relation to sidewalk and ramp maintenance. The Town should independently verify that it has copies of all relevant maintenance agreements, particularly those associated with "state-maintained" streets (e.g., Federal Street, Union Street, etc.) and then review those agreements with its legal counsel to ensure that it understands the full breadth of its responsibilities for maintenance and upgrade and act accordingly.

4.2.2. As the Town continues to develop an asset management program to strategically administer its sidewalk maintenance activities, it should ensure that any sidewalks and ramps not reflected in the data presented herein is also collected and folded into the program.

4.2.3. Establish a transition plan. Transition Plans are required under ADA for state and local governments with 50 or more employees. Even if the Town of Milton employs less than 50 personnel, a transition plan (even if it is a less formal plan and even called something else) can be constructive in guiding long term plans for sidewalk upgrades and serve as part of an affirmative defense if an unfortunate lawsuit were to arise. Even a transition plan that provides for a protracted schedule (ten years or longer) can be effective for both these purposes, as long as it is a reasonable timeframe. Under such a plan, Milton could prioritize existing areas to upgrade sidewalks and ramps and target longer range plans for establishing new sidewalks in areas where pedestrian activity merits it.

4.2.4. Upgrades during alterations. Alterations are defined broadly under the case law surrounding ADA and include milling and paving of streets. Milton should be careful to include upgrade of curb ramps at a minimum in all street pavement projects where sidewalks are present.

4.2.5. Targeted safety improvements.

4.2.5.1. Chestnut Street. The degraded condition along much of the Chestnut Street sidewalk is not inviting to pedestrian activity and even poses safety concerns, since some pedestrians may instead choose to walk in the roadway. The Town should prioritize sections of Chestnut Street and then work through the Town Ordinance that requires adjacent property owners to maintain sidewalks, work in conjunction with the Safe Routes to Schools initiatives, and/or employ its own resources to reconstruct the sidewalks and establish ADAAG compliant curb ramps.

4.2.5.2. Parking enforcement. In some areas, such as Chestnut Street, it has become common to find cars parked partially on the sidewalks. In addition to destroying the sidewalk, this obstructs the sidewalk for both able-bodied pedestrians and the disabled and may divert pedestrians into the street where they can be struck by motorists. Town Ordinances should be strengthened if necessary, the streets should be properly signed and curbs painted to designate no parking areas, and then consistent enforcement should be applied to cause the activity to stop. As sidewalks and curbs are replaced, the use of standard curbing should also help discourage parking on the sidewalk, as these curbs will not be as easily mounted.

4.2.6. SRTS coordination

During the course of this study, the T^2 team and the Public Works Superintendent have established a relationship with the Safe Routes to School team and this relationship should be fostered to keep all stakeholders involved, maximize resources, and avoid project redundancies.

4.2.7. Town Ordinance to establish passage plane maintenance. The Town should consider developing and adopting an ordinance similar to snow removal requirements for sidewalks. In such an expanded ordinance, the Town would require that residents keep adjacent sidewalks free of all obstructions (trash cans, vegetative encroachments such as trees or shrubs, grass, and ground covers) at all times.

4.2.8. New construction. To the extent that the Town has not already adopted aggressive standards for new construction of sidewalks and equally strong inspection authority and terms of acceptance, these should be developed and implemented to protect the Town from future corrective liabilities. Some example elements that could be particularly protective:

4.2.8.1. Design standards that meet or exceed the ideal sidewalk and ramp configurations (such as 60” sidewalks and ramps, tolerances for cross slope, etc.).

4.2.8.2. Address driveway entrances to provide ideal slope approaches.

4.2.8.3. Provide for trained inspection and require public works agreements that have adequate financial insurance.

4.3. Signage

Like sidewalks, signage is no longer dealt with in the casual way it used to be in roadway design and maintenance. In particular, retroreflectivity levels have now been established in the MUTCD and will become mandatory in January 2012. These requirements have been rolled out in a high profile manner and will attract the attention of the legal community, resulting in civil lawsuits that may be legitimate or may not; regardless, the costs to defend those claims will be significant. Signage is especially important for visitors who travel to and through Milton and may be unfamiliar with the streets. Properly placed signs, height of signs, breakaway or yielding anchors, setback of signs, and retroreflectivity are now just as important as proper pavement maintenance.

While we have focused on Stop, Yield, One Way, Do Not Enter, and Speed Limit signs, there are other significant signs that should be taken into consideration. The five signs we chose were the most populated as well as the ones that the team found to be most critical. It is important to follow the MUTCD guidelines for all regulated signs in order to create a management plan for signage before January 2012. Using the Google Earth overlay file and spread sheets attached with this document can be of help to prioritize which signs to update first, next, and in the future, recognizing that limited funds will likely be available each year for sign rehabilitation. Stop signs should be the Town's first priority, especially at key intersections such as Chestnut Street and Front Street.

The MUTCD recognizes that, despite a responsible sign management plan and diligent execution, some signs may yet be out of compliance at any given time; the manual explicitly defines compliance as having a suitable plan in place with proper execution. Therefore, the team recommends the following:

4.3.1. Similar to the recommendation in Section 4.2, clarify the meaning of the DelDOT/Town agreements with relation to sign maintenance. The Town should review all such agreements with its legal counsel to ensure that it understands the full breadth of its responsibilities for maintenance of signs, particularly as it relates to retroreflectivity.

4.3.2. As the Town continues to develop an asset management program to strategically administer its sign maintenance activities, it should ensure that any signs not reflected in the data presented herein is also collected and folded into the program.

4.3.3. Develop, adopt, and execute a maintenance or management plan consistent with the MUTCD requirements. All three of these steps should be formal and documented in case they are needed as part of an affirmative defense.

4.3.4. Develop routine inspection and maintenance cycles, coupled with budgetary support. These routine cycles should check for overgrown vegetation that can decrease visible distance of signs, as well as damage to signs or failing retroreflectivity.

4.3.5. As signs are replaced, the Town should systematically ensure that they are in full compliance with the MUTCD. For example, sign posts should provide mounting at least seven feet above the pavement (better to be 7'1" than 6'11"to make sure of compliance), lateral offset at least two feet from curbs and six feet from the edge of open section pavement sections, and include breakaway or yielding anchors.

4.3.6. One or more Town representatives should attend workshops regarding retroreflectivity and how to measure and manage it, training that the Delaware T^2 Center anticipates offering in the fall of 2009.

4.3.7. Keep records of maintenance, inspection, management actions.

4.3.8. Develop a list of high priority intersections that should be first priorities for sign replacement. The data spreadsheets and Google Earth browsing tools developed by the team can be helpful in completing this analysis.

4.3.9. Examine those areas where signs are currently in the pavement and determine if they can be relocated behind the curb. If they simply cannot be relocated at this time, they should at least be equipped with breakaway or yielding anchors until such time as they can be relocated. Section 2A.19 of the MUTCD provides for the use of some engineering discretion in this manner (as with other areas), but it should not be applied indiscriminately and in any case, it is best for such reviews to be documented in writing so that the limitations and judgment can serve as part of an affirmative defense should the occasion arise. Note, however, that the MUTCD does not endorse any placement in or immediately adjacent to the paved travel way.

4.3.10. Plan for future sign replacement by consciously selecting sheeting types that are best suited for the chosen maintenance or management methods the Town selects for retroreflectivity maintenance. Whether Engineering Grade, Super Engineering Grade, High Intensity, Prismatic, DG-3, or other sheeting types is chosen could make a significant difference in the Town's sign costs over time.

4.3.11. Targeted safety improvements.

4.3.11.1. Replace Stop signs with non-compliant retroreflective levels as soon as possible.

4.3.11.2. Replace or correct leaning sign posts before they have a chance to fall into traffic or otherwise.

4.3.11.3. Trim and prune vegetation at all locations where signage is obstructed, to the extent permissible at this time.

4.3.11.4. Chevron signs should be considers in the vicinity of Country Road and Atlantic Avenue (may require coordination with DelDOT), as visiting motorists may fail to detect the road curvature at night.

4.4. General

Use the Planning Level Cost Estimating Tool included with the electronic deliverables to evaluate various scenarios of replacement for pavement, sidewalks, and signage. This tool is basic, but can be a good planning level asset to determine budgeting needs over the long term.

5. Future T^2 Center Assistance

This report concludes our current efforts to evaluate transportation infrastructure in the Town of Milton, but the Delaware T^2 Center remains available to assist Milton to the greatest extent our resources allow over time. Milton officials are encouraged to call on the T^2 Center with questions about the data we've provided, the analyses and analytical tools delivered with this report, our recommendations, initiatives that the Town develops independently, and technology alternatives that you wish to consider in the areas of pavement, sidewalk management, signage and other arenas.

Appendices

Appendix A
Data

Appendix B
Representative Photographs

Appendix C
Tech Topics

Appendix D
Data Collection Sheets & Methodologies

Appendix E
SRTS Coordination Summary

Appendix F
Milton Town Agreements Summary

Delaware T² Center

Appendix A1

Street Conditions and Notes

Physical Data Arranged By Street

Town of Milton														
Street Conditions														
Date	Road Name	Owner	Length	Width	Number of Travel Lanes	Number of Parking Lanes	Rating From Evaluation Form	Longitudinal Slope	Center Lane Cross Slope	Current Drain Conditions	Number of Sidewalks	Sidewalk Conditions	Sidewalk Material	Note Number
6/22/2009	Atlantic Ave	Town	2,843'	21'6"	2	0	80.5	Under 1%	Over 3%	Good				1
7/8/2009	B St	Town	251'	9'	1	0	47.5	1%-8%	Under 1%	Poor				
6/22/2009	Bay Ave	Town	2,686'	18'	2	0	100	Under 1%	Over 3%	Good				2
6/23/2009	Bay Ct	Town	310'6"	28'	2	1	85.85	Under 1%	1%-3%	Fair				3
6/22/2009	Behringer Ave	Town	585'	37'	2	2	91.5	Under 1%	1%-3%	Good				4
7/7/2009	Behringer Ave	Town	956'	20'	2	0	72.65	Under 1%	Under 1%	Good				5
7/14/2009	Bennett St	Town	869'	16'	2	0	59.65	Under 1%	1%-3%	Fair				6
7/6/2009	Betts St	Town	516'	29'	2	2	97	1%-8%	1%-3%	Good				
6/22/2009	Boxwood St	Town	578'1"	40'	2	2	89.7	Under 1%	Under 1%	Fair				
7/7/2009	Broad St	Town	576'	27'	1	2	73	Under 1%	Under 1%	Good	2	Good	Concrete	7
7/2/2009	Carey Ave	Town	250'	9'	1	0	N/R	1%-8%	1%-3%	Good				8
7/2/2009	Carey St	Town	467'	15'	1	1	85.45	Under 1%	Over 3%	Good				
6/22/2009	Cedar St	Town	589'	27'1"	2	1	74.4	Under 1%	1%-3%	Good				
7/7/2009	Chandler St	Town	2,059'	22'	2	0	98.2	Under 1%	Under 1%	Good				
7/8/2009	Chestnut St	Town	2,798'		2	0	65.5	1%-8%	1%-3%	Fair	2	Poor	Concrete	9
6/29/2009	Church St	Town	508'	17', 26'4"	1	1	98	1%-8%	Under 1%	Good		Poor		10
7/6/2009	Clifton St	Town	610'	15'	1	0	55.7	Under 1%	1%-3%	Fair				
7/8/2009	Collins St	Town	1,270'	21', 30'	2	0	91.6	1%-8%	Under 1%	Fair		Poor		11
6/22/2009	Conwell St	Town	574'6"	40'	2	2	75.1	1%-8%	1%-3%	Good				
7/8/2009	Coulter St	Town	1,020'	12', 16', 36'	1	0	89.05	1%-8%	1%-3%	Good				12
6/23/2009	Duory Cir	Town	756'8"	26'	2	1	100	1%-8%	1%-3%	Fair				13
7/8/2009	Federal St	Town	222'	30'	2	1	89	1%-8%		Good	1	Good	Concrete, Brick	14
7/14/2009	Frederick St	Town	350'	15'	1	0	100	Under 1%	1%-3%	Good				
7/8/2009	Front St	Town	243'	31'6"	2	0	86.5	1%-8%	Under 1%	Good	2	Good	Concrete, Brick	

Town of Milton														
Street Conditions														
Date	Road Name	Owner	Length	Width	Number of Travel Lanes	Number of Parking Lanes	Rating From Evaluation Form	Longitudinal Slope	Center Lane Cross Slope	Current Drain Conditions	Number of Sidewalks	Sidewalk Conditions	Sidewalk Material	Note Number
7/8/2009	Front St Ext	Town	216'	16'	1	0	58.5	1%-8%	1%-3%	Good				15
6/23/2009	Genoa Ln	Town	685'5"	26'	2	1	90.2	Under 1%	1%-3%	Good				16
6/22/2009	Hazzard Ave	Town	585'	24', 17'3"	2	0	97	Under 1%	1%-3%	Good				17
6/29/2009	Hazzard Ln	Town	357'	13'	1	0	76.6	1%-8%	Under 1%	Fair		Poor		
6/22/2009	Hemlock St	Town	584'9"	40'	2	2	100	Under 1%	1%-3%	Fair				18
7/14/2009	Holland St	Town	617'	12', 20'	2	0	96.6	1%-8%	1%-3%	Good				19
7/2/2009	Lake Dr	Town	637'	19'6"	2	0	88.7	1%-8%	Over 3%	Good	1	Good	Concrete	
7/2/2009	Lavina St	Town	1,742'	21'	2	0	100	1%-8%	1%-3%	Good				
7/8/2009	Magnolia St	Town	689'	28'	2	0	86	Under 1%	Under 1%	Good	1	Good	Concrete	20
7/2/2009	Mainsail Dr	Town	525'	24'	2	0	97.5	Under 1%	1%-3%	Good				21
6/23/2009	Main-sail Ln	Town	569'2"	26'	2	2	76	1%-8%	1%-3%	Poor				22
6/29/2009	Manship St	Town	382'	14'	1	0	75.55	1%-8%	Over 3%	Fair		Poor		
6/29/2009	Marshall St	Town	573'	16'	2	0	96.6	Under 1%	1%-3%	Good		Poor		
6/23/2009	Mermaid Ln	Town	709'6"	26'	2	1	100	Under 1%	1%-3%	Good				23
7/8/2009	Mill St	Town	1,109'	20'	2	0	79.6	Under 1%	Over 3%	Good				24
7/14/2009	Morris Ave	Town	893'	30', 23'	2	0	83.3	Under 1%	Under 1%	Good				25
6/23/2009	N. Spinnaker Ln	Town	1,307'4"	26'	2	1	100	Under 1%	1%-3%	Good				27
6/29/2009	New St	Town	545'	28'	2	0	64.4	Under 1%	Over 3%	Good		Poor		27
6/23/2009	Ocean Ct	Town	308'	26'	2	1	80.2		1%-3%	Fair				28
7/6/2009	Orchard St	Town	802'	16'	1	0	75.7	Under 1%	Over 3%	Good				29
7/14/2009	Palmer St	Town	2,640'	35'4"	2	1	85.35	Under 1%	1%-3%	Good				
6/29/2009	Park St	Town	370'	28, 12'6"	1	0	93.1	1%-8%	1%-3%	Good		Poor		30
7/8/2009	Parker St	Town	201'	10'-13'	1	0	59.15	Under 1%	Under 1%	Good		Poor		31
6/22/2009	Pine St	Town	582'	29'	2	1	83.25	Under 1%	1%-3%	Good				

Town of Milton														
Street Conditions														
Date	Road Name	Owner	Length	Width	Number of Travel Lanes	Number of Parking Lanes	Rating From Evaluation Form	Longitudinal Slope	Center Lane Cross Slope	Current Drain Conditions	Number of Sidewalks	Sidewalk Conditions	Sidewalk Material	Note Number
7/2/2009	Plum St	Town	220'	10'6"	1	0	96	1%-8%	1%-3%	Good				32
6/29/2009	Poplar St	Town	406'	19'	1	1	100	1%-8%	1%-3%	Good	1	Fair	Concrete	33
7/8/2009	Prettyman St	Town	274'	17'	1	1	64.15	1%-8%	Over 3%	Fair	1	Poor	Concrete, Brick	34
7/6/2009	Reed St	Town	683'	17'	2	0	96	Under 1%	1%-3%	Good				
7/7/2009	Ridge Rd	Town	506'	22'	2	0	100	1%-8%	1%-3%	Good	1	Good	Brick	35
6/23/2009	Rudder Ln	Town	602'6"	28'	2	2	64.5	Under 1%	1%-3%	Fair				
6/23/2009	S. Spinnaker 3	Town	521'	26'	2	1	67.05	Under 1%	1%-3%	Fair				36
6/23/2009	S. Spinnaker Ln 1	Town	455'7"	28'	2	1	56.55	1%-8%	1%-3%	Poor				37
6/23/2009	S. Spinnaker Ln 2	Town	1,124'10"	28'	2	1	64.5	Under 1%	1%-3%	Fair				38
6/23/2009	Sailor Ln	Town	684'4"	26'	2	1	100	Under 1%	Under 1%	Good				39
6/29/2009	Sand St	Town	439'	12'	1	0	81.5	1%-8%	Over 3%	Good		Poor		
6/23/2009	Shipbuilder Blvd & N.Spinnaker	Town	120'	28'	2	0	100	Under 1%	1%-3%	Poor				40
6/23/2009	Shipbuilders Blvd	Town	598'6"	24'6"	2	0	86.6	Under 1%	1%-3%	Good				41
6/23/2009	Shipbuilders Blvd	Town	539'6"	20'5"	2	0	86.6	Under 1%	1%-3%	Good				42
6/16/2009	Spruce St	Town	579'	28'5"	2	2	100	1%-8%	1%-3%	Fair				
7/8/2009	Strawberry Alley	Town	237'	10', 11', 14'	1	0	97.25	1%-8%	1%-3%	Good				43
6/22/2009	Sussex St	Town	580'	37'4"	2	2	100	1%-8%	1%-3%	Good				44
7/7/2009	Tilney St	Town	587'	16'	1	1	95	1%-8%	1%-3%	Good				
7/6/2009	Tobin Dr	Town	732'	30'	2	1	67.6	Under 1%	Under 1%	Fair				45
7/8/2009	Walnut St	Town	1,425'6"	27'	2	1	93.6	1%-8%	Over 3%	Fair	2	Fair	Concrete	46
7/6/2009	Waples St	Town	241'	20'	2	0	95.75	Under 1%	1%-3%	Good				47
7/6/2009	Willow St	Town	691'	20'	2	0	89.2	Under 1%	Over 3%	Good				
6/22/2009	Yew St	Town	582'	46'8"	2	2	86.5	1%-8%	Under 1%	Good				

Town of Milton

Street Condition Notes

Note Number	Notes:
1	Lenth is measured through County Rd. Width from Spruce to Pine is 24'.
2	Width from Hazzard to Union is 24'. Center lane cross slope over 3% from county rd to pine st, 1-3% from pine st to union.
3	Diameter of culdasac: 58'.
4	10" gutter pan. Road Condition is rated from Bay Ave to Atlantic Ave. Over 3% center land cross slope is for the sides of the road.
5	Behringer Ave from Chandler to Atlantic.
6	Ponding at dead end of street. [Resident at 507 states that he has major ponding issues in driveway, evident after last repaving project, notes encroachment into PROW at 505 Bennet (fence & mailbox), waterline breaks are "frequent" which is evident via many utility patches].
7	Center lane cross slope: -1%. Negative grade cross slope.
8	Gravel Rd. Low ADT - driveway. Picture at 1:09pm - point & shoot.
9	Sidewalk conditions are mixed from good to poor.
10	26'4" width for a 200' length at the North end. Ponding at North end around catch basins.
11	80' culdesac diameter. 150' length of 30' width.
12	16' width for 100', Chestnut to Walnut 36' width.
13	Length is from Genoa to East end of Genoas asphalt. Gutter pan 12". Ponding evident by sediment buildup.
14	Length is Union to dead end. Center lane cross slope = -4%
15	Pavement ends at 75'. Road serves newly paved parking lot in rear of business'.
16	12" gutter pan.
17	Width is 24' for 190' length, then 17'3" for the rest of the roadway. Sides near Bay Ave are 7.5% center lane cross slope: excessive slope, requires wedge and level. Center is about 0%.
18	Some localized ponding. Keep eye on ponding locations for crack development.
19	12' width for 180' length, 20' for rest of roadway.
20	Minor cracking on sidewalks at parking lot entrance.
21	Mainsail Dr - off Mulberry. Minor ponding. Not on MSAF. Diameter of culdasac: 73'.
22	12" gutter pan.
23	12" gutter pan.
24	One way, though no signs.
25	30' width for 180' length, 23' for rest of roadway.
27	12" gutter pan. Minor ponding.
27	High truck traffic. High ADT. Intermittent concrete valley gutters.

Town of Milton	
Street Condition Notes	
Note Number	Notes:
28	Diameter of culdesac: 57'6". 12" gutter pan. Ponding. Needs 1.5" surface coarse. Loss of fines near intersection, high priority.
29	One way.
30	Width breaks to 12'6" at 125' from Federal. 294' to manhole and cold hot mix joing. 370' to concrete tipping pad. picture.
31	Variable width. One way street.
32	No stop sign. Low ADT, services two houses.
33	Discontinuous <48".
34	Sidewalk is 36", terminates midblock, poor condition, material is concrete and brick. One way street.
35	1' gutter pan.
36	Length is from Rudder Ln to Shipbuilders. 12" gutter pan.
37	Length is from Shipbuilders to joint at Rudder Ln. Very bad drainage, a lot of ponding. Needs 1.5" surface coarse. Some potholes, should be redone between Shipbuilders and Rudder Ln.
38	Length is from Rudder Ln to Rudder Ln.
39	12" gutter pan.
40	T-intersection. [Drawing on sheet].
41	Length is entrance to S.Spinnaker. Width refers to each section [2 sections, divided by grass median].
42	12" gutter pan. Grass median is 12' wide. Median is setback 40'.
43	Width 10' for 60' length, width 11' for 120' length, width 14' for rest of roadway.
44	11" gutter pan.
45	Width is 37' at east end for 100'. Center lane cross slope readings were -.6% and -.4%. Valley center line slope at east end is negative, and so ponding occurs. water drains to center of road, evident becuase of many crack types.
46	No sidewalks East of Mill. 2 sidewalks West of Mill.
47	Root uplift, cracking.

Appendix A2
Pavement Condition Ratings

Pavement Deficiencies And Compiled Ratings, Based On Ohio DOT's Pavement Condition Rating (PCR) System

Pavement Condition Rating Sheet

Street	Raveling 10.00			Bleeding 5.00			Patching 5.00			Potholes/ Debonding (S) 10.00			Crack Sealing Deficency 5.00			Rutting (S) 10.00			Settlement 10.00			Corrugations 5.00			Wheel Track Cracking (S) 15.00			Block/Transverse Cracking (S 10.00			Longitudinal Joint Cracking 5.00			Edge Cracking 5.00			Random Cracking (S) 5.00			Deduction	Structural Deduction	Rating	
	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points				
DUORY CIR			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	Ponding in gutter
SAILOR LN			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
SHIPBUILDERS BLVD - N			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
BAY AVE			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
RIDGE RD			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
SPRUCE ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
LAVINIA ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
POPLAR ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
MERMAID LN			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
N SPINNAKER - SHIPBUIL			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
SUSSEX ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
FREDERICK ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
HEMLOCK ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00	0.00	100.00	
CHANDLER ST			0.00			0.00	M	O	1.80			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	1.80	0.00	98.20	
CHURCH ST			0.00			0.00			0.00	L	O	2.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	2.00	2.00	98.00	
MAINSAIL DR - AT MULBE			0.00			0.00			0.00			0.00			0.00			0.00	L	O	2.50			0.00			0.00			0.00			0.00			0.00			0.00	2.50	0.00	97.50	
STRAWBERRY ALLEY			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	M	O	1.75	L	O	1.00			0.00	2.75	0.00	97.25	
BETTS ST			0.00			0.00	H	O	3.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	3.00	0.00	97.00	
HAZZARD ST			0.00			0.00	H	O	3.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	3.00	0.00	97.00	
MARSHALL LN			0.00			0.00	M	F	2.40			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	L	O	1.00	3.40	1.00	96.60	
HOLLAND ST			0.00			0.00	M	F	2.40			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	L	O	1.00	3.40	1.00	96.60	
REED ST			0.00			0.00	M	E	3.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	L	O	1.00	4.00	1.00	96.00	
PLUM ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	L	O	3.00			0.00			0.00			0.00	L	O	1.00	4.00	4.00	96.00	
WAPLES ST			0.00			0.00			0.00			0.00	L	O	2.50			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	M	O	1.75	4.25	1.75	95.75	
TILNEY ST			0.00			0.00	H	F	4.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	L	O	1.00	5.00	1.00	95.00	
WALNUT ST			0.00			0.00	L	O	0.90			0.00			0.00			0.00			0.00			0.00			0.00	M	O	3.50	L	O	1.00			0.00	L	O	1.00	6.40	4.50	93.60	
PARK ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	M	F	4.90			0.00	L	O	1.00	L	O	1.00	6.90	5.90	93.10	
COLLINS ST			0.00			0.00			0.00			0.00	L	O	2.50			0.00			0.00			0.00			0.00	M	F	4.90			0.00			0.00	L	O	1.00	8.40	5.90	91.60	
BEHRINGER AVE - BAY T			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	L	O	3.00	L	O	2.00	M	E	3.50			0.00			0.00	8.50	5.00	91.50	
GENOA LN			0.00			0.00	M	O	1.80	M	O	3.50	L	O	2.50			0.00			0.00			0.00			0.00			0.00	L	O	1.00			0.00	L	O	1.00	9.80	4.50	90.20	
BOXWOOD ST			0.00			0.00	H	O	3.00			0.00	M	O	2.50			0.00			0.00			0.00			0.00			0.00	L	E	2.00	L	F	1.40	L	F	1.40	10.30	1.40	89.70	
WILLOW ST			0.00			0.00	L	O	0.90			0.00	H	F	4.00			0.00			0.00			0.00			0.00			0.00	M	F	4.90			0.00			0.00	L	O	1.00	10.80	5.90	89.20	
COULTER ST			0.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	H	O	7.50			0.00	M	F	2.45			0.00	L	O	1.00	10.95	8.50	89.05	
FEDERAL ST - UNION TO			0.00			0.00	H	F	4.00			0.00			0.00			0.00			0.00			0.00			0.00			0.00	M	E	3.50	L	O	1.00	H	O	2.50	11.00	2.50	89.00	
LAKE DR			0.00			0.00			0.00			0.00	H	F	4.00			0.00			0.00			0.00			0.00	M	F	4.90	L	F	1.40			0.00	L	O	1.00	11.30	5.90	88.70	
SHIPBUILDERS BLVD - M			0.00			0.00	H	F	4.00			0.00	L	O	2.50			0.00			0.00			0.00			0.00	M	F	4.90	L	O	1.00			0.00	L	O	1.00	13.40	5.90	86.60	
FRONT ST - CHESTNUT T			0.00			0.00	H	O	3.00			0.00			0.00			0.00			0.00			0.00			0.00	M	E	7.00			0.00	M	E	3.50			0.00	13.50	7.00	86.50	
YEW ST			0.00			0.00	H	O	3.00			0.00	M	E	5.00			0.00			0.00			0.00			0.00	L	O	2.00	M	E	3.50			0.00			0.00	13.50	2.00	86.50	
MAGNOLIA ST			0.00			0.00	H	F	4.00			0.00	H	F	4.00			0.00			0.00			0.00			0.00			0.00	H	E	5.00			0.00	L	O	1.00	14.00	1.00	86.00	
BAY CT			0.00			0.00	L	O	0.90			0.00			0.00			0.00			0.00			0.00	M	O	5.25	H	F	7.00			0.00			0.00	L	O	1.00	14.15	13.25	85.85	
CAREY ST			0.00			0.00	L	O	0.90			0.00	M	F	4.00			0.00			0.00			0.00	M	O	5.25	L	O	2.00	L	F	1.40			0.00	L	O	1.00	14.55	8.25	85.45	
PALMER ST			0.00			0.00			0.00			0.00	L	O	2.50			0.00			0.00			0.00	M	O	5.25	M	F	4.90	L	E	2.00			0.00			0.00	14.65	10.15	85.35	
MORRIS AVE			0.00			0.00	M	O	1.80			0.00	L	O	2.50			0.00			0.00			0.00	H	O	7.50	M	F	4.90			0.00			0.00			0.00	16.70	12.40	83.30	

Pavement Condition Rating Sheet

Street	Raveling 10.00			Bleeding 5.00			Patching 5.00			Potholes/ Debonding (S) 10.00			Crack Sealing Deficency 5.00			Rutting (S) 10.00			Settlement 10.00			Corrugations 5.00			Wheel Track Cracking (S) 15.00			Block/Transverse Cracking (S			Longitudinal Joint Cracking 5.00			Edge Cracking 5.00			Random Cracking (S) 5.00			Deduction	Structural Deduction	Rating	
	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points	Frequency	Extent	Points				
PINE ST			0.00			0.00			0.00			0.00	M	E	5.00			0.00			0.00			0.00	M	O	5.25	L	O	2.00	M	E	3.50			0.00	L	O	1.00	16.75	8.25	83.25	
OCEAN CT	M	F	4.80			0.00	M	O	1.80	L	O	2.00			0.00			0.00	L	O	2.50			0.00	H	O	7.50			0.00			0.00			0.00			0.00	18.60	9.50	81.40	
ATLANTIC AVE			0.00	H	E	5.00	H	E	5.00			0.00			0.00			0.00	M	E	7.00			0.00			0.00			0.00			0.00	H	O	2.50			0.00	19.50	0.00	80.50	
MILL ST			0.00			0.00	M	F	2.40	L	O	2.00	M	F	4.00			0.00			0.00			0.00	H	O	7.50	M	O	3.50			0.00			0.00	L	O	1.00	20.40	14.00	79.60	
HAZZARD LN	L	F	2.40	L	O	2.40	L	F	1.20	H	E	10.00	L	O	2.50			0.00			0.00			0.00			0.00			0.00			0.00	M	F	2.45	M	F	2.45	23.40	12.45	76.60	
MAIN-SAIL LN - IN	L	O	1.50			0.00	H	F	4.00	H	F	8.00			0.00			0.00			0.00			0.00	H	F	10.50			0.00			0.00			0.00			0.00	24.00	18.50	76.00	
ORCHARD ST	M	O	3.00	H	F	4.50	M	O	1.80	L	O	2.00			0.00			0.00	L	O	2.50			0.00	H	O	7.50	L	O	2.00			0.00			0.00	L	O	1.00	24.30	12.50	75.70	
MANSHIP ST			0.00	M	F	3.60	L	O	0.90	H	E	10.00			0.00			0.00	L	O	2.50			0.00			0.00			0.00			0.00	H	E	5.00	M	F	2.45	24.45	12.45	75.55	
CONWELL ST	M	O	3.00			0.00	L	O	0.90	L	O	2.00			0.00			0.00	L	F	4.00			0.00	H	F	10.50	M	O	3.50	L	O	1.00			0.00			0.00	24.90	16.00	75.10	
CEDAR ST			0.00	M	F	3.60	H	E	5.00	L	O	2.00			0.00			0.00			0.00			0.00	H	E	15.00			0.00			0.00			0.00			0.00	25.60	17.00	74.40	
BROAD ST	L	O	1.50			0.00			0.00			0.00	H	E	5.00			0.00			0.00			0.00	H	O	7.50	M	E	7.00	H	E	5.00			0.00	L	O	1.00	27.00	15.50	73.00	
BEHRINGER AVE - CHAN			0.00			0.00	L	O	0.90			0.00	H	E	5.00			0.00	M	E	7.00			0.00			0.00	H	F	7.00	H	E	5.00			0.00	M	F	2.45	27.35	9.45	72.65	
SAND ST	L	O	1.50	L	O	2.40	H	E	5.00	M	E	7.00			0.00			0.00	M	F	5.60			0.00			0.00	L	O	2.00			0.00	H	E	5.00			0.00	28.50	9.00	71.50	
TOBIN DR			0.00			0.00	H	F	4.00	L	O	2.00	H	E	5.00			0.00			0.00			0.00	H	F	10.50	M	F	4.90	H	E	5.00	L	O	1.00			0.00	32.40	17.40	67.60	
S SPINNAKER - RUDDER			0.00			0.00	L	F	1.20	H	F	8.00	M	F	4.00			0.00			0.00			0.00	H	O	7.50	M	E	7.00	H	F	3.50			0.00	M	O	1.75	32.95	24.25	67.05	
CHESTNUT ST			0.00			0.00	H	E	5.00			0.00	H	E	5.00			0.00			0.00			0.00	M	E	10.50	M	E	7.00	H	E	5.00			0.00	L	E	2.00	34.50	19.50	65.50	
S SPINNAKER - RUDDER			0.00			0.00	H	E	5.00	L	E	4.00	L	O	2.50			0.00			0.00			0.00	H	E	15.00	H	F	7.00	L	O	1.00			0.00	L	O	1.00	35.50	27.00	64.50	
RUDDER LN			0.00			0.00	M	O	1.80	M	O	3.50	M	F	4.00			0.00			0.00			0.00	H	E	15.00	H	F	7.00	M	F	2.45			0.00	M	O	1.75	35.50	27.25	64.50	
NEW ST			0.00			0.00			0.00	H	E	10.00			0.00			0.00	M	F	5.60			0.00	H	E	15.00			0.00			0.00	H	E	5.00			0.00	35.60	25.00	64.40	
PRETTYMAN ST	L	F	2.40			0.00	M	E	3.00			0.00	H	E	5.00			0.00	M	F	5.60			0.00	H	E	15.00	L	O	2.00			0.00	M	F	2.45	L	O	1.00	36.45	18.00	63.55	
S SPINNAKER - RU	H	E	10.00			0.00	H	E	5.00	M	E	7.00			0.00			0.00			0.00			0.00	H	E	15.00			0.00	M	F	2.45			0.00			0.00	39.45	22.00	60.55	No surface coat
BENNETT ST	L	O	1.50			0.00	H	E	5.00			0.00	H	E	5.00			0.00	H	E	10.00			0.00	H	F	10.50	M	F	4.90			0.00	L	O	1.00	M	F	2.45	40.35	17.85	59.65	
PARKER ST	M	E	6.00			0.00	M	F	2.40			0.00	H	E	5.00			0.00	H	E	10.00			0.00	H	E	15.00			0.00			0.00			0.00	M	F	2.45	40.85	17.45	59.15	
FRONT ST EXT	L	O	1.50			0.00			0.00			0.00	H	E	5.00			0.00	H	E	10.00			0.00	H	E	15.00	H	E	###			0.00			0.00			0.00	41.50	25.00	58.50	
CLIFTON ST			0.00	L	O	2.40	M	O	1.80	M	E	7.00	H	E	5.00			0.00	H	E	10.00			0.00	H	F	10.50	H	F	7.00			0.00			0.00	L	O	1.00	44.70	25.50	55.30	
B ST	H	E	10.00			0.00	H	E	5.00	H	E	10.00	H	E	5.00			0.00	H	E	10.00			0.00	H	O	7.50			0.00			0.00			0.00	H	E	5.00	52.50	22.50	47.50	

Appendix A3
Pavement Quantities Summary

Calculated Pavement Quantities And Theoretical Hot Mix Asphalt Quantities

Town of Milton									
Planning Level Quantity Estimates									
Street	From	To	Length (ft)	Paved Width (ft)	Cul-de-sac Diameter (ft)	Total Square Yards (SY)	Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Total Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Proposed Overlay (in) 1 Tons of HMA per Street
Atlantic Ave	Union	Country (minus Spruce to Pine)	2,529	21.5		6,042	343.23	Atlantic Ave Total:	
Atlantic Ave	Spruce	Pine	305	24		813	46.21	389.44	389.4402188
B St	Prettyman	Coulter	251	9		251	14.26	14.26	14.2599375
Bay Ave	Country	Hazzard	1,895	18		3,790	215.32	Bay Ave	
Bay Ave	Union	W. of Behringer	507	20		1,127	64.01	Total:	
Bay Ave	Behringer	End of sidewalk	284	24		757	43.03	322.35	322.354125
Bay Ct	S. Spinnaker	Cul-de-sac	311	28	58	1,171	66.52	66.52	66.52162635
Behringer Ave	Bay	Atlantic	585	37		2,405	136.63	136.63	136.6340625
Behringer Ave	Chandler	Atlantic	956	20		2,124	120.70	120.70	120.695
Bennett St	Broadkill	Dead End	869	16		1,545	87.77	87.77	87.769
Betts St	Waples	Mulberry	516	29		1,663	94.46	94.46	94.46025
Boxwood St	Bay	Atlantic	578	40		2,569	145.95	145.95	145.945
Broad St	Union	Mulberry	576	27		1,728	98.17	98.17	98.172
Carey Ave	Carey St	Dead End	250	9		250	14.20	14.20	14.203125
Carey St	Lavina	Lake Dr	467	15		778	44.22	44.22	44.2190625
Cedar St	Bay	Atlantic	589	27		1,767	100.39	100.39	100.3876875
Chandler St	Union	Cul-de-sac	2,059	22		5,033	285.94	285.94	285.943625
Chestnut St	0.01 N. of New St.	Front St.	2,798	27		8,394	476.88	476.88	476.884125
Church St	Chestnut	Federal	308	17		582	33.05	Church St Total:	
Church St (at north end)	Chestnut	Federal	200	26.25		583	33.14	66.19	66.192875
Clifton St	Union	Mulberry	610	15		1,017	57.76	57.76	57.759375
Collins St	Front	Coulter	1,120	21		2,613	148.47	Collins St Total:	
Collins St	Coulter	Cul-de-sac	150	30	80	925	52.56	201.03	201.0313358
Conwell St	Bay	Atlantic	575	40		2,556	145.19	145.19	145.1875

Town of Milton

Planning Level Quantity Estimates

Street	From	To	Length (ft)	Paved Width (ft)	Cul-de-sac Diameter (ft)	Total Square Yards (SY)	Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Total Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Proposed Overlay (in) 1 Tons of HMA per Street
Coulter St	Collins	100'	100	16		178	10.10		
Coulter St	100'	Walnut	450	12		600	34.09	Coulter St	
Coulter St	Walnut	Chestnut	205	36		820	46.59	Total:	
Coulter St	Chestnut	Federal	265	19.5		574	32.62	90.77	90.77375
Duory Cir	Genoa	East end of Genoa	757	26		2,187	124.24	124.24	124.242625
Federal St	Union	Dead End	222	30		740	42.04	42.04	42.04125
Frederick St	Bennett	Dead End	350	15		583	33.14	33.14	33.140625
Front St	Federal	Chestnut	243	31.5		851	48.32	48.32	48.31903125
Front St Ext	Union	Parking Lot	216	16		384	21.82	21.82	21.816
Genoa Ln	Shipbuilders	Genoa	686	26		1,982	112.59	112.59	112.58975
Hazzard Ave	Bay	Atlantic	190	24		507	28.79	Hazzard Ave Total:	
Hazzard Ave	Bay	Atlantic	395	17.25		757	43.01	71.80	71.79679688
Hazzard Ln	Federal	Chestnut	357	13		516	29.30	29.30	29.2963125
Hemlock St	Bay	Atlantic	585	40		2,600	147.71	147.71	147.7125
Holland St	Palmer	180'	180	12		240	13.64	Holland St Total:	
Holland St	180'	0.05 W. of bennett	437	20		971	55.17	68.81	68.80625
Lake Dr	Mulberry	Dead End	637	19.5		1,380	78.41	78.41	78.41071875
Lavina St	W. of Town Limits	Mulberry	1,742	21		4,065	230.92	230.92	230.923875
Magnolia St	Union	Mulberry	689	28		2,144	121.78	121.78	121.78075
Mainsail Dr	Mulberry	End	525	24	73	1,768	100.43	100.43	100.4280043
Main-sail Ln	S. Spinnaker	S. Spinnaker	569	26		1,644	93.39	93.39	93.387125
Manship St	Federal	Chestnut	382	14		594	33.76	33.76	33.75925
Marshall St	Federal	Dead End	573	16		1,019	57.87	57.87	57.873
Mermaid Ln	Shipbuilders	N. Spinnaker	710	26		2,051	116.53	116.53	116.52875
Mill St	Federal	Collins	1,109	20		2,464	140.01	140.01	140.01125

Town of Milton

Planning Level Quantity Estimates

Street	From	To	Length (ft)	Paved Width (ft)	Cul-de-sac Diameter (ft)	Total Square Yards (SY)	Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Total Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Proposed Overlay (in) 1 Tons of HMA per Street
Morris Ave	Union	180'	180	30		600	34.09	Morris Ave Total:	
Morris Ave	180'	Broadkill	713	23		1,822	103.52	137.61	137.6061875
N. Spinnaker Ln	Genoa	Shipbuilders	1307	26		3,776	214.51	214.51	214.511375
New St	Federal	Chestnut	545	28		1,696	96.33	96.33	96.32875
Ocean Ct	S. Spinnaker	Cul-de-sac	308	26	57.5	1,095	62.22	62.22	62.22371815
Orchard St	Union	Mulberry	802	16		1,426	81.00	81.00	81.002
Palmer St	Broadkill	Bay	2,640	35.25		10,340	587.44	587.44	587.44125
Park St	Federal	80'	80	28		249	14.14	Park St	
Park St	80' to 125' road tapers		45	20.25		101	5.75	Total:	
Park St	125'	Concrete tipping pad	245	12.5		340	19.33	39.22	39.22429688
Parker St	Chestnut	Walnut	201	12		268	15.23	15.23	15.22575
Pine St	Bay	Atlantic	582	29		1,875	106.54	106.54	106.542375
Plum St	Bay	Dead End	220	10.5		257	14.58	14.58	14.581875
Poplar St	Chestnut	Federal	406	19		857	48.69	48.69	48.694625
Prettyman St	Federal	Chestnut	274	17		518	29.40	29.40	29.403625
Reed St	Broad	Dead End	683	17		1,290	73.29	73.29	73.2944375
Ridge Rd	Chandler	Chandler	506	22		1,237	70.27	70.27	70.27075
Rudder Ln	S. Spinnaker	S. Spinnaker	603	28		1,876	106.58	106.58	106.58025
S. Spinnaker Ln 1	Shipbuilders	Rudder Ln	456	28		1,419	80.60	S. Spinnaker	
S. Spinnaker Ln 2	Rudder Ln	Rudder Ln	1125	28		3,500	198.84	Total:	
S. Spinnaker Ln 3	Rudder Ln	Shipbuilders	521	26		1,505	85.51	364.95	364.950875
Sailor Ln	Shipbuilders	N. Spinnaker	685	26		1,979	112.43	112.43	112.425625
Sand St	Federal	Chestnut	439	12		585	33.25	33.25	33.25425
Shipbuilders Blvd	Mulberry	Intersection at Genoa	599	24.5		1,631	92.64		
Shipbuilders Blvd	Area between intersection at Shipbuilders and Genoa		92	85		869	49.36	Shipbuilders	

Town of Milton

Planning Level Quantity Estimates

Street	From	To	Length (ft)	Paved Width (ft)	Cul-de-sac Diameter (ft)	Total Square Yards (SY)	Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Total Theoretical tons hot mix asphalt per inch overlay (tons/inch)	Proposed Overlay (in) 1 Tons of HMA per Street
Shipbuilders Blvd	Intersection at Genoa	S. Spinnaker	540	20.5		1,230	69.88	Blvd	
Shipbuilders Blvd	Intersection of Shipbuilders and S. Spinnaker		120	28		373	21.21	Total:	
Shipbuilders Blvd	Area in between each median		34	12		45	2.58	235.67	235.6677188
Spruce St	Bay	Atlantic	579	28.5		1,834	104.17	104.17	104.1657188
Strawberry Alley	Federal	Chestnut	60	10		67	3.79	Strawberry Alley	
Strawberry Alley	Federal	Chestnut	120	11		147	8.33	Total:	
Strawberry Alley	Federal	Chestnut	57	14		89	5.04	17.16	17.157375
Sussex St	Bay	Atlantic	580	37.5		2,417	137.30	137.30	137.296875
Tilney St	Union	Mulberry	587	16		1,044	59.29	59.29	59.287
Tobin Dr	Mulberry	632'	632	30		2,107	119.69	Tobin Drive Total:	
Tobin Dr	632'	Union	100	37		411	23.36	143.04	143.04125
Walnut St	Atlantic	Front	1426	27		4,278	243.04	243.04	243.043875
Waples St	Orchard	Betts	241	20		536	30.43	30.43	30.42625
Willow St	Union	Mulberry	691	20		1,536	87.24	87.24	87.23875
Yew St	Bay	Atlantic	582	46.75		3,023	171.75	171.75	171.7536563

Mix Asphalt Density (in-place, compacted), #/cubic foot:	151.5	*REFERENCE DelDOT Density Guidelines Superpave Production - 2008 Production Season.

Appendix A4
Sidewalk Conditions

Physical Sidewalk Data

Town of Milton Intersection Conditions

Date Street	Owner Open New Curb Ramp Form	Intersection Type	Intersection Control	Crosswalk Control	Crosswalk Type	Sidewalk Type	Domes	Ponding Issues	Ramp Width 48" DelDOT 60" 36" ADA	Ramp Slope 8.33% ADA	Ramp Cross Slope 1.5% - 2% 2% ADA	Sidewalk Width 48" DelDOT 60" 36" ADA	Sidewalk Running Slope 5%	Sidewalk Cross Slope 1.5% - 2% 2% ADA	Landing Size 60" 36"	Adjoining Backslope <16.60% 16.60%	Corner	Ramp Type
6/22/2009																		
Country Rd	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Bay Ave	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Hemlock St	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Yew St	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Boxwood St	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Conwell St	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Sussex St	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Hazzard St	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Behringer Ave	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Pine St	Municipality Owned																	No Ramps
6/22/2009																		
Atlantic Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Cedar St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Hemlock St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Yew St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Boxwood St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Conwell St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Sussex St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	1 Side		No Ponding Issues										No Ramps
Hazzard St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Behringer Ave	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Pine St	Municipality Owned																	No Ramps
6/22/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Cedar St	Municipality Owned																	No Ramps
6/23/2009																		
Duory Cir	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Genoa Ln	Municipality Owned																	No Ramps
6/23/2009																		
Genoa Ln	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Duory Cir	Municipality Owned																	No Ramps
6/23/2009																		
N. Spinnaker Ln	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Mermaid Ln	Municipality Owned																	No Ramps
6/23/2009																		
N. Spinnaker Ln	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Sailor Ln	Municipality Owned																	No Ramps
6/23/2009																		
N. Spinnaker Ln	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Shipbuilders Blvd	Municipality Owned																	No Ramps
6/23/2009																		
Shipbuilders Blvd	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	None		Ponding Issues										No Ramps
Genoa Cir	Municipality Owned																	No Ramps
																		No Ramps
																		No Ramps
6/23/2009																		
Shipbuilders Blvd	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Mermaid Ln	Municipality Owned																	No Ramps
6/23/2009																		
Shipbuilders Blvd	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Sailor Ln	Municipality Owned																	No Ramps
6/23/2009																		
Shipbuilders Blvd	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Bay Ct	Municipality Owned																	No Ramps
6/23/2009																		
S. Spinnaker Ln	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		Ponding Issues										No Ramps
Main-Sail Ln	Municipality Owned																	No Ramps

Town of Milton Intersection Conditions

Date / Street	Owner	Intersection Type	Intersection Control	Crosswalk Control	Crosswalk Type	Sidewalk Type	Domes	Ponding Issues	Ramp Width 48" DelDOT 60" 36" ADA	Ramp Slope 8.33% ADA	Ramp Cross Slope 1.5% - 2% 2% ADA	Sidewalk Width 48" DelDOT 60" 36" ADA	Sidewalk Running Slope 5%	Sidewalk Cross Slope 1.5% - 2% 2% ADA	Landing Size 60" 36"	Adjoining Backslope <16.60% 16.60%	Corner	Ramp Type
	Open New Curb Ramp Form																	
6/23/2009																		
S. Spinnaker Ln	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		Ponding Issues										No Ramps
Ocean Ct	Municipality Owned																	No Ramps
6/23/2009																		
S. Spinnaker Ln	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues										No Ramps
Rudder Ln	Municipality Owned																	No Ramps
6/29/2009																		
Chestnut St	Municipality Owned	T-Intersection	No Control	No Control	No Markings	2 Sides	N	No Ponding Issues	60 inches and Over	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Church St	Municipality Owned						N		60 inches and Over	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
6/29/2009																		
Chestnut St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	N	Ponding Issues	36 to 48 inches	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Hazzard Ln	Municipality Owned						N		36 to 48 inches	Under 8.33%	Over 3%	60 inches and Over	2% to 5%	2.5% to 3%	Under 36 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
6/29/2009																		
Chestnut St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	N	Ponding Issues	60 inches and Over	Over 8.33% (12:1)	1.5% to 2.5%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Manship	Municipality Owned						N		60 inches and Over	Under 5%	2.5% to 3%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
6/29/2009																		
Chestnut St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	N	No Ponding Issues	60 inches and Over	Under 8.33%	1% to 1.5%	60 inches and Over	Under 2%	1% to 1.5%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
New St	Municipality Owned						N		60 inches and Over	Under 8.33%	1% to 1.5%	60 inches and Over	Under 2%	1% to 1.5%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
6/29/2009																		
Chestnut St	Municipality Owned	T-Intersection	No Control	No Control	No Markings	2 Sides	N	No Ponding Issues	48 to 60 inches	Under 8.33%	2.5% to 3%	48 to 60 inches	2% to 5%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Poplar St	Municipality Owned						N		60 inches and Over	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
6/29/2009																		
Chestnut St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	N	Ponding Issues	48 to 60 inches	Under 8.33%	2.5% to 3%	48 to 60 inches	2% to 5%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Sand St	Municipality Owned						N		48 to 60 inches	Over 8.33% (12:1)	Over 3%	48 to 60 inches	2% to 5%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
6/29/2009																		
Federal St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Church St	Municipality Owned						Y		60 inches and Over	Under 8.33%	Over 3%	60 inches and Over	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
6/29/2009																		
Federal St	State Owned	2 Way to 2 Way	2-Way Stop	Ped. Crossing Signs	No Markings	2 Sides	Y	Ponding Issues	60 inches and Over	Over 8.33% (12:1)	Under 1%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
Hazzard Ln	Municipality Owned						Y		60 inches and Over	Under 8.33%	2.5% to 3%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
							Y		60 inches and Over	Over 8.33% (12:1)	1.5% to 2.5%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
							Y		48 to 60 inches	Under 8.33%	1% to 1.5%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
6/29/2009																		
Federal St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 5%	Under 1%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Manship	Municipality Owned						Y		60 inches and Over	Under 8.33%	Under 1%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
6/29/2009																		
Federal St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		Ponding Issues									SW	No Ramps
New St	Municipality Owned																SE	No Ramps
6/29/2009																		
Federal St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	Ponding Issues	60 inches and Over	Under 8.33%	Under 1%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Under 16.6% (6:1)	NE	1 Angled Ramp
Park St	Municipality Owned						Y		60 inches and Over	Under 5%	Under 1%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
6/29/2009																		
Federal St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 5%	Under 1%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Poplar St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	Over 3%	60 inches and Over	Under 2%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	SE	1 Angled Ramp
6/29/2009																		
Federal St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	Ponding Issues	36 to 48 inches	Under 8.33%	1.5% to 2.5%	36 to 48 inches	Under 2%	1% to 1.5%	36 to 48 inches	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
Sand St	Municipality Owned						Y		48 to 60 inches	Under 5%	Over 3%	48 to 60 inches	Under 2%	Under 1%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
7/2/2009																		
Lake Dr	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	1 Side	N	No Ponding Issues									SE	No Ramps
Carey St	Municipality Owned						N										SW	No Ramps
7/2/2009																		
Lavinia St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									SE	No Ramps
Carey St	Municipality Owned																SW	No Ramps
7/2/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	No Ponding Issues	48 to 60 inches	Over 8.33% (12:1)	Under 1%	60 inches and Over	2% to 5%	2.5% to 3%	48 to 60 inches	Over 16.6% (6:1)	Nw	1 Angled Ramp
Lake Dr	Municipality Owned						Y		60 inches and Over	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
7/2/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	Ponding Issues	48 to 60 inches	Under 5%	2.5% to 3%	60 inches and Over	2% to 5%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	SW	1 Angled Ramp
Lavinia St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	1.5% to 2.5%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
7/6/2009																		
Betts St	Municipality Owned	2 Way to 2 Way	No Control	No Control	No Markings	None		No Ponding Issues									SW	No Ramps
Waples St	Municipality Owned																	
7/6/2009																		
Clifton St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									SW	No Ramps
Reed St	Municipality Owned																NW	No Ramps
7/6/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	1 Side	Y	No Ponding Issues	60 inches and Over	Under 8.33%	1% to 1.5%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
Betts St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	Under 1%	48 to 60 inches	Under 2%	1% to 1.5%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
7/6/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	1 Side	Y	No Ponding Issues	60 inches and Over	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Clifton St	Municipality Owned						Y		60 inches and Over	Under 8.33%	1% to 1.5%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/6/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	No Ponding Issues	48 to 60 inches	Under 5%	Under 1%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Orchard St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	Under 1%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/6/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	No Ponding Issues	48 to 60 inches	Under 8.33%	1% to 1.5%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
Tobin Dr	Municipality Owned						Y		48 to 60 inches	Under 8.33%	1.5% to 2.5%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
7/6/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	Under 1%	60 inches and Over	Under 2%	1% to 1.5%	No Landing	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Willow St	Municipality Owned						Y		48 to 60 inches	Under 5%	1% to 1.5%	60 inches and Over	2% to 5%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/6/2009																		
Orchard St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									SE	No Ramps
Waples St	Municipality Owned																SW	No Ramps
7/6/2009																		
Tilney St	Municipality Owned	2 Way to 1 Way	2-Way Stop	No Control	No Markings	None		No Ponding Issues									SE	No Ramps
Reed St	Municipality Owned																SW	No Ramps
																	NE	No Ramps
																	NW	No Ramps
7/6/2009																		

Town of Milton Intersection Conditions

Date Street	Owner Open New Curb Ramp Form	Intersection Type	Intersection Control	Crosswalk Control	Crosswalk Type	Sidewalk Type	Domes	Ponding Issues	Ramp Width 48" DelDOT 60" 36" ADA	Ramp Slope 8.33% ADA	Ramp Cross Slope 1.5% - 2% 2% ADA	Sidewalk Width 48" DelDOT 60" 36" ADA	Sidewalk Running Slope 5%	Sidewalk Cross Slope 1.5% - 2% 2% ADA	Landing Size 60" 36"	Adjoining Backslope <16.60% 16.60%	Corner	Ramp Type
Union St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	1% to 1.5%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Over 16.6% (6:1)	SW	1 Ramp Squared to Street
Clifton St	Municipality Owned						Y		60 inches and Over	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
7/6/2009																		
Union St	State Owned	T-Intersection	No Control	No Control	No Markings	2 Sides	Y	No Ponding Issues	48 to 60 inches	Under 5%	1.5% to 2.5%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Orchard St	Municipality Owned						Y		60 inches and Over	Under 8.33%	1.5% to 2.5%	48 to 60 inches	Under 2%	1% to 1.5%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
7/6/2009																		
Union St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	Over 3%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Tobin Dr	Municipality Owned						Y		60 inches and Over	Under 5%	Over 3%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
7/6/2009																		
Union St	State Owned	2 Way to 2 Way	2-Way Stop	No Control	Striped	2 Sides	Y	No Ponding Issues	48 to 60 inches	Under 5%	Over 3%	48 to 60 inches	Under 2%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Angled Ramp
Willow St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	1% to 1.5%	48 to 60 inches	Under 2%	1% to 1.5%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
							Y		48 to 60 inches	Under 8.33%	Over 3%	60 inches and Over	2% to 5%	Over 3%	60 inches and Over	Under 16.6% (6:1)	NE	1 Angled Ramp
							Y		60 inches and Over	Under 5%	1% to 1.5%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/8/2009																		
Atlantic St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	1 Side	Y	No Ponding Issues	60 inches and Over	Over 8.33% (12:1)	Under 1%	48 to 60 inches	Under 2%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Angled Ramp
Walnut St	Municipality Owned								60 inches and Over	Under 8.33%	Over 3%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/8/2009																		
Chestnut St	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	2 Sides	N	Ponding Issues	36 to 48 inches	Under 8.33%	Over 3%	48 to 60 inches	2% to 5%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Atlantic St	State Owned						N		60 inches and Over	Under 5%	1.5% to 2.5%	36 to 48 inches	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Angled Ramp
							Y		60 inches and Over	Under 5%	Over 3%	48 to 60 inches	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	NW	1 Angled Ramp
							Y		48 to 60 inches	Under 5%	Over 3%	60 inches and Over	Under 2%	Under 1%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Angled Ramp
7/8/2009																		
Chestnut St	Municipality Owned	T-Intersection	No Control	No Control	No Markings	2 Sides	N	Ponding Issues	48 to 60 inches	Over 8.33% (12:1)	Over 3%	48 to 60 inches	Under 2%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Parker St	Municipality Owned						N		36 to 48 inches	Under 8.33%	Over 3%	60 inches and Over	Under 2%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/8/2009																		
Chestnut St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	N	No Ponding Issues	48 to 60 inches	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Under 16.6% (6:1)	NW	1 Angled Ramp
Prettyman St	Municipality Owned						N		36 to 48 inches	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NE	1 Angled Ramp
7/8/2009																		
Collins St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		Ponding Issues									NW	No Ramps
Mill St	Municipality Owned																NE	No Ramps
7/8/2009																		
Coulter St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		Ponding Issues									NW	No Ramps
Collins St	Municipality Owned																NE	No Ramps
7/8/2009																		
Front St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		Ponding Issues									NW	No Ramps
Collins St	Municipality Owned																NE	No Ramps
7/8/2009																		
Front St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	Ponding Issues	36 to 48 inches	Under 5%	Over 3%	36 to 48 inches	Under 2%	Over 3%	36 to 48 inches	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Walnut St	Municipality Owned						Y		36 to 48 inches	Over 8.33% (12:1)	Under 1%	36 to 48 inches	2% to 5%	Over 3%	36 to 48 inches	Under 16.6% (6:1)	SW	1 Angled Ramp
7/8/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	No Ponding Issues	48 to 60 inches	Over 8.33% (12:1)	1.5% to 2.5%	48 to 60 inches	2% to 5%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Magnolia St	Municipality Owned						Y		48 to 60 inches	Under 5%	1% to 1.5%	48 to 60 inches	2% to 5%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/8/2009																		
Union St	State Owned	T-Intersection	1-Way Stop	No Control	Striped	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	Under 1%	60 inches and Over	2% to 5%	Under 1%	48 to 60 inches	Over 16.6% (6:1)	SW	1 Angled Ramp
Magnolia St	Municipality Owned						N										NW	No Ramps
							N		60 inches and Over	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	SE Midblock	1 Angled Ramp
7/8/2009																		
Walnut St	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	2.5% to 3%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Coulter St	Municipality Owned						Y		60 inches and Over	Over 8.33% (12:1)	1.5% to 2.5%	60 inches and Over	2% to 5%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
							Y		60 inches and Over	Under 5%	1% to 1.5%	60 inches and Over	2% to 5%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
							Y		60 inches and Over	Under 5%	Over 3%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
7/8/2009																		
Walnut St	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	2 Sides	Y	Ponding Issues	48 to 60 inches	Under 5%	1% to 1.5%	48 to 60 inches	2% to 5%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NE	2 Perpendicular Ramps
Mill St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	Over 3%	48 to 60 inches	Under 2%	1% to 1.5%	48 to 60 inches	Under 16.6% (6:1)	NW 1 perp ramp	2 Perpendicular Ramps
							Y		60 inches and Over	Under 8.33%	Over 3%	60 inches and Over	2% to 5%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Angled Ramp
																	SE	No Ramps
7/8/2009																		
Walnut St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	36 to 48 inches	Under 5%	1.5% to 2.5%	48 to 60 inches	Under 2%	Under 1%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Parker St	Municipality Owned						Y		36 to 48 inches	Under 5%	2.5% to 3%	48 to 60 inches	2% to 5%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
7/14/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									NW	No Ramps
Palmer St	Municipality Owned																NE	No Ramps
7/14/2009																		
Bennett St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									NW	No Ramps
Frederic St	Municipality Owned																NE	No Ramps
7/14/2009																		
Bennett St	Municipality Owned	2 Way to 2 Way	1-Way Stop	No Control	No Markings	None		Ponding Issues									NW	No Ramps
Holland St	Municipality Owned																NE	No Ramps
																	SW	No Ramps
																	SE	No Ramps
7/14/2009																		
Broadkill Rd	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									SW	No Ramps
Bennett St	Municipality Owned																SE	No Ramps
7/14/2009																		
Broadkill Rd	State Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	1 Side		No Ponding Issues									NW	No Ramps
Morris Ave	Municipality Owned																SE	No Ramps
																	SW	No Ramps
							Y		60 inches and Over	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Under 16.6% (6:1)	NE	1 Angled Ramp
7/14/2009																		
Broadkill Rd	State Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	1 Side		No Ponding Issues									NW	No Ramps
Palmer St	Municipality Owned																SE	No Ramps
																	SW	No Ramps
																	NE	No Ramps
7/14/2009																		
Chestnut St	Municipality Owned	2 Way to 2 Way	1-Way Stop	No Control	No Markings	2 Sides	N	No Ponding Issues	48 to 60 inches	Over 8.33% (12:1)	Over 3%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NW	2 Perpendicular Ramps
Coulter St	Municipality Owned						N		60 inches and Over	Under 5%	Over 3%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
							N		48 to 60 inches	Over 8.33% (12:1)	Over 3%	48 to 60 inches	Under 2%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	SE	2 Perpendicular Ramps
							N		36 to 48 inches	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
7/14/2009																		
Chestnut St	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	2 Sides	N	No Ponding Issues	Under 36 inches	Over 8.33% (12:1)	Over 3%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	SW 1 perp ramp	2 Perpendicular Ramps

Town of Milton Intersection Conditions

Date / Street	Owner	Intersection Type	Intersection Control	Crosswalk Control	Crosswalk Type	Sidewalk Type	Domes	Ponding Issues	Ramp Width 48" DelDOT 60" 36" ADA	Ramp Slope 8.33% ADA	Ramp Cross Slope 1.5% - 2% 2% ADA	Sidewalk Width 48" DelDOT 60" 36" ADA	Sidewalk Running Slope 5%	Sidewalk Cross Slope 1.5% - 2% 2% ADA	Landing Size 60" 36"	Adjoining Backslope <16.60% 16.60%	Corner	Ramp Type
Mill St	Municipality Owned						N		60 inches and Over	Under 5%	Over 3%	60 inches and Over	Over 5% (20:1)	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Angled Ramp
							N		48 to 60 inches	Over 8.33% (12:1)	Under 1%	48 to 60 inches	2% to 5%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Angled Ramp
							N		60 inches and Over	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	Over 3%	60 inches and Over	Over 16.6% (6:1)	NW	1 Angled Ramp
7/14/2009																		
Chestnut St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides		No Ponding Issues									SW	No Ramps
Strawberry Alley	Municipality Owned																SE	No Ramps
7/14/2009																		
Coulter St	Municipality Owned	T-Intersection	No Control	No Control	No Markings	None		No Ponding Issues									SW	No Ramps
B St	Municipality Owned																SE	No Ramps
7/14/2009																		
Federal St	State Owned	T-Intersection	1-Way Stop	Ped. Crossing Signs	No Markings	2 Sides	Y	No Ponding Issues	48 to 60 inches	Under 5%	2.5% to 3%	48 to 60 inches	Under 2%	1.5% to 2.5%	36 to 48 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Coulter St	Municipality Owned						Y		60 inches and Over	Under 5%	Over 3%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/14/2009																		
Federal St	State Owned	T-Intersection	No Control	Ped. Crossing Signs	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Over 8.33% (12:1)	Under 1%	48 to 60 inches	2% to 5%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Mill St	Municipality Owned						Y		60 inches and Over	Under 5%	Over 3%	60 inches and Over	Over 5% (20:1)	Over 3%	60 inches and Over	Over 16.6% (6:1)	SE	1 Ramp Squared to Street
7/14/2009																		
Federal St	State Owned	2 Way to 2 Way	2-Way Stop	No Control	Striped	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	Over 3%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	SE	1 Angled Ramp
Mulberry St	State Owned						Y		48 to 60 inches	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Angled Ramp
							Y		60 inches and Over	Over 8.33% (12:1)	Over 3%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Under 16.6% (6:1)	NW	2 Perpendicular Ramps
							Y		60 inches and Over	Under 8.33%	Over 3%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NE	1 Angled Ramp
7/14/2009																		
Federal St	State Owned	T-Intersection	No Control	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 5%	Over 3%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
Prettyman St	Municipality Owned						Y		60 inches and Over	Under 8.33%	Under 1%	60 inches and Over	Under 2%	Under 1%	60 inches and Over	Over 16.6% (6:1)	SW	1 Ramp Squared to Street
7/14/2009																		
Federal St	State Owned	T-Intersection	No Control	No Control	No Markings	2 Sides		No Ponding Issues									SE	No Ramps
Strawberry Alley	Municipality Owned																SW	No Ramps
7/14/2009																		
Front St	State Owned	T-Intersection	2-Way Stop	No Control	No Markings	2 Sides	N	No Ponding Issues									NW	No Ramps
Chestnut St	Municipality Owned						Y		48 to 60 inches	Over 8.33% (12:1)	Over 3%	60 inches and Over	2% to 5%	Over 3%	60 inches and Over	Under 16.6% (6:1)	SW	1 Angled Ramp
							N										SE	No Ramps
7/14/2009																		
Palmer St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									NW	No Ramps
Holland St	Municipality Owned																SW	No Ramps
7/14/2009																		
Prettyman St	Municipality Owned	T-Intersection	No Control	No Control	No Markings	None		No Ponding Issues									NE	No Ramps
B St	Municipality Owned																SE	No Ramps
7/14/2009																		
Union / Front	State Owned	2 Way to 2 Way	2-Way Stop	No Control	Striped	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 5%	2.5% to 3%	60 inches and Over	2% to 5%	Under 1%	60 inches and Over	Under 16.6% (6:1)	SE	1 Angled Ramp
Federal St	State Owned						Y		60 inches and Over	Under 8.33%	Over 3%	48 to 60 inches	2% to 5%	1.5% to 2.5%	60 inches and Over	Over 16.6% (6:1)	SW	1 Angled Ramp
							Y		48 to 60 inches	Over 8.33% (12:1)	2.5% to 3%	48 to 60 inches	2% to 5%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Angled Ramp
							N		48 to 60 inches	Over 8.33% (12:1)	Under 1%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
7/14/2009																		
Union St	State Owned	T-Intersection	No Control	No Control	No Markings	2 Sides		No Ponding Issues									NW	No Ramps
Front St Ext	Municipality Owned																SW	No Ramps
7/14/2009																		
Union St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 5%	1.5% to 2.5%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Morris Ave	Municipality Owned						Y		60 inches and Over	Under 8.33%	Over 3%	60 inches and Over	Under 2%	2.5% to 3%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/2/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 5%	1.5% to 2.5%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
Mainsail Dr	Municipality Owned						Y		60 inches and Over	Under 5%	1% to 1.5%	60 inches and Over	Under 2%	1% to 1.5%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
7/7/2009																		
Broad St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides		No Ponding Issues										No Ramps
Reed St	Municipality Owned																	No Ramps
7/7/2009																		
Chandler St	Municipality Owned	T-Intersection	Other	No Control	No Markings	1 Side	N	No Ponding Issues	48 to 60 inches	Under 5%	1.5% to 2.5%	48 to 60 inches	2% to 5%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	S heading East	1 Ramp Squared to Street
Behringer Ave	Municipality Owned																NW	No Ramps
																	NE	No Ramps
7/7/2009																		
Chandler St	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	N	No Ponding Issues	48 to 60 inches	Under 5%	Under 1%	48 to 60 inches	Under 2%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	NW	1 Angled Ramp
Ridge Rd SE	Municipality Owned						N		48 to 60 inches	Under 5%	Over 3%	48 to 60 inches	Under 2%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
7/7/2009																		
Chandler St	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	No Markings	2 Sides	N	No Ponding Issues	48 to 60 inches	Under 5%	2.5% to 3%	48 to 60 inches	2% to 5%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Ridge Rd / Valley F	Municipality Owned						N		48 to 60 inches	Under 5%	Over 3%	48 to 60 inches	Over 5% (20:1)	Under 1%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
							N		48 to 60 inches	Under 5%	1.5% to 2.5%	48 to 60 inches	2% to 5%	2.5% to 3%	48 to 60 inches	Under 16.6% (6:1)	SE	2 Perpendicular Ramps
																	NW	No Ramps
7/7/2009																		
Mulberry St	State Owned	T-Intersection	1-Way Stop	Stop Bar	Striped	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 5%	1.5% to 2.5%	48 to 60 inches	2% to 5%	1.5% to 2.5%	36 to 48 inches	Over 16.6% (6:1)	NE	1 Angled Ramp
Broad St	Municipality Owned						Y		60 inches and Over	Over 8.33% (12:1)	1.5% to 2.5%	60 inches and Over	Under 2%	1.5% to 2.5%	Under 36 inches	Under 16.6% (6:1)	SE	1 Angled Ramp
7/7/2009																		
Mulberry St	State Owned	T-Intersection	No Control	No Control	Striped	2 Sides	Y	No Ponding Issues	48 to 60 inches	Under 8.33%	Under 1%	48 to 60 inches	Under 2%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Tilney St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	2.5% to 3%	48 to 60 inches	2% to 5%	1% to 1.5%	48 to 60 inches	Over 16.6% (6:1)	SE	1 Ramp Squared to Street
7/7/2009																		
Union St	State Owned	T-Intersection	No Control	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Over 8.33% (12:1)	Over 3%	60 inches and Over	2% to 5%	1% to 1.5%	60 inches and Over	Over 16.6% (6:1)	NW	1 Ramp Squared to Street
Broad St	Municipality Owned						Y		48 to 60 inches	Under 8.33%	Over 3%	60 inches and Over	2% to 5%	Over 3%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
7/7/2009																		
Union St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	1.5% to 2.5%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NE	1 Ramp Squared to Street
Chandler St	Municipality Owned						Y		60 inches and Over	Under 5%	1.5% to 2.5%	60 inches and Over	Under 2%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SE	1 Ramp Squared to Street
7/7/2009																		
Union St	State Owned	T-Intersection	1-Way Stop	No Control	No Markings	2 Sides	Y	No Ponding Issues	60 inches and Over	Under 8.33%	Under 1%	60 inches and Over	2% to 5%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	NW	1 Ramp Squared to Street
Tilney St	Municipality Owned						Y		60 inches and Over	Under 5%	1.5% to 2.5%	60 inches and Over	2% to 5%	1.5% to 2.5%	60 inches and Over	Under 16.6% (6:1)	SW	1 Ramp Squared to Street
6/16/2009																		
Bay Ave	Municipality Owned	T-Intersection	1-Way Stop	No Control	No Markings	None		No Ponding Issues									SE	No Ramps
Spruce St	Municipality Owned																SW	No Ramps
6/16/2009																		
Atlantic Ave	Municipality Owned	2 Way to 2 Way	2-Way Stop	No Control	Striped	1 Side	Y	No Ponding Issues	48 to 60 inches	Under 8.33%	1.5% to 2.5%	48 to 60 inches	2% to 5%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	SE	1 Angled Ramp
Spruce St / Valley	Municipality Owned						Y		48 to 60 inches	Under 8.33%	1.5% to 2.5%	48 to 60 inches	2% to 5%	1.5% to 2.5%	48 to 60 inches	Under 16.6% (6:1)	SW	1 Angled Ramp
																	NW	No Ramps
																	NE	No Ramps

Appendix A5
Sign Retroreflectivity (All Signs)

Sign Retroreflective Levels And Physical Data For All Measured Signs

Town of Milton Signage Conditions - All Signs

Barcode	LeAlpha =.2	BkAlpha =.2	User Comment	STDCom	Sign Type	Date	Location (ft)	Direction	Primary St	Cross St	Sign Type	Setback	Breakaway Anchor	Height	Viewable Distance	Sign Size: Height	Width	Notes
150	72.7	9.5		6	DO NOT ENTER	7/14/2009	9	South West	Federal St	Coulter St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	Under 200'	24	24	
103	433	96.9		6	DO NOT ENTER	7/7/2009	10	North East	Mulberry St	Broad St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
136	0.4	8.5		6	DO NOT ENTER	7/8/2009		North West	Chestnut St	Prettyman St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	REPLACE. Major delamination.
60	39.3	15.3		6	DO NOT ENTER	6/29/2009	12	South East	Federal St	Poplar St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Replace. White bleeding through red.
55	58.8	6.9		6	DO NOT ENTER	6/29/2009	12	South East	Federal St	Church St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	Under 200'	24	24	
129	66.2	6.7		6	DO NOT ENTER	7/8/2009	75	North West	Walnut St	Parker St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	24	
143	78.3	6.7		6	DO NOT ENTER	7/14/2009	10	North West	Chestnut St	Mill St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	24	24	In Street.
97	86.4	1.6		6	DO NOT ENTER	7/7/2009	8	South West	Union St	Tilney St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
79	228	6.7		6	DO NOT ENTER	7/6/2009	23	North East	Mulberry St	Orchard St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
95	0	84.2	N FACE	4	ONE WAY	7/7/2009		North East	Mulberry St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	36	12	N Facing
94	0	82.5	S FACE	4	ONE WAY	7/7/2009		North East	Mulberry St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	36	12	S Facing
105	0.3	253	S FACE	4	ONE WAY	7/7/2009	6	South East	Mulberry St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	12	36	S Facing
104	0.4	274	N FACE	4	ONE WAY	7/7/2009	6	South East	Mulberry St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	12	36	N Facing
91	0.4	67.4	N FACE	4	ONE WAY	7/6/2009	5	South East	Tilney St	Reed St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	24	18	See photo. Vegetation covers sign
76	0.5	254		4	ONE WAY	7/6/2009	6	North West	Union St	Orchard St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	Under 200'	12	36	N. Facing
77	0.6	264	S FACE	4	ONE WAY	7/6/2009	6	North West	Union St	Orchard St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	Under 200'	12	36	S. Facing
58	1.6	75		4	ONE WAY	6/29/2009	7	North East	Chestnut St	Poplar St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	12	24	
100	0	41.4	N FACE	4	ONE WAY	7/7/2009	10	South West	Union St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	24	18	N Facing
99	0	5	S FACE	4	ONE WAY	7/7/2009	8	South West	Union St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	24	18	S Facing
101	0.1	12.4	S FACE	4	ONE WAY	7/7/2009	10	South West	Union St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	S Facing
139	0.1	0.3	E FACE	4	ONE WAY	7/14/2009		North West	Chestnut St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	E Facing. In Street.
152	0.2	38.1	W FACE	4	ONE WAY	7/14/2009	10	South West	Federal St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	24	18	W Facing
151	0.2	33.2	E FACE	4	ONE WAY	7/14/2009	10	South West	Federal St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	24	18	E Facing
154	0.2	12.1	W FACE	4	ONE WAY	7/14/2009		South West	Federal St	Prettyman St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	W Facing.
153	0.2	9.1	E FACE	4	ONE WAY	7/14/2009		South West	Federal St	Prettyman St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	E Facing.
98	0.2	8.4	N FACE	4	ONE WAY	7/7/2009	8	South West	Union St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	N Facing
134	0.2	1	E FACE	4	ONE WAY	7/8/2009		South West	Chestnut St	Parker St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	24	Old. E Facing.
135	0.2	0.6	W FACE	4	ONE WAY	7/8/2009		South West	Chestnut St	Parker St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	W Facing. Hidden by Tree.
140	0.2	0.5	W FACE	4	ONE WAY	7/14/2009		North West	Chestnut St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	W Facing. In Street.
148	0.3	3.6	W FACE	4	ONE WAY	7/14/2009	12	South West	Federal St	Mill St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	W Face.
75	0.3	0.6	S FACE	4	ONE WAY	7/6/2009	12	South East	Orchard St	Waples	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	12	36	Vegetation - poor vis.
89	0.4	19.3	S FACE	4	ONE WAY	7/6/2009	10	North West	Tilney St	Reed St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	24	18	S. Facing
147	0.4	0.6	E FACE	4	ONE WAY	7/14/2009	12	South West	Federal St	Mill St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	E Face.
53	1.5	9.3		4	ONE WAY	6/29/2009	10	North West	Chestnut St	Church St	One Way (R6-1,1a)	Open Section: Greater than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	24	18	Overhanging Branches
52	1.5	1.6		4	ONE WAY	6/29/2009	10	North West	Chestnut St	Church St	One Way (R6-1,1a)	Open Section: Greater than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	24	18	Overhanging Branches
59	1.6	41.6		4	ONE WAY	6/29/2009	7	North East	Chestnut St	Poplar St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	12	24	
93	14.3	48.3		4	ONE WAY	7/7/2009	8	North West	Broad St	Reed St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	200'-400'	24	18	
176	152	0	PED XING	7	PED XING	7/16/2009	300	North West	Mulberry St	Federal St	PEDXING	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	Ped X-ing. N Facing.
174	186	0	PED XING	7	PED XING	7/16/2009	80	South East	Federal St	Park St	PEDXING	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	30	Ped X-ing. W Facing. Pole Mounted.
175	199	0	PED XING	7	PED XING	7/16/2009	300	North East	Mulberry St	Federal St	PEDXING	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	Ped X-ing. S Facing.
171	200	0	PED XING	7	PED XING	7/16/2009	100	North East	Federal St	New St	PEDXING	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	Ped X-ing
173	208	0	PED XING	7	PED XING	7/16/2009	25	South West	Federal St	New St	PEDXING	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	Ped X-ing. W Facing. Pole Mounted.
172	217	0	PED XING	7	PED XING	7/16/2009	120	South East	Federal St	New St	PEDXING	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	550'-675'	30	30	Ped X-ing. W Facing. Pole Mounted.
68	0	238	25	3	SPEED LIMIT	7/2/2009	1000	North West	Federal St	Lavinia St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	24	
111	0	94.5	25	3	SPEED LIMIT	7/7/2009	50	South West	Chandler St	Behringer St	Speed Limit (R2-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	W Facing
107	0	86.3	25	3	SPEED LIMIT	7/7/2009	150	East	Union St	Chandler St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	
115	0.1	53.6	25	3	SPEED LIMIT	7/7/2009	90	South East	Atlantic Ave	Behringer St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	24	18	Graffitti.
156	0.2	205	E FACE, 25	3	SPEED LIMIT	7/14/2009	50	East	Federal St	Prettyman St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	36	24	Looks to have been hit by trucks / tall vehicles.
127	0.2	65.6	15	3	SPEED LIMIT	7/8/2009	75	South	Walnut St	Coulter St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	N Facing
155	0.4	237	W FACE, 25	3	SPEED LIMIT	7/14/2009		South East	Federal St	Prettyman St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	36	24	Missing Lower Bolt
15	1.3	84	25	3	SPEED LIMIT	6/22/2009	85	East	Bay Ave	Cedar St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	24	18	
28	1.4	253	25	3	SPEED LIMIT	6/22/2009	100	West	Bay Ave	Sussex St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: Under 5'	200'-400'	30	24	Leans toward roadway
27	1.4	84	25	3	SPEED LIMIT	6/22/2009		West	Bay Ave	Hazzard St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	24	18	
120	1.4	76.7	15	3	SPEED LIMIT	7/8/2009	100	North	Collins St	Coulter St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	Bee's Nest!!
82	2.5	279	N FACE, 25	3	SPEED LIMIT	7/6/2009	7	South East	Union St	Tobin St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	24	N. Facing
133	0.2	9.4	25	3	SPEED LIMIT	7/8/2009	50	West	Chestnut St	Wharton St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	24	Old / Cracking
31	1.4	5.1	25	3	SPEED LIMIT	6/22/2009		South East	Atlantic Ave	Hazzard St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	24	Cracking
19	1.4	2.2	25	3	SPEED LIMIT	6/22/2009	25	West	Atlantic Ave	Valley Rd	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	24	Old, rusty, surface cracking, Shrubs block sign from being seen
8	1.5	39.2	25	3	SPEED LIMIT	6/22/2009	20	North East	Atlantic Ave	Yew St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	24	
32	50.2	7		1	STOP	6/23/2009		North West	Shipbuilders Blvd	Genoa Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
3	53.5	10.1		1	STOP	6/22/2009		North West	Atlantic Ave	Sussex St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Leans to Right
165	63.1	9.7		1	STOP	7/14/2009		South West	Bennett St	Frederic St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
90	63.7	8.5		1	STOP	7/6/2009	5	South East	Tilney St	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	See photo
30	64.6	10.3		1	STOP	6/22/2009		North East	Union St	Atlantic St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
67	65.4	11		1	STOP	6/29/2009	10	North West	Federal St	Park	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
166	70.4	7		1	STOP	7/14/2009		South East	Bennett St	Holland St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
110	72.8	9.5		1	STOP	7/7/2009	10	North East	Chandler St	Behringer St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Missing lower bolt.
74	73.8	10.8		1	STOP	7/6/2009	12	South East	Orchard St	Waples	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	Vegetation - poor vis. .. One way sign under stop - ok?
51	74.6	13.3		1	STOP	6/29/2009	10	North West	Chestnut St	New St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	400'-550'	30	30	
117	74.9	10.2		1	STOP	7/8/2009		North East	Mulberry St	Magnolia St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	Pine Tree Branch Obstruction
144	75.3	7.1		1	STOP	7/14/2009	5	North West	Chestnut St	Strawberry Alley	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	

Town of Milton Signage Conditions - All Signs

Barcode	LeAlpha =.2	BkAlpha =.2	User Comment	STDCom	Sign Type	Date	Location (ft)	Direction	Primary St	Cross St	Sign Type	Setback	Breakaway Anchor	Height	Viewable Distance	Sign Size: Height	Width	Notes
159	77.1	25.1		1	STOP	7/14/2009	8	North East	Federal St	Union St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	High variability. White streak down center due to red lamination deterioration.
2	81.4	9.2		1	STOP	6/22/2009		South West	Country Rd	Bay Ave	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
113	83.6	7.2		1	STOP	7/7/2009	10	South East	Chandler St	Ridge Rd	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	NW Intersection. Appears to be E.G. coating on non-metallic sign backing.
114	85.9	10		1	STOP	7/7/2009	20	North West	Chandler St	Valley Rd	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	NW Intersection. Appears to be E.G. coating on non-metallic sign backing.
112	89.6	10.4		1	STOP	7/7/2009	12	South West	Chandler St	Ridge Rd	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	SE Intersection. Appears to be E.G. coating on non-metallic sign backing.
44	92.7	9.3		1	STOP	6/23/2009		South West	S. Spinnaker Ln	Main-sail Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	
109	95.2	14.4		1	STOP	7/7/2009	20	North West	Chandler St	Behringer St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
85	178	15.8		1	STOP	7/6/2009	10	South West	Union St	Clifton	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	Lots of dirt / mold on sign.
88	181	12.7		1	STOP	7/6/2009	10	North West	Tilney St	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
69	193	9.8		1	STOP	7/2/2009	12	South East	Lavinia St	Carey St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
83	208	10.7		1	STOP	7/6/2009	8	North East	Mulberry St	Willow St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
9	209	13		1	STOP	6/22/2009		North West	Atlantic Ave	Yew St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	Close trees that reduce viewable distance. Sign located in roadway
92	216	7.4		1	STOP	7/7/2009	8	North West	Broad St	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
13	217	7.3		1	STOP	6/22/2009		North West	Atlantic Ave	Cedar St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Delamination
11	218	8.5		1	STOP	6/22/2009		South East	Bay Ave	Hemlock St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
125	222	11		1	STOP	7/8/2009		North West	Walnut St	Coulter St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
17	224	20.6		1	STOP	6/22/2009		North West	Atlantic Ave	Pine St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Small amount of spray paint.
119	225	43.8		1	STOP	7/8/2009		North East	Coulter St	Collins St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	Angled Away from Street. Scratches and Vandalized. Corner Resident requests that sight clearances be checked. States decent volume of pedestrian traffic and "blind" turn.
168	228	7.3		1	STOP	7/14/2009		South West	Palmer St	Holland St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	Dirty. Hit by rocks.
128	232	11.9		1	STOP	7/8/2009	75	North West	Walnut St	Parker St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
130	233	12.8		1	STOP	7/8/2009		North East	Atlantic St	Walnut St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
62	234	7.2		1	STOP	6/29/2009	10	South East	Federal St	Manship	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	Minor delamination
123	236	15		1	STOP	7/8/2009		North East	Walnut St	Mill St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Scratched via rocks (minor).
142	237	9.6		1	STOP	7/14/2009	10	North West	Chestnut St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	In Street.
34	243	44.9		1	STOP	6/23/2009		South East	Duory Cir	Genoa Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	
36	243	44.1		1	STOP	6/23/2009		North West	Shipbuilders Blvd	Sailor Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
37	243	44		1	STOP	6/23/2009		North West	Shipbuilders Blvd	Mermaid Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
38	244	44.4		1	STOP	6/23/2009		South East	N. Spinnaker Ln	Mermaid Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
33	244	44.1		1	STOP	6/23/2009		North East	Genoa Ln	Duory Cir	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
66	245	10.5		1	STOP	6/29/2009	10	North West	Federal St	Marshall St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Dead End Street sign attached to back of stop - not permitted by MUTCD?
126	247	15.3		1	STOP	7/8/2009		South East	Walnut St	Coulter St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
35	248	45.6		1	STOP	6/23/2009		South East	N. Spinnaker Ln	Sailor Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
39	248	45		1	STOP	6/23/2009		North East	N. Spinnaker Ln	Shipbuilders Blvd	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	30	
4	248	16.2		1	STOP	6/22/2009		North West	Atlantic Ave	Conwell St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
12	248	14.4		1	STOP	6/22/2009		North West	Atlantic Ave	Hemlock St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Surface condition poor
20	249	7		1	STOP	6/22/2009		North	Atlantic Ave	Spruce St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
41	250	45.8		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Main-sail Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	Under 200'	30	30	
40	250	44.8		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Ocean Ct	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	
137	251	12.1		1	STOP	7/8/2009		North West	Chestnut St	Prettyman St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
57	253	14.4		1	STOP	6/29/2009	10	North West	Chestnut St	Sand St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
87	255	29		1	STOP	7/6/2009	4	South East	Clifton	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Mounted on Utility pole
63	255	9.8		1	STOP	6/29/2009	8	North West	Chestnut St	Manship	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
7	259	25.2		1	STOP	6/22/2009		North West	Atlantic Ave	Boxwood St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Peeling, Bubbling
116	265	54		1	STOP	7/8/2009		South West	Union St	Magnolia St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	Minor Spraypaint
65	265	10		1	STOP	6/29/2009	7	South East	Federal St	Hazzard Ln	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
141	267	30.7		1	STOP	7/14/2009	5	South East	Chestnut St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
145	272	52.5		1	STOP	7/14/2009	7	South West	Front St	Chestnut St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
157	280	54.4		1	STOP	7/14/2009	15	South East	Federal St	Mulberry St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	Delaminating due to rocks.
131	388	100		1	STOP	7/8/2009		South East	Chestnut St	Atlantic St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	In Street. Scratches from minor vandalism. Delamination.
132	395	108		1	STOP	7/8/2009		North West	Chestnut St	Wharton St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	
86	421	94.9		1	STOP	7/6/2009	12	North East	Mulberry St	Clifton	Stop (R1-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	
48	423	92.5		1	STOP	7/2/2009	15	South West	Mulberry St	Mainsail Dr	Stop (R1-1)	Open Section: Greater than 6' from pavement	Yes	Ground Mount: Over 7'	Under 200'	30	30	
102	426	99.3		1	STOP	7/7/2009	10	North East	Mulberry St	Broad St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	400'-550'	30	30	
49	434	101		1	STOP	7/2/2009	8	South West	Mulberry St	Lavinia St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	
46	435	88.5		1	STOP	6/23/2009		South East	Shipbuilders Blvd	S. Spinnaker Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
47	442	97.3		1	STOP	6/23/2009		South West	Mulberry St	Shipbuilders Blvd	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	30	
160	448	110		1	STOP	7/14/2009	12	South East	Federal St	Front St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	
158	458	90.1		1	STOP	7/14/2009	30	North West	Federal St	Mulberry St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	
42	463	87.2		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Rudder Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
73	486	81.7		1	STOP	7/6/2009	14	North East	Mulberry St	Betts St.	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	Start Alpha = 0.2
18	558	97.9		1	STOP	6/22/2009		South East	Atlantic Ave	Valley Rd	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	400'-550'	30	30	
72	1.8	0.1	CAST IRON	1	STOP	7/2/2009		North West	Hickory Blvd	Sassafras Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	24	Glass bead or sand encrusted paint (legend) on cast iron plate. Private street not yet accepted? Does post qualify as breakaway anchor?
170	42	18.7		1	STOP	7/14/2009		South East	Broadkill Rd	Palmer St	Stop (R1-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	

Town of Milton Signage Conditions - All Signs

Barcode	LeAlpha =.2	BkAlpha =.2	User Comment	STDCom	Sign Type	Date	Location (ft)	Direction	Primary St	Cross St	Sign Type	Setback	Breakaway Anchor	Height	Viewable Distance	Sign Size: Height	Width	Notes
118	44.2	2.5		1	STOP	7/8/2009		South West	Front St	Collins St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	
164	45	39		1	STOP	7/14/2009	15	South East	Broadkill Rd	Bennett St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	Rotated away from road.
167	53.5	5.7		1	STOP	7/14/2009		South West	Bennett St	Holland St	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	
45	57.8	6.6		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Bay Ct	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
43	59.1	4.8		1	STOP	6/23/2009		South West	S. Spinnaker Ln	Rudder Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
81	67.1	33.2		1	STOP	7/6/2009	8	South West	Union St	Tobin	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Red coating is worn and white bleeding through red.
108	73.4	2.7		1	STOP	7/7/2009	5	South West	Chandler St	Behringer St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
25	73.8	6.6		1	STOP	6/22/2009		North West	Atlantic Ave	Hazzard St	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
163	87.9	6.2		1	STOP	7/14/2009		South East	Broadkill Rd	Morris Ave	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Leaning, rotated away from road.
14	193	2.3		1	STOP	6/22/2009		South East	Bay Ave	Cedar St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Vandalized. poor surface condition
26	199	2.1		1	STOP	6/22/2009		South East	Bay Ave	Hazzard St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
84	200	3.5		1	STOP	7/6/2009	8	South West	Union St	Willow St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	400'-550'	30	30	
96	202	2.4		1	STOP	7/7/2009	10	South West	Union St	Tilney St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Missing upper bolt
56	212	3.2		1	STOP	6/29/2009	12	South East	Federal St	Sand St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	Sheeting lashed - see photo
6	214	2.3		1	STOP	6/22/2009		South East	Bay Ave	Boxwood St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
70	225	5		1	STOP	7/2/2009	8	North West	Lake Dr	Carey St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	Delamination due to gunshots
64	226	5.2		1	STOP	6/29/2009	8	North West	Chestnut St	Hazzard Ln	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	Tree partially blocking view.
5	226	2.4		1	STOP	6/22/2009		South East	Bay Ave	Conwell St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
169	229	2.1		1	STOP	7/14/2009		North West	Bay Ave	Palmer St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	
1	230	0.6		1	STOP	6/22/2009		South East	Bay Ave	Sussex St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Peeling Background, Rusted Hardware
21	231	2.1		1	STOP	6/22/2009		South East	Bay Ave	Spruce St	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
162	232	2.3		1	STOP	7/14/2009		North East	Union St	Morris Ave	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	
22	234	4.6		1	STOP	6/22/2009		South East	Bay Ave	Behringer Ave	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
121	235	3.9		1	STOP	7/8/2009		North West	Collins St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	
149	237	4.7		1	STOP	7/14/2009	9	South East	Federal St	Coulter St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
16	242	1.9		1	STOP	6/22/2009		South East	Bay Ave	Pine St	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
78	244	2		1	STOP	7/6/2009	23	North East	Mulberry St	Orchard St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Do not enter sign posted on back.
71	244	1.8		1	STOP	7/2/2009	10	South West	Mulberry St	Lake Dr	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Minor Delamination
124	245	2.6		1	STOP	7/8/2009		South West	Walnut St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	
106	248	5.7		1	STOP	7/7/2009	12	North East	Union St	Chandler St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
122	248	2.4		1	STOP	7/8/2009		South West	Front St	Walnut St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	Scratched via rocks. In Street.
146	256	2.2		1	STOP	7/14/2009	8	South East	Front St	Chestnut St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	In Street.
29	259	5.3		1	STOP	6/22/2009		North East	Union St	Bay Ave	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
23	260	6.2		1	STOP	6/22/2009		North West	Atlantic Ave	Behringer Ave	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	550'-675'	30	30	
10	260	3.1		1	STOP	6/22/2009		South East	Bay Ave	Yew St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	550'-675'	30	30	
50	262	2.9		1	STOP	6/29/2009	30	South	Federal St	New St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	Stop sign @ Federal 30' back. Add Stop line? See MUTCD
80	268	2		1	STOP	7/6/2009	8	North East	Mulberry St	Tobin	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
54	271	4.6		1	STOP	6/29/2009	12	South East	Federal St	Church St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	
61	275	4.1		1	STOP	6/29/2009	12	South East	Federal St	Poplar St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
138	277	2.1		1	STOP	7/14/2009		South East	Chestnut St	Coulter St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	In Street.
24	278	5.2		1	STOP	6/22/2009		South East	Atlantic Ave	Behringer Ave	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	Visible damage due to rocks and vandalism
161	77.6	424		2	YIELD	7/14/2009		North West	Federal St	Union St	Yield (R2-2)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	On Porkchop Island.

Appendix A6
Sign Retroreflectivity (Compliant Signs)

Sign Retroreflective Levels And Physical Data For Retroreflective-Compliant Measured Signs

Town of Milton Signage Conditions - Compliant Signs

Barcode	LeAlpha =.2	BkAlpha =.2	User Comment	STDCom	Sign Type	Date	Location (ft)	Direction	Primary St	Cross St	Sign Type	Setback	Breakaway Anchor	Height	Viewable Distance	Sign Size: Height	Width	Notes
150	72.7	9.5		6	DO NOT ENTER	7/14/2009	9	South West	Federal St	Coulter St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	Under 200'	24	24	
103	433	96.9		6	DO NOT ENTER	7/7/2009	10	North East	Mulberry St	Broad St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
95	0	84.2	N FACE	4	ONE WAY	7/7/2009		North East	Mulberry St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	36	12	N Facing
94	0	82.5	S FACE	4	ONE WAY	7/7/2009		North East	Mulberry St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	36	12	S Facing
105	0.3	253	S FACE	4	ONE WAY	7/7/2009	6	South East	Mulberry St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	12	36	S Facing
104	0.4	274	N FACE	4	ONE WAY	7/7/2009	6	South East	Mulberry St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	12	36	N Facing
91	0.4	67.4	N FACE	4	ONE WAY	7/6/2009	5	South East	Tilney St	Reed St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	24	18	See photo. Vegetation covers sign
76	0.5	254		4	ONE WAY	7/6/2009	6	North West	Union St	Orchard St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	Under 200'	12	36	N. Facing
77	0.6	264	S FACE	4	ONE WAY	7/6/2009	6	North West	Union St	Orchard St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	Under 200'	12	36	S. Facing
58	1.6	75		4	ONE WAY	6/29/2009	7	North East	Chestnut St	Poplar St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	12	24	
176	152	0	PED XING	7	PED XING	7/16/2009	300	North West	Mulberry St	Federal St	PEDXING	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	Ped X-ing. N Facing.
174	186	0	PED XING	7	PED XING	7/16/2009	80	South East	Federal St	Park St	PEDXING	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	30	Ped X-ing. W Facing. Pole Mounted.
175	199	0	PED XING	7	PED XING	7/16/2009	300	North East	Mulberry St	Federal St	PEDXING	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	Ped X-ing. S Facing.
171	200	0	PED XING	7	PED XING	7/16/2009	100	North East	Federal St	New St	PEDXING	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	Ped X-ing
173	208	0	PED XING	7	PED XING	7/16/2009	25	South West	Federal St	New St	PEDXING	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	Ped X-ing. W Facing. Pole Mounted.
172	217	0	PED XING	7	PED XING	7/16/2009	120	South East	Federal St	New St	PEDXING	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	550'-675'	30	30	Ped X-ing. W Facing. Pole Mounted.
68	0	238	25	3	SPEED LIMIT	7/2/2009	1000	North West	Federal St	Lavinia St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	24	
111	0	94.5	25	3	SPEED LIMIT	7/7/2009	50	South West	Chandler St	Behringer St	Speed Limit (R2-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	W Facing
107	0	86.3	25	3	SPEED LIMIT	7/7/2009	150	East	Union St	Chandler St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	
115	0.1	53.6	25	3	SPEED LIMIT	7/7/2009	90	South East	Atlantic Ave	Behringer St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	24	18	Graffitti.
156	0.2	205	E FACE, 25	3	SPEED LIMIT	7/14/2009	50	East	Federal St	Prettyman St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	36	24	Looks to have been hit by trucks / tall vehicles.
127	0.2	65.6	15	3	SPEED LIMIT	7/8/2009	75	South	Walnut St	Coulter St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	N Facing
155	0.4	237	W FACE, 25	3	SPEED LIMIT	7/14/2009		South East	Federal St	Prettyman St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	36	24	Missing Lower Bolt
15	1.3	84	25	3	SPEED LIMIT	6/22/2009	85	East	Bay Ave	Cedar St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	24	18	
28	1.4	253	25	3	SPEED LIMIT	6/22/2009	100	West	Bay Ave	Sussex St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: Under 5'	200'-400'	30	24	Leans toward roadway
27	1.4	84	25	3	SPEED LIMIT	6/22/2009		West	Bay Ave	Hazzard St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	24	18	
120	1.4	76.7	15	3	SPEED LIMIT	7/8/2009	100	North	Collins St	Coulter St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	Bee's Nest!!
82	2.5	279	N FACE, 25	3	SPEED LIMIT	7/6/2009	7	South East	Union St	Tobin St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	24	N. Facing
32	50.2	7		1	STOP	6/23/2009		North West	Shipbuilders Blvd	Genoa Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
3	53.5	10.1		1	STOP	6/22/2009		North West	Atlantic Ave	Sussex St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Leans to Right
165	63.1	9.7		1	STOP	7/14/2009		South West	Bennett St	Frederic St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
90	63.7	8.5		1	STOP	7/6/2009	5	South East	Tilney St	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	See photo
30	64.6	10.3		1	STOP	6/22/2009		North East	Union St	Atlantic St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
67	65.4	11		1	STOP	6/29/2009	10	North West	Federal St	Park	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
166	70.4	7		1	STOP	7/14/2009		South East	Bennett St	Holland St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
110	72.8	9.5		1	STOP	7/7/2009	10	North East	Chandler St	Behringer St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Missing lower bolt.
74	73.8	10.8		1	STOP	7/6/2009	12	South East	Orchard St	Waples	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	Vegetation - poor vis. .. One way sign under stop - ok?
51	74.6	13.3		1	STOP	6/29/2009	10	North West	Chestnut St	New St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	400'-550'	30	30	
117	74.9	10.2		1	STOP	7/8/2009		North East	Mulberry St	Magnolia St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	Pine Tree Branch Obstruction
144	75.3	7.1		1	STOP	7/14/2009	5	North West	Chestnut St	Strawberry Alley	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
159	77.1	25.1		1	STOP	7/14/2009	8	North East	Federal St	Union St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	High variability. White streak down center due to red lamination deterioration.
2	81.4	9.2		1	STOP	6/22/2009		South West	Country Rd	Bay Ave	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
113	83.6	7.2		1	STOP	7/7/2009	10	South East	Chandler St	Ridge Rd	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	NW Intersection. Appears to be E.G. coating on non-metallic sign backing.
114	85.9	10		1	STOP	7/7/2009	20	North West	Chandler St	Valley Rd	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	NW Intersection. Appears to be E.G. coating on non-metallic sign backing.
112	89.6	10.4		1	STOP	7/7/2009	12	South West	Chandler St	Ridge Rd	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	SE Intersection. Appears to be E.G. coating on non-metallic sign backing.
44	92.7	9.3		1	STOP	6/23/2009		South West	S. Spinnaker Ln	Main-sail Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	
109	95.2	14.4		1	STOP	7/7/2009	20	North West	Chandler St	Behringer St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
85	178	15.8		1	STOP	7/6/2009	10	South West	Union St	Clifton	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	Lots of dirt / mold on sign.
88	181	12.7		1	STOP	7/6/2009	10	North West	Tilney St	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
69	193	9.8		1	STOP	7/2/2009	12	South East	Lavinia St	Carey St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
83	208	10.7		1	STOP	7/6/2009	8	North East	Mulberry St	Willow St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
9	209	13		1	STOP	6/22/2009		North West	Atlantic Ave	Yew St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	Close trees that reduce viewable distance. Sign located in roadway
92	216	7.4		1	STOP	7/7/2009	8	North West	Broad St	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
13	217	7.3		1	STOP	6/22/2009		North West	Atlantic Ave	Cedar St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Delamination
11	218	8.5		1	STOP	6/22/2009		South East	Bay Ave	Hemlock St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
125	222	11		1	STOP	7/8/2009		North West	Walnut St	Coulter St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
17	224	20.6		1	STOP	6/22/2009		North West	Atlantic Ave	Pine St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Small amount of spray paint.
119	225	43.8		1	STOP	7/8/2009		North East	Coulter St	Collins St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	Angled Away from Street. Scratches and Vandalized. Corner Resident requests that sight clearances be checked. States decent volume of pedestrian traffic and "blind" turn.
168	228	7.3		1	STOP	7/14/2009		South West	Palmer St	Holland St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	Dirty. Hit by rocks.
128	232	11.9		1	STOP	7/8/2009	75	North West	Walnut St	Parker St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
130	233	12.8		1	STOP	7/8/2009		North East	Atlantic St	Walnut St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
62	234	7.2		1	STOP	6/29/2009	10	South East	Federal St	Manship	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	Minor delamination
123	236	15		1	STOP	7/8/2009		North East	Walnut St	Mill St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Scratched via rocks (minor).
142	237	9.6		1	STOP	7/14/2009	10	North West	Chestnut St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	In Street.
34	243	44.9		1	STOP	6/23/2009		South East	Duory Cir	Genoa Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	
36	243	44.1		1	STOP	6/23/2009		North West	Shipbuilders Blvd	Sailor Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
37	243	44		1	STOP	6/23/2009		North West	Shipbuilders Blvd	Mermaid Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
38	244	44.4		1	STOP	6/23/2009		South East	N. Spinnaker Ln	Mermaid Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
33	244	44.1		1	STOP	6/23/2009		North East	Genoa Ln	Duory Cir	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	

Town of Milton Signage Conditions - Compliant Signs

Barcode	LeAlpha =.2	BkAlpha =.2	User Comment	STDCom	Sign Type	Date	Location (ft)	Direction	Primary St	Cross St	Sign Type	Setback	Breakaway Anchor	Height	Viewable Distance	Sign Size: Height	Width	Notes
66	245	10.5		1	STOP	6/29/2009	10	North West	Federal St	Marshall St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Dead End Street sign attached to back of stop - not permitted by MUTCD?
126	247	15.3		1	STOP	7/8/2009		South East	Walnut St	Coulter St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
35	248	45.6		1	STOP	6/23/2009		South East	N. Spinnaker Ln	Sailor Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	550'-675'	30	30	
39	248	45		1	STOP	6/23/2009		North East	N. Spinnaker Ln	Shipbuilders Blvd	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	30	
4	248	16.2		1	STOP	6/22/2009		North West	Atlantic Ave	Conwell St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
12	248	14.4		1	STOP	6/22/2009		North West	Atlantic Ave	Hemlock St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Surface condition poor
20	249	7		1	STOP	6/22/2009		North	Atlantic Ave	Spruce St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
41	250	45.8		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Main-sail Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	Under 200'	30	30	
40	250	44.8		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Ocean Ct	Stop (R1-1)	Closed Section: Greater than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	
137	251	12.1		1	STOP	7/8/2009		North West	Chestnut St	Prettyman St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
57	253	14.4		1	STOP	6/29/2009	10	North West	Chestnut St	Sand St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
87	255	29		1	STOP	7/6/2009	4	South East	Clifton	Reed St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Mounted on Utility pole
63	255	9.8		1	STOP	6/29/2009	8	North West	Chestnut St	Manship	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
7	259	25.2		1	STOP	6/22/2009		North West	Atlantic Ave	Boxwood St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Peeling, Bubbling
116	265	54		1	STOP	7/8/2009		South West	Union St	Magnolia St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	Minor Spraypaint
65	265	10		1	STOP	6/29/2009	7	South East	Federal St	Hazzard Ln	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	
141	267	30.7		1	STOP	7/14/2009	5	South East	Chestnut St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
145	272	52.5		1	STOP	7/14/2009	7	South West	Front St	Chestnut St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
157	280	54.4		1	STOP	7/14/2009	15	South East	Federal St	Mulberry St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	Delaminating due to rocks.
131	388	100		1	STOP	7/8/2009		South East	Chestnut St	Atlantic St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	In Street. Scratches from minor vandalism. Delamination.
132	395	108		1	STOP	7/8/2009		North West	Chestnut St	Wharton St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	
86	421	94.9		1	STOP	7/6/2009	12	North East	Mulberry St	Clifton	Stop (R1-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	
48	423	92.5		1	STOP	7/2/2009	15	South West	Mulberry St	Mainsail Dr	Stop (R1-1)	Open Section: Greater than 6' from pavement	Yes	Ground Mount: Over 7'	Under 200'	30	30	
102	426	99.3		1	STOP	7/7/2009	10	North East	Mulberry St	Broad St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	400'-550'	30	30	
49	434	101		1	STOP	7/2/2009	8	South West	Mulberry St	Lavinia St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	
46	435	88.5		1	STOP	6/23/2009		South East	Shipbuilders Blvd	S. Spinnaker Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
47	442	97.3		1	STOP	6/23/2009		South West	Mulberry St	Shipbuilders Blvd	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	400'-550'	30	30	
160	448	110		1	STOP	7/14/2009	12	South East	Federal St	Front St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	
158	458	90.1		1	STOP	7/14/2009	30	North West	Federal St	Mulberry St	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	400'-550'	30	30	
42	463	87.2		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Rudder Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
73	486	81.7		1	STOP	7/6/2009	14	North East	Mulberry St	Betts St.	Stop (R1-1)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	Start Alpha = 0.2
18	558	97.9		1	STOP	6/22/2009		South East	Atlantic Ave	Valley Rd	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	400'-550'	30	30	
161	77.6	424		2	YIELD	7/14/2009		North West	Federal St	Union St	Yield (R2-2)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: Over 7'	200'-400'	30	30	On Porkchop Island.

Appendix A7
Sign Retroreflectivity (Noncompliant Signs)

Sign Retroreflective Levels And Physical Data For Retroreflective-Noncompliant Measured Signs

Town of Milton Signage Conditions - Non-Compliant Signs

Barcode	LeAlpha =.2	BkAlpha =.2	User Comment	STDCom	Sign Type	Date	Location (ft)	Direction	Primary St	Cross St	Sign Type	Setback	Breakaway Anchor	Height	Viewable Distance	Sign Size: Height	Width	Notes
136	0.4	8.5		6	DO NOT ENTER	7/8/2009		North West	Chestnut St	Prettyman St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	REPLACE. Major delamination.
60	39.3	15.3		6	DO NOT ENTER	6/29/2009	12	South East	Federal St	Poplar St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Replace. White bleeding through red.
55	58.8	6.9		6	DO NOT ENTER	6/29/2009	12	South East	Federal St	Church St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	Under 200'	24	24	
129	66.2	6.7		6	DO NOT ENTER	7/8/2009	75	North West	Walnut St	Parker St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	24	
143	78.3	6.7		6	DO NOT ENTER	7/14/2009	10	North West	Chestnut St	Mill St	Do Not Enter (R5-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	200'-400'	24	24	In Street.
97	86.4	1.6		6	DO NOT ENTER	7/7/2009	8	South West	Union St	Tilney St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
79	228	6.7		6	DO NOT ENTER	7/6/2009	23	North East	Mulberry St	Orchard St	Do Not Enter (R5-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
100	0	41.4	N FACE	4	ONE WAY	7/7/2009	10	South West	Union St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	24	18	N Facing
99	0	5	S FACE	4	ONE WAY	7/7/2009	8	South West	Union St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	24	18	S Facing
101	0.1	12.4	S FACE	4	ONE WAY	7/7/2009	10	South West	Union St	Broad St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	S Facing
139	0.1	0.3	E FACE	4	ONE WAY	7/14/2009		North West	Chestnut St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	E Facing. In Street.
152	0.2	38.1	W FACE	4	ONE WAY	7/14/2009	10	South West	Federal St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	24	18	W Facing
151	0.2	33.2	E FACE	4	ONE WAY	7/14/2009	10	South West	Federal St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	24	18	E Facing
154	0.2	12.1	W FACE	4	ONE WAY	7/14/2009		South West	Federal St	Prettyman St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	W Facing.
153	0.2	9.1	E FACE	4	ONE WAY	7/14/2009		South West	Federal St	Prettyman St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	E Facing.
98	0.2	8.4	N FACE	4	ONE WAY	7/7/2009	8	South West	Union St	Tilney St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	18	N Facing
134	0.2	1	E FACE	4	ONE WAY	7/8/2009		South West	Chestnut St	Parker St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	24	Old. E Facing.
135	0.2	0.6	W FACE	4	ONE WAY	7/8/2009		South West	Chestnut St	Parker St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	W Facing. Hidden by Tree.
140	0.2	0.5	W FACE	4	ONE WAY	7/14/2009		North West	Chestnut St	Coulter St	One Way (R6-1,1a)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	W Facing. In Street.
148	0.3	3.6	W FACE	4	ONE WAY	7/14/2009	12	South West	Federal St	Mill St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	W Face.
75	0.3	0.6	S FACE	4	ONE WAY	7/6/2009	12	South East	Orchard St	Waples	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	12	36	Vegetation - poor vis.
89	0.4	19.3	S FACE	4	ONE WAY	7/6/2009	10	North West	Tilney St	Reed St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	24	18	S. Facing
147	0.4	0.6	E FACE	4	ONE WAY	7/14/2009	12	South West	Federal St	Mill St	One Way (R6-1,1a)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	24	18	E Face.
53	1.5	9.3		4	ONE WAY	6/29/2009	10	North West	Chestnut St	Church St	One Way (R6-1,1a)	Open Section: Greater than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	24	18	Overhanging Branches
52	1.5	1.6		4	ONE WAY	6/29/2009	10	North West	Chestnut St	Church St	One Way (R6-1,1a)	Open Section: Greater than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	24	18	Overhanging Branches
59	1.6	41.6		4	ONE WAY	6/29/2009	7	North East	Chestnut St	Poplar St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	12	24	
93	14.3	48.3		4	ONE WAY	7/7/2009	8	North West	Broad St	Reed St	One Way (R6-1,1a)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	200'-400'	24	18	
133	0.2	9.4	25	3	SPEED LIMIT	7/8/2009	50	West	Chestnut St	Wharton St	Speed Limit (R2-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	24	Old / Cracking
31	1.4	5.1	25	3	SPEED LIMIT	6/22/2009		South East	Atlantic Ave	Hazzard St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	24	Cracking
19	1.4	2.2	25	3	SPEED LIMIT	6/22/2009	25	West	Atlantic Ave	Valley Rd	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	24	Old, rusty, surface cracking, Shrubs block sign from being seen
8	1.5	39.2	25	3	SPEED LIMIT	6/22/2009	20	North East	Atlantic Ave	Yew St	Speed Limit (R2-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	24	
72	1.8	0.1	CAST IRON	1	STOP	7/2/2009		North West	Hickory Blvd	Sassafras Ln	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	24	24	Glass bead or sand encrusted paint (legend) on cast iron plate. Private street not yet accepted? Does post qualify as breakaway anchor?
170	42	18.7		1	STOP	7/14/2009		South East	Broadkill Rd	Palmer St	Stop (R1-1)	Open Section: Less than 6' from pavement	Yes	Ground Mount: 5'-7'	200'-400'	30	30	
118	44.2	2.5		1	STOP	7/8/2009		South West	Front St	Collins St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	
164	45	39		1	STOP	7/14/2009	15	South East	Broadkill Rd	Bennett St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	Rotated away from road.
167	53.5	5.7		1	STOP	7/14/2009		South West	Bennett St	Holland St	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	
45	57.8	6.6		1	STOP	6/23/2009		North East	S. Spinnaker Ln	Bay Ct	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
43	59.1	4.8		1	STOP	6/23/2009		South West	S. Spinnaker Ln	Rudder Ln	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
81	67.1	33.2		1	STOP	7/6/2009	8	South West	Union St	Tobin Drive	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	Red coating is worn and white bleeding through red.
108	73.4	2.7		1	STOP	7/7/2009	5	South West	Chandler St	Behringer St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
25	73.8	6.6		1	STOP	6/22/2009		North West	Atlantic Ave	Hazzard St	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
163	87.9	6.2		1	STOP	7/14/2009		South East	Broadkill Rd	Morris Ave	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Leaning, rotated away from road.
14	193	2.3		1	STOP	6/22/2009		South East	Bay Ave	Cedar St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Vandalized. poor surface condition
26	199	2.1		1	STOP	6/22/2009		South East	Bay Ave	Hazzard St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
84	200	3.5		1	STOP	7/6/2009	8	South West	Union St	Willow St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	400'-550'	30	30	
96	202	2.4		1	STOP	7/7/2009	10	South West	Union St	Tilney St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Missing upper bolt
56	212	3.2		1	STOP	6/29/2009	12	South East	Federal St	Sand St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Under 5'	Under 200'	30	30	Sheeting lashed - see photo
6	214	2.3		1	STOP	6/22/2009		South East	Bay Ave	Boxwood St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
70	225	5		1	STOP	7/2/2009	8	North West	Lake Dr	Carey St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	Delamination due to gunshots
64	226	5.2		1	STOP	6/29/2009	8	North West	Chestnut St	Hazzard Ln	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	Under 200'	30	30	Tree partially blocking view.
5	226	2.4		1	STOP	6/22/2009		South East	Bay Ave	Conwell St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
169	229	2.1		1	STOP	7/14/2009		North West	Bay Ave	Palmer St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	
1	230	0.6		1	STOP	6/22/2009		South East	Bay Ave	Sussex St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	Peeling Background, Rusted Hardware
21	231	2.1		1	STOP	6/22/2009		South East	Bay Ave	Spruce St	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
162	232	2.3		1	STOP	7/14/2009		North East	Union St	Morris Ave	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: Under 5'	550'-675'	30	30	
22	234	4.6		1	STOP	6/22/2009		South East	Bay Ave	Behringer Ave	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
121	235	3.9		1	STOP	7/8/2009		North West	Collins St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	
149	237	4.7		1	STOP	7/14/2009	9	South East	Federal St	Coulter St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
16	242	1.9		1	STOP	6/22/2009		South East	Bay Ave	Pine St	Stop (R1-1)	Closed Section: Greater than 2' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
78	244	2		1	STOP	7/6/2009	23	North East	Mulberry St	Orchard St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Do not enter sign posted on back.
71	244	1.8		1	STOP	7/2/2009	10	South West	Mulberry St	Lake Dr	Stop (R1-1)	Open Section: Greater than 6' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	Minor Delamination
124	245	2.6		1	STOP	7/8/2009		South West	Walnut St	Mill St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	
106	248	5.7		1	STOP	7/7/2009	12	North East	Union St	Chandler St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: Over 7'	200'-400'	30	30	
122	248	2.4		1	STOP	7/8/2009		South West	Front St	Walnut St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Under 5'	200'-400'	30	30	Scratched via rocks. In Street.
146	256	2.2		1	STOP	7/14/2009	8	South East	Front St	Chestnut St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	In Street.
29	259	5.3		1	STOP	6/22/2009		North East	Union St	Bay Ave	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	550'-675'	30	30	
23	260	6.2		1	STOP	6/22/2009		North West	Atlantic Ave	Behringer Ave	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	550'-675'	30	30	

Town of Milton Signage Conditions - Non-Compliant Signs

Barcode	LeAlpha =.2	BkAlpha =.2	User Comment	STDCom	Sign Type	Date	Location (ft)	Direction	Primary St	Cross St	Sign Type	Setback	Breakaway Anchor	Height	Viewable Distance	Sign Size: Height	Width	Notes
10	260	3.1		1	STOP	6/22/2009		South East	Bay Ave	Yew St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: Over 7'	550'-675'	30	30	
50	262	2.9		1	STOP	6/29/2009	30	South	Federal St	New St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	Stop sign @ Federal 30' back. Add Stop line? See MUTCD
80	268	2		1	STOP	7/6/2009	8	North East	Mulberry St	Tobin	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	
54	271	4.6		1	STOP	6/29/2009	12	South East	Federal St	Church St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	
61	275	4.1		1	STOP	6/29/2009	12	South East	Federal St	Poplar St	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	Under 200'	30	30	
138	277	2.1		1	STOP	7/14/2009		South East	Chestnut St	Coulter St	Stop (R1-1)	Closed Section: Less than 2' from pavement	No	Ground Mount: 5'-7'	200'-400'	30	30	In Street.
24	278	5.2		1	STOP	6/22/2009		South East	Atlantic Ave	Behringer Ave	Stop (R1-1)	Open Section: Less than 6' from pavement	No	Ground Mount: 5'-7'	400'-550'	30	30	Visible damage due to rocks and vandalism

Appendix B
Representative Photographs

Illustrations Of Street Character, Distresses, Or Other Representative Features

Selected Photographs

Atlantic Avenue

B Street

Bay Avenue

Bay Court

Behringer Avenue

Bennett Street

Betts Street

Boxwood Street

Broad Street

Carey Avenue

Carey Street

Cedar Street

Chandler Street

Chestnut Street

Church Street

Clifton Street

Collins Street

Conwell Street

Coulter Street

Duory Circle

Federal Street

Frederick Street

Front Street Extended

Front Street

Genoa Lane

Hazzard Avenue

Hazzard Lane

Hemlock Street

Holland Street

Lake Drive

Lavinia Street

Magnolia Street

Mainsail Drive

Main-sail Lane

ManshipStreet

Marshall Street

Mermaid Lane

Mill Street

Morris Avenue

North Spinnaker Lane

New Steet

Ocean Court

Orchard Street

Palmer Street

Park Street

Parker Street

Pine Street

Poplar Street

Prettyman Street

Reed Street

Ridge Road

Rudder Lane

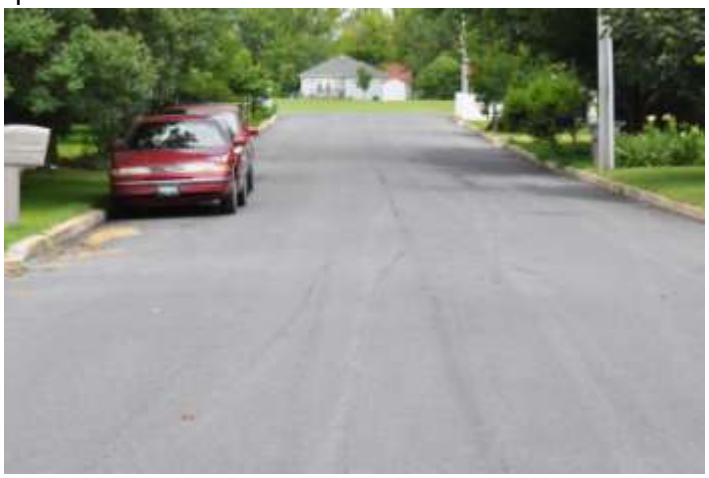
South Spinnaker Lane

Sailor Lane

Sand Street

Shipbuilders Boulevard

Spruce Street



Strawberry Alley

Sussex Street

Tilney Street

Tobin Drive

Walnut Street

Waples Street

Willow Street

Yew Street

Appendix C - Tech Topics

Streets:

Flexible Pavement
Importance of Pavement Integrity
Pavement Distresses
Pavement Maintenance and Repair Techniques

Sidewalks:

Americans with Disabilities Act (ADA)
Why ADA Matters
Physical Dimension Requirements
Civil suits
Passage Plane Encroachment

Signage:

Manual on Uniform Traffic Control Devices (MUTCD)
Retroreflectivity
Signage and Placement Standards
Google Earth Overlays

T^2 Center/LTAP

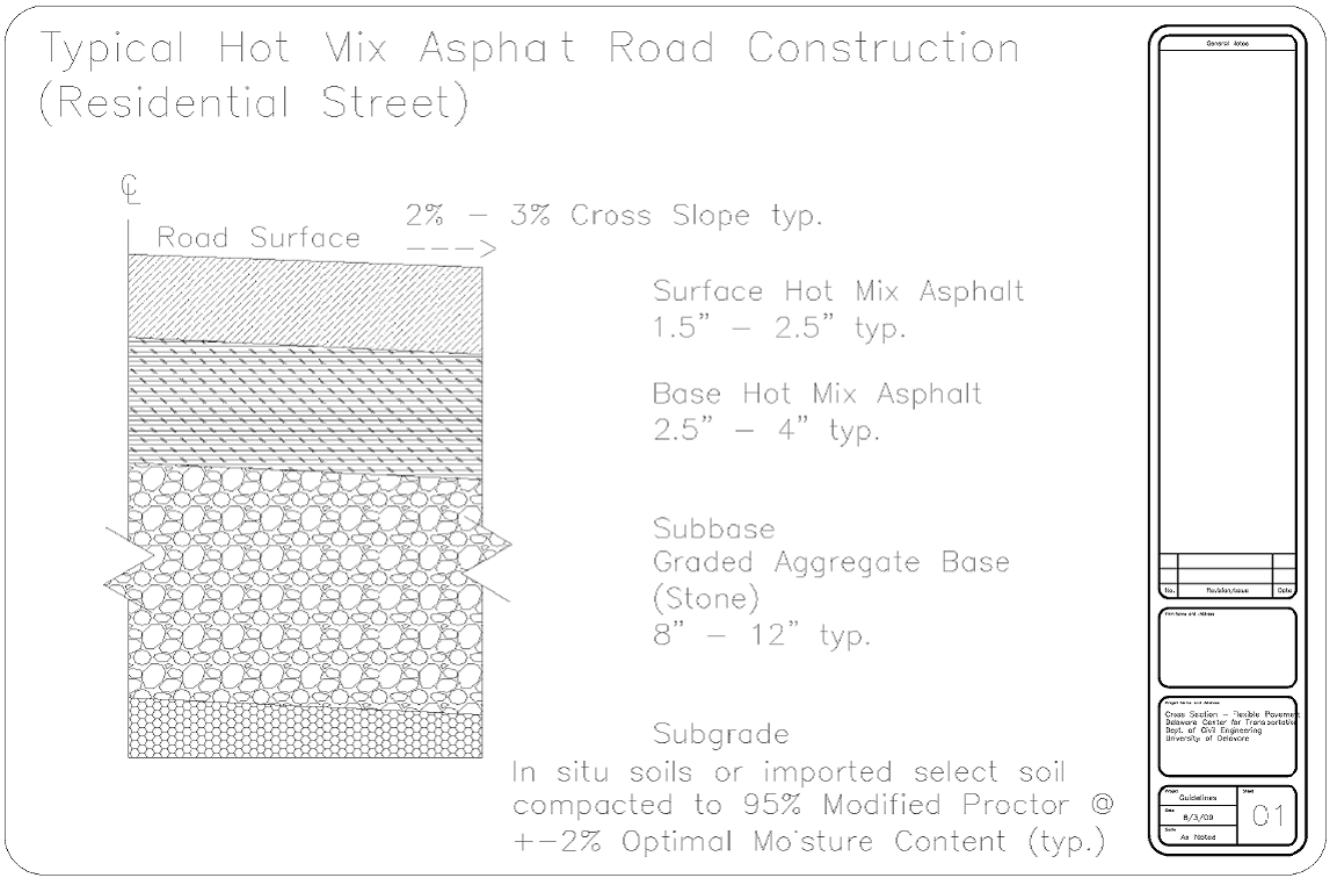
Tech Topic

Flexible Pavement

Roadway pavements are generally categorized as either flexible pavement (i.e., bituminous concrete, aka asphalt) or rigid pavements (i.e., concrete). It is helpful to understand how pavements are generally constructed before considering the distresses that plague them and the remedies that are available. This tech topic will focus on flexible pavements only.

How flexible pavements are built:

Flexible pavement is assembled by several layers of granular material covered with one or more layers of asphalt concrete (see figure below). The construction of the roadway begins with the subgrade, which can be indigenous soils (free of organics) or imported select fill, fine graded to establish the longitudinal and cross slope grades that are desired in the final roadway. Next, a subbase course (typically graded aggregate base or crusher run) is added, followed by an asphalt binder course and an asphalt wearing course. Historically, the asphalt layers have been hot mix asphalt, but warm mix asphalt may become increasingly common in the next few years. The structural strength of each layer is different, with the asphaltic materials contributing the most strength to the road section, followed by the subbase stone, and then the subgrade materials. Flexible pavement is particularly distinguished from rigid pavements in its ability to bend (e.g., when tire loads are applied) rather than crack.



How flexible pavements fail:

All roadway pavements are subjected to a variety of loads, ranging from pedestrians to bicycles and motorcycles to light passenger vehicles to large semi-truck loads. The weight of vehicles is transferred to the pavement as wheel loads, thereby concentrating the stresses along a portion of the pavement width. These wheel loads, together with other factors, can result in a number of failure modes for the pavement, including but not limited to the following.

- Potholes often form as a result of errors during construction (such as segregated hot mix asphalt, poor compactive effort, or poor temperature control) or may result after initial cracking has allowed water intrusion into the subbase stone layer.
- Utility excavation of flexible pavement can allow intrusion of water into the subbase stone and subgrade unless the backfill of these excavations is carefully executed.
- Thermal cracking can result as asphalt ages or because of extreme variations in temperature; cracking allows water to intrude into the subbase stone and exacerbate into other, more significant distresses.
- When excessive flexing of the pavement occurs (e.g., when subgrade strength is lost due to water intrusion), structural support is lost and alligator cracking will occur; this condition allows even greater water intrusion and the concentrated wheel loads will escalate the failure of the road section.
- Rutting or shoving of hot mix layers are usually surface defects that may not affect the structural strength of the road section, but cause discomfort to vehicle passengers and can pose safety concerns (e.g., ability to brake dependably).
- Bleeding is usually a manifestation of poor hot mix production or poor installation, such that the asphalt binder material rises above the aggregate and creates a slick surface, again creating skidding concerns for vehicles.

<u>Suggested Further Reading and References:</u>

- Distress Identification Manual: http://www.faa.gov/airports/great_lakes/airports_resources/certification_bulletins/media/09-07%20Attachment.pdf
- Distress Identification Manual (Old Version): http://onlinepubs.trb.org/Onlinepubs/shrp/SHRP-P-338.pdf
- FHWA Flexible Pavement Distress: http://training.ce.washington.edu/wsdot/modules/09_pavement_evaluation/09-7_body.htm

The Delaware T² Center's full-time Engineer position was established with the primary mission of providing transportation advice and technical assistance to Delaware municipalities. Contact Matt Carter at matheu@udel.edu or at (302) 831-7236 for assistance.

Tech Topic

Importance of Pavement Integrity

Smooth, comfortable, and well-maintained roadways are not only expected by a community's residents, but are important for safety reasons and the local economics. Most residents of a community think primarily in terms of aesthetics or ride comfort when they think of the road system in area. Understandably, they look to see public dollars result in smooth rides and attractive roadside areas.

Public officials look to balance those aesthetic desires with a need to stretch public funds (including many areas outside of transportation). Construction of roadways requires a large capital expense that should be reflected by a responsible long term maintenance program. Pavement distresses that area remedied before they allow a systemic reduction in pavement integrity will avoid costly rehabilitation when distresses area allowed to compound. It has been shown time and again that the life cycle cost of operating a roadway are increased dramatically when the surface condition is allowed to deteriorate beyond a maintainable point.

But pavement integrity is perhaps most important from a safety perspective. A well maintained pavement surface will reduce the likelihood of skidding crashes, braking issues, and vehicle/pedestrian conflicts.

Hence, there are many reasons to construct good roads and then maintain good pavement surface conditions. Long term costs are minimized. The community finds the roadway comfortable and attractive. Safety of motorists, pedestrians, and bicyclists is increased.

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Tech Topic

Flexible Pavement Distresses

Flexible pavements can suffer from several categories and subcategories of distresses that will lead to progressive deterioration of ride condition, structural strength, and motorist/pedestrian safety. The more common distresses found in the Delaware area are introduced herein.

Bleeding

Description: A film of asphalt binder on the pavement surface, such that the surface will appear shiny and/or have black spots or blotchy areas.

Causes: Bleeding occurs when asphalt binder fills the aggregate voids during hot weather, then expands onto the pavement surface. Since bleeding is not reversible during cold weather, asphalt binder will accumulate on the pavement surface over time. This can be caused by an excess amount of asphalt binder in the flexible pavement mixture and/or low air void content. Bleeding typically originates from poor hot mix production or transportation (i.e., segregation of aggregate and binder).

Leads to: Bleeding reduces the friction characteristics of the road surface. As the skid resistance of the roadway decrease, the likelihood of crashes increases.

Typical Repair Methods: When bleeding is minor, coarse sand can be applied to the pavement in order to absorb the excess asphalt binder. When much of the pavement surface is affected by bleeding, the surface may need to be removed (i.e., milled) and the surface wearing course replaced.

Patching

Description: Patches are localized areas of surface asphalt replacement related to utility work or repair of distressed areas.

Causes: Patches commonly are a reaction to localized pavement deterioration (potholes, alligator cracking, etc.) and are intended to be a short to medium term repair. Other times, patches are a response to utility excavations related to repairs or new installation.

Leads to: More long-term deterioration. Well-constructed patches will minimize water intrusion into the subbase stone (which leads to structural deterioration) and maintain an adequate ride condition, but can still be expected to deteriorate over time. A poorly constructed patch will more quickly deteriorate into additional cracking in the area (due to uneven resistance to forces from wheel loads), differential settlement of the surface, additional ponding, and ultimately, loss of structural strength, renewed cracking, and potholing.

Typical Repair Methods: Patching is a repair method itself, but no matter how well a patch is done, it is considered a defect, because it is, under the best circumstances, a discontinuity in the surface material and will allow water intrusion into the subbase.

Alligator Cracking

Description: A series of small interconnected cracks (often originates along wheel track areas). Usually the cracks are many sided and angled pieces with the longest side being less than 1 foot.

Causes: Alligator cracking usually occurs in high stress areas and is usually caused by repeated and/or heavy traffic loadings together with inadequate structural support from supporting layers underneath. Alligator cracking results when the pavement cannot bear the required stress and flexes beyond its ability to ability to self-heal because of a loss of base, subbase, or subgrade support. Stripping at the bottom of the pavement layer (where the asphalt bonds with the subbase aggregate) can limit the road cross section to act as a structural unit and allow cracking. The excess stress that causes alligator cracking may also be a result of heavier loads than provided for in the design of the road.

Leads to: Alligator cracking allows water intrusion, which then accelerates deterioration of the underlying subbase stone and subgrade layers. Ultimately, loss of subgrade strength spreads and creates more widespread cracking and potholes develop.

Typical Repair Methods: In order to be repaired correctly, the root problem of alligator cracking must be identified first. A small and localized area of alligator cracking indicates a loss of subgrade support. This can be repaired by removing the cracked pavement, replacing the poor subgrade area and fixing the drainage, then installing a patch back over this area. The long-term effectiveness of this will depend upon many factors, including the integrity of the subgrade and subbase and bonding of the new and existing hot mix asphalt layers.

A large area of alligator cracking shows that there is structural damage to the pavement. This typically requires replacement of a larger area with a whole new flexible pavement overlay on the entire road.

Crack Sealing Deficiency

Description: Cracks that have developed and begun to expand unabated. These may be cracks that have been sealed before but are no longer effective in preventing water intrusion or they may be newer cracks that have never been treated.

Causes: Cracks, to some extent, are inevitable in pavements. Crack sealing deficiency is when cracks have been allowed to expand, unabated, in both length and width or have not been monitored for recurrence of open conditions or expanded reach.

Leads to: Cracks allow water intrusion into the pavement, which causes more cracks and debonding and allows accelerated development of other pavement distresses. Ultimately, the unmaintained roads have to be replaced more often, increasing the life cycle costs of the roadway.

Typical Repair Methods: Crack seal large cracks in pavement periodically to maintain a sealed surface condition and minimize pavement rehabilitation costs over time.

[need another picture of where it WAS crack sealed before but is no longer effective]

Potholes/Debonding

Description: Potholes are bowl shaped voids or depressions in the pavement surface. Debonding is when the surface layer separates from its underlying layer of asphalt.

Causes: Often, potholes begin as alligator cracking; the small cracks cause pieces of pavement to dislodge when cars drive over them causing the pothole to enlarge. However, potholes also result from local poor compaction, inadequate bonding between layers, or segregation of aggregate and binder during placement.

Debonding usually occurs from poor construction of pavement where a thin surface layer does not adequately bond with the underlying material or flexes excessively. Between asphalt layers, debonding is usually related to inadequate tack application, wet paving conditions, or dust/dirt on the underlying asphalt. Debonding between asphalt layers and underlying stone are more commonly a result of too thin an asphalt layer to withstand forces that cause it to flex. Freeze-thaw action can also be a factor with thinner pavement layers.

Leads to: Unsafe surface conditions, further deterioration, and subgrade failure due to water intrusion. Serious vehicular damage can occur, especially at high speeds.

Typical Repair Methods: A patch is usually done in order to help fix the problem of a pothole. It is best to cut liberally around the entire cracking area in a rectangular shape, remove all loose material, tack seal the edge well, fill in with new asphalt, and crack seal the perimeter to avoid water intrusion. But sometimes pot holes are just filled in with new asphalt without cutting around the entire problem area ("throw and go").

Block and Transverse Cracking

Description: Block cracking is characterized by interconnected cracks that break the pavement into large rectangular pieces. It is different than alligator cracking in that the crack areas tend to be larger, more rectangular, and generally without settlement of the surface material. Transverse cracking forms perpendicular to the centerline of the roadway and usually extends across one or all of the lanes of the road.

Causes: Block cracking occurs from a change in volume of the pavement surface because of temperature conditions, along with the hardening or oxidation of asphalt as the pavement ages. Transverse cracking results more specifically from longitudinal shrinkage of the asphalt surface.

Leads to: The cracks will allow water intrusion and the crack edges will deteriorate by raveling and erode the adjacent pavement. As water enters the underlying layers, the subbase and subgrade will deteriorate and alligator cracking tends to develop, followed by potholes and general pavement section failure.

Typical Repair Methods: Low severity cracks should be crack sealed early to prevent water intrusion and further raveling of the crack edges. In advanced stages of block cracking, milling with an asphalt overlay is generally more effective.

Longitudinal Cracking

Description: Often seen at the centerline, this is any continuous or semi-continuous cracking that parallels the centerline.

Causes: Centerline cracking is usually associated with poor joint construction during the paving operation. However, fatigue can also be a cause, particularly when longitudinal cracking is seen near the edge of pavements where the structural strength of the subbase and subgrade are inadequate.

Leads to: The cracks will allow water intrusion, which damages the underlying support material and leads to crack widening and the erosion of the adjacent pavement. As water enters the underlying layers, the subbase and subgrade will deteriorate and alligator cracking tends to develop, followed by potholes and general pavement section failure.

Typical Repair Methods:

Centerline joint cracks should be avoided to the extent possible through best construction practices during paving operations. When joint cracks do develop, early crack sealing can be an effective means of minimizing the spread of deterioration.

Suggested Further Reading and References:

- Distress Identification Manual: http://www.faa.gov/airports/great_lakes/airports_resources/certification_bulletins/media/09-07%20Attachment.pdf
- FHWA Flexible Pavement Distress: http://training.ce.washington.edu/wsdot/modules/09_pavement_evaluation/09-7_body.htm
- Pavement Condition Rating System, Appendix A: http://www.pavementpreservation.org/publications/PCR%20MANUAL/5pcrappa.pdf
- Distress examples (color photographs): http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_388appendixB.pdf

Tech Topic

Flexible Pavement Maintenance and Repair Techniques

Maintenance and repair of flexible pavements can take a number of basic forms and still other variants on those basic themes. This brief introduction is intended as an overview of the techniques that are more typically used in the Delaware region. The reader will detect a recurring theme – the more early and often pavement preservation and maintenance techniques are applied, the lower the life cycle costs for a given pavement section will be and roadway users will be happier because of it. These brief descriptions are intended only to raise awareness for those not immersed in the transportation field; a plethora of information is available from Internet sites for Federal Highway Administration, state departments of transportation, research universities, and professional organizations specialized in these transportation areas.

Pavement Preservation

Crack Sealing. Rubberized asphalt materials are used to fill cracks that develop in pavement. Crack sealing is appropriate for a broad range of cracks, including centerline and other longitudinal cracks, random cracking, low severity block cracking, and transverse cracking, but is not suitable for high severity cracking such as alligator cracking, which is usually associated with structural deficiencies that crack sealing cannot address. A successful crack seal requires that the crack be free of loose material (usually it is cleaned with compressed air) and dry. Best performance will result from warm weather application.

Figure 1 Crack sealing after several years

Seal Coats and Fog Coats. These types of light applications are somewhat similar to seal coats that are applied to driveways and are suitable only for low volume roads that can be closed to traffic for several hours while the material dries and cures. The benefit of these applications is to minimize water intrusion in pavements that are relatively crack-free and to rejuvenate older pavements that may have oxidized. Care must be taken to avoid the creation of a slick surface that will promote skidding or sliding; sand is sometimes spread lightly before the material dries to create a more skid resistant surface.

Ultra-Thin Lift Hot Mix Overlays. This overlay of typically one inch or less is perhaps the highest form of pavement preservation and is suitable when the pavement is free of structural issues and alligator cracking but has a high degree of other cracking. The intent is to protect the underlying surface material, reduce water intrusion, correct some surface irregularities, and generally extend the pavement life. Their small thickness will allow them to flex more than a typical hot mix layer and its success depends even more than normal on both the design and construction of the material.

Maintenance and General Repair

Figure 2 Pothole or distress patching

Pothole Patching. Maintenance patching is usually associated with minor, localized potholes or utility trenches. In the case of potholes, the repair is typically limited to removal and replacement of the asphalt; if underlying structural problems have developed, a full-depth repair is necessary (see below). Otherwise, "throw and go" or "throw and roll" techniques are quite often used for surface defects and their effectiveness is predictably poor in terms of longevity. Significantly greater effectiveness usually results when the area is saw cut, the degraded asphalt and any loose material is removed, the edge of the existing asphalt is treated with tack as a binding material, good quality hot mix asphalt is placed in the saw cut area with a minimum of handling (which segregates asphalt binder and the aggregate), and the area is compacted with at least a plate tamper (preferably a small drum roller).

Utility Trench Patching. Utility trenches need not create the classic dip or hump most of us are familiar with. Best construction practices dictate that utility trenches be backfilled free of standing water, with good quality fill in small (usually 8") lifts that are thoroughly compacted. Existing hot mix should be cut back from the edge of the trench at least a few inches to stagger the trench joint with the asphalt joint. As with pothole repair, the edge of the existing asphalt should be tacked and a good quality asphalt should be placed with a minimum of handling and compacted with (preferably) a drum roller.

Chip Seals. Some call this tar and chip, but that term is more appropriate for old, ineffective techniques involving very little quality control. Experienced chip seal teams with updated equipment can achieve a surface application that provides protection for an aging asphalt pavement while providing a superior skid resistant surface. Most often, chip sealing is applied to lower volume, lower speed roads, but proper application is not limited to those circumstances. A specialized asphaltic binder is applied to the existing dry surface (after sweeping) with a distributor truck adjusted to apply a uniform coating at a specific rate per square yard (often 0.55-0.65 gal/yd^2. Immediately following the distributor truck, a specialized machine called a chip spreader applies a uniform layer of small stone (⅜" typically), again, at a specific rate per square yard (e.g., 14-18 #/SY). Following close behind the chip spreader, one or more pneumatic (rubber tired) rollers orient and set the chips into the

Figure 3 Finished chip seal on the left, oxidized pavement in the center and hot mix widening on the right, both ready to receive chip seal

asphaltic binder. The binder is usually an emulsion that requires a small amount of time (as little as 20 minutes to perhaps an hour or two, depending upon the weather) to "break" (the process in the curing of an asphalt emulsion by which the globules of asphalt becomes separated from the water; the color of the material will change from brown to black at this point).

Figure 4 Slurry Seal

Slurry Seals. This surface treatment is often used over chip seals but can be used on older asphalt pavements or other surfaces also. It is a homogeneous mixture of emulsified asphalt, water, well-graded fine aggregate, and mineral filler with a creamy, fluid-like appearance. These components are usually mixed in a specialized truck body and transferred to a spreader box that augers the material evenly and thinly across the surface. Slurry seals do not increase the structural strength of the roadway; their primary purposes are to seal out water intrusion and provide a somewhat smoother ride in comparison to other surfaces.

Micro-Surfacing. This treatment is an outgrowth of the slurry seal technology. It is a mixture of asphalt emulsion, water, and mineral fillers, together with polymers and other additives. The technique allows the application of multi-stone thicknesses, whereas slurry seals tend to be applied in a thickness equal to the stone sized used; as such, micro-surfacing is well suited for addressing wheel rutting and other distresses. Its suitability for feathering also makes it a versatile thin overlay. As with chip seals and slurry seals, the asphalt emulsion "breaks" and changes color from a chocolate brown to black, indicating that the material has set.

Rehabilitation and Reconstruction

Full-Depth Subgrade Repairs. When surface distress suggests that a localized structural deficiency exists (e.g., there is settlement at the surface), the simple patch technique described above is insufficient. In this case, the area should be saw cut as before and the existing asphalt removed, but the underlying material that is poorly graded, wet, unconsolidated, or otherwise unsuitable should also be fully removed; it is not unusual for the depth to extend 12-16". The excavated area is then backfilled with graded aggregate base or other suitable subbase material (in no more than 8" layers) and thoroughly compacted. As with the patching described above, the repair is completed with a quality hot mix asphalt layer joined to the existing asphalt with tack. While all patches can benefit from crack sealing upon their completion, full-depth patches are particularly good candidates, given their history for subgrade deterioration.

Mill and Overlay. When larger areas of pavement distress are evident, milling (typically 1-2½") the surface asphalt and replacing with new hot mix asphalt may be more economical and effective. The milling operation also can provide an opportunity to establish a 2-3% cross slope if one does not already exist, which should eliminate standing water in the roadway (thereby minimizing safety

concerns with icing and reducing future pavement distresses associated with water intrusion). Milling and overlay can extend the useful life of a roadway for many years, but only if constructed correctly. There are many critical components (e.g., consideration of drainage impacts, fully swept surface before paving, proper tack application, selection of suitable hot mix design, good paving techniques, compaction, etc.) and best construction practices should be insisted on, enforced with qualified inspectors.

Figure 5 Pavement overlay of a milled surface

Pavement Recycling and Reclaiming. These techniques take on many forms, ranging from cold in-place recycling of the surface asphalt to full depth reclamation of the surface and subbase with or without augmentation, such as soil-cement. Their application depend upon the circumstances, the distresses present, the economics, and other factors. For example, cold in-place recycling can be helpful to reduce hauling costs and the use of virgin materials. Full-depth reclamation using soil cement can be effective where the roadway has lost its structural strength over an extended area.

Suggested Further Reading and References:

This Tech Topic is sufficient only to raise awareness of different techniques. There are many more such techniques available and volumes of detail to help choose techniques for specific situations and achieve a high quality product, only a few of which follow.

- Pavement Preservation Toolbox: http://www.pavementpreservation.org/toolbox/start.html
- Delaware Department of Transportation (DelDOT) pavement specifications: http://www.deldot.gov/information/pubs_forms/manuals/standard_specifications/index.shtml
- Pre-Overlay Treatment of Existing Pavements: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_388.pdf
- Pavement Maintenance (Cornell Local Roads Program): http://www.clrp.cornell.edu/workshops/pdf/pavement%20_maintenance-web.pdf
- Optimal Timing of Pavement Preventative Maintenance Treatment Applications: http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_523.pdf
- Minnesota T^2/LTAP Best Practices Handbook on Asphalt Pavement Maintenance: http://www.lrrb.org/PDF/200004.pdf

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Tech Topic

Sidewalks and the Americans with Disabilities Act

Historically, sidewalks were an afterthought for many roadway designs. Increasingly, sidewalks are seen as an important element of many roadway designs that can integrate transportation modes (vehicles, bicycles, pedestrians, etc.) and provide accommodation for all transportation users and the ADA is primarily responsible for the elevation of sidewalks in transportation design.

The Americans with Disabilities Act

The Equal Opportunity for Individuals with Disabilities (42 U.S.C., Chapter 136, Section 12101, et seq.), better known as the Americans with Disabilities Act (ADA) was signed into law July 26, 1990 and is one of the most far reaching public policies in the world relative to the mobility and accessibility for those with disabilities. An understanding of ADA is essential for those agencies that own and maintain public roadways of any kind, since any alteration of the roadway will require compliance with ADA.

The implications of ADA for the construction, maintenance, and modification of sidewalks are significant and manifest themselves in the Act itself, guidelines and standards from the Access Board (see below), state department of transportation guidelines, tort liability case law, and elsewhere. The applicable standards largely begin with the Access Board, but state DOTs and other agencies often adopt more aggressive standards, and the courts have continued to evolve the standard of care they see in the ADA.

The Access Board

The U.S. Access Board is an independent federal agency that was created in 1973 to ensure access to federally funded facilities and is now a leading source of information on accessible design. The Board develops and maintains design criteria for the built environment, transit vehicles, telecommunications equipment, and for electronic and information technology. Increasingly, the Board was asked to take part in research and testimony before Congress on a range of accessible design issues which would come together as part of the civil rights legislation known as ADA, which expanded the Board's mandate to include: developing the accessibility guidelines for facilities and transit vehicles covered by the law; providing technical assistance and training on these guidelines; and conducting research to support and maintain the guidelines. A year after ADA became law, the Board published its first accessibility guidelines under the ADA.

Guidelines, Guides, and Standards

The Accessibility Guidelines for Buildings and Facilities (also known as Americans with Disabilities Accessibilities Guidelines, ADAAG) is perhaps the best know of these guidelines and has been generally used as a guide for transportation design and retrofit. But because it was developed mostly with buildings in mind, a need for guidelines specifically tailored to roadway issues was need and the Access Board has been in the process of rulemaking for public rights of way since at least 1992, with draft guidelines in 2002 and 2005, but no final ruling as of yet. However, a guide does exist for planning and

design of roadway alterations to provide accessible public rights of way, commonly known as the PROWAC. This guide provides a host of example situations often faced with upgrading sidewalks and curb ramps in challenging environments, together with suggestion solutions.

Beyond the Access Board, state DOTs and other local agencies have developed standards that may exceed those in the ADAAG or PROWAC, either as goals or outright requirements. For example, the Delaware Department of Transportation (DelDOT) has standards for the construction of new streets where elements such as width of sidewalks significantly exceed the Access Board minimum requirements, but its guidance for curb ramp installations during roadway alterations recognizes that existing street rights of way and other limitations may not allow for the ideal sidewalk or ramp at all locations.

Sidewalk and ramp guidelines cover an array of design parameters, but the typical drivers reduce down to several physical characteristics. Specifically, the Access Board calls for a minimum 36" width for sidewalks and curb ramps, but allows as little as 32" outside of ramp areas where unavoidable obstructions are present, provided that there is a relief area at least every 200 feet. However, guidance for new construction and for achievable retrofit locations is to establish 60" wide sidewalks and ramps. Cross slopes of sidewalks and ramps are consistently required at 2%, but most guidelines and standards fail to put an acceptable tolerance (such as 1.5% to 2.5%), allowing too much argument over "how close is close." Running or longitudinal slopes are limited to 8.33% and this is considered a strict upper limit (i.e., 8.5% is not "close enough"). While sidewalks themselves (outside of ramp areas) may exceed 8.33%, any area in excess of 5% is considered a ramp and requirements for resting and recovery areas then apply. ADA applies to all disabilities (beyond just wheelchairs), and so elements like truncated domes are required at ramps as well.

Suggested Further Reading and References:

- Equal Opportunity for Individuals with Disabilities, ADA, 42 U.S.C. §12101 et seq., http://www.law.cornell.edu/uscode/42/usc_sup_01_42_10_126.html
- U.S. Access Board: http://www.access-board.gov/index.htm
- Access Board ADAAG: http://www.access-board.gov/adaag/html/adaag.htm
- Access Board public right of way background: http://www.access-board.gov/prowac/index.htm
- Access Board PROWAC: http://www.access-board.gov/prowac/alterations/guide.pdf
- DelDOT Standards and Regulations for Subdivision Streets and State Highway Access: http://www.deldot.gov/information/pubs_forms/manuals/subdivisions/pdf/standards_and_regulations_031108.pdf
- DelDOT curb ramp design guidance: http://www.deldot.gov/information/pubs_forms/manuals/dgm/pdf/1-16_curb_ramps.pdf
- ADA small town guide: http://www.ada.gov/smtown.pdf

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Tech Topic

Why the Americans with Disabilities Act Matters to Transportation Design

The Equal Opportunity for Individuals with Disabilities (42 U.S.C., Chapter 136, Section 12101, et seq.), better known as the Americans with Disabilities Act (ADA), together with the standards and guidelines at the federal and state level and various tort liability case law, can be confusing and the standards of care even now are evolving to some degree, at least as it applies to transportation elements. It would not be unreasonable for a local agency, mired in any number of unfunded and other mandates, to wonder where accessible sidewalks should fall in their transportation priorities. With some reflection, however, most would find one or more reasons why it should figure prominently.

First, it is sometimes forgotten that ADA covers a number of different disabilities, despite that most of us naturally think of those in wheelchairs only. Other disabilities include, but are not limited to, persons with low vision, those who are legally blind, and other ambulatory and gait impairments (including walkers, canes, and crutches). Some disabilities are temporary (someone on crutches after an accident) and some are permanent. For that matter, those in wheelchairs may be in manually propelled versions, powerful electric wheelchairs, and anything in between and even these different situations provide different demands for accessibility.

Next, municipalities often have surprising concentrations of disabled persons and connectivity with necessary and attractive destinations is something that is usually consistent with the municipality's goals. Local officials want all residents to access government services, shopping, cultural activities, parks, and other attractions to the extent possible. Similarly, economic development often demands that these attractions be as accessible as possible.

Of course, at its most basic level, it should be understood that reasonable accommodation through accessible transportation routes is not a guideline, but rather a law. This should be reason enough, but local officials have many competing responsibilities and usually not enough resources to meet them all, so in the absence of some enforcement process, it is too easy for accessibility to fall by the wayside.

And that leads to tort liability. As can be seen in another Tech Topic, ADA case law has not exempted small communities and has not made allowances for inadequate funding. The courts have upheld ADA requirements for all owners of public facilities, including rights of way. As such, it is important for local governments to establish and implement transition plans that allow eventual consistency with the Access Board's guidelines.

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Tech Topic

Physical Sidewalk Requirements Under ADA

There are many qualitative and quantitative requirements for sidewalks that stem from the Americans with Disabilities Act, but the significant drivers tend to be physical dimensions and a review of those is helpful. This very brief treatment is intended to outline the sometimes challenging criteria for sidewalks, but is no substitute for a thorough understanding of relevant requirements and guidance at the federal, state, and local level.

Sidewalk Widths

In the language of ADA, a sidewalk should be thought of as an "accessible route." The U.S. Access Board's ADA Accessibility Guidelines (ADAAG), in Section 4.2 and Figure 1, requires a minimum width for accessible routes of 36" on a continuous basis, which should generally be thought of as the legal minimum width of a sidewalk. ADAAG does provide for an occasional obstruction that limits the width to no less than 32" for a length no greater than 24"; for example, a utility pole or street sign that leaves only a 32" sidewalk would be permissible, but a utility pole that left a 30" width would not be, nor would an extended planter that limited the width to 32" for more than two feet. Using ADAAG Section 4.13.7, such obstructions (that limit a sidewalk to less than 36") can occur at a maximum frequency such that there is at least a 48" clear distance between the obstructions where a minimum 36" sidewalk is available. Regardless of the presence or absence of obstructions, any sidewalk with less than 60" clear width must be provided passing spaces at least 60" by 60" at least every 200 feet of length. The foregoing details from ADAAG should be considered the minimum requirements under the law. The Access Board and many state DOTs, including DelDOT, target a 48" continuous width where they can achieve it in an upgrade and 60" for new construction. Sidewalks widths are measured from the back of the curb to the back of the sidewalk; the curb is not included in any width measurement.

Ramp Widths

Similarly, ADAAG requires the minimum ramp width to be 36", exclusive of any flared sides (Section 4.7.3). DelDOT requires a minimum 48" wide ramp, with 60" preferred. Curb ramps must have detectable warnings (truncated domes) extending the full width and depth of the ramp (ADAAG, Section 4.7.7).

Sidewalk Slopes

Sidewalk cross slopes must not exceed 2% (ADAAG, Section 4.3.7), and DelDOT's guidance agrees; however, some cross slope approaching 2% is desirable for proper drainage and safety considerations. Longitudinal or running slopes of sidewalks should generally be kept less than 5%, because any length of sidewalk that exceeds 5% must then comply with ADAAG Section 4.8 as a ramp.

Ramp Slopes

Any sidewalk running slope in excess of 5% is considered a ramp (ADAAG, Section 4.3.7), which can then not exceed 8.33% and may not rise more than 30" without requirements for periodic landings (ADAAG, Section 4.8). Ramp cross slopes may not exceed 2%.

Construction Tolerances

Small deviations from these requirements are considered by the disabled community to be critically important and tolerances in construction should not be taken lightly. A 59" wide sidewalk should not be accepted where the required width on construction documents is 60". Cross slopes should be specified, for example, as no less than 1.5% and no greater than 2%, and constructed cross slopes outside of that range should be removed and replaced at the contractor's expense to ensure that the project owner is not held liable in a civil lawsuit. Adequate construction inspection is essential to minimize owner liability.

Again, these are only some of the physical requirements for sidewalks and ramps and even the details for these elements can be more complex under some situations. All upgrade of sidewalks and ramps and all new construction design should be carefully reviewed against the requirements of the Access Board, and relevant state and local codes. Moreover, detailed construction inspection is essential to ensure rigid compliance.

Suggested Further Reading and References:

- Equal Opportunity for Individuals with Disabilities, ADA, 42 U.S.C. §12101 et seq., http://www.law.cornell.edu/uscode/42/usc_sup_01_42_10_126.html
- U.S. Access Board: http://www.access-board.gov/index.htm
- Access Board ADAAG: http://www.access-board.gov/adaag/html/adaag.htm
- Access Board public right of way background: http://www.access-board.gov/prowac/index.htm
- Access Board PROWAC: http://www.access-board.gov/prowac/alterations/guide.pdf
- DelDOT Standards and Regulations for Subdivision Streets and State Highway Access: http://www.deldot.gov/information/pubs_forms/manuals/subdivisions/pdf/standards_and_regulations_031108.pdf
- DelDOT curb ramp design guidance: http://www.deldot.gov/information/pubs_forms/manuals/dgm/pdf/1-16_curb_ramps.pdf
- ADA small town guide: http://www.ada.gov/smtown.pdf

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Tech Topic

Sidewalks, ADA, and Civil Suits

Like the rest of the transportation network, sidewalks can pose safety concerns under even the best of circumstances, and sidewalks are a source of litigation for a variety of reasons. Historically, the classic case involved a sidewalk that was to some degree deteriorated and a pedestrian that tripped and sustained some injury, real or imagined, severe or not. More recently, civil suits centered on the Americans with Disabilities Act (and related statutes, regulations, and standards) have refocused attention for many local governments on the condition and accessibility of their sidewalks.

Like their pavements, signs, and other components, local governments generally wish to have a robust pedestrian system that is in good condition and responsive to the needs of its residents and visitors. But, just as with those other transportation components, there is rarely the available funding, right of way, or other resources necessary to achieve all those goals, and priorities must inevitably be set. Some of the landmark case law related to ADA requires that local agencies adjust those priorities to provide reasonable accommodation for all pedestrians, both able-bodied and disabled.

President Bush, speaking at the 1990 signing of the ADA, predicted limited tort litigation, saying *"…I want to reassure you right now that my administration and the United States Congress have carefully crafted this Act. We've all been determined to ensure that it gives flexibility, particularly in terms of the timetable of implementation, and we've been committed to containing the costs that may be incurred."* Nonetheless, tort liability cases have been prevalent in the courts and have demonstrably impacted planning and design of all manner of public facilities. Regardless of where one comes down on these cases, local governments are well served to be aware of them and develop transition plans to comply with the standards of the U.S. Access Board. The synopses below should not be considered legal interpretation or advice; instead, these descriptions are an attempt to highlight significant finds of the Courts and agencies should consult with their Counsel to determine how these and other cases may bear on them.

In Kinney v. Yerusalim (1993), Kinney et al. pursued complaints against the Secretary of the Pennsylvania Department of Transportation (Yerusalim) and the Philadelphia Streets Department and among other findings, the Court of Appeals for the Third Circuit established that the resurfacing of a city street constituted an "alteration" in the language of ADA and as such, the City was ordered to install curb ramps on those portions of streets where resurfacing would take place (including retroactive requirements for those streets that had been resurfaced since January 26, 1992, the effective date of ADA). Also, the Court agreed that the "undue burden" language in ADA applies only to existing facilities and does not apply once alterations take place; hence, the cost of providing accessible ramps was of no issue once the resurfacing was established as an alteration.

In Barden v. City of Sacramento, California (2004), the final settlement set a nationwide precedent that required all cities and public agencies to make public sidewalks accessible. Under the settlement, the City will allocate 20% of its annual Transportation Fund for the ensuing 30 years to make pedestrian rights of way accessible to those with vision and/or mobility disabilities. This effort went beyond mere

curb ramps and included removal of barriers obstructing the sidewalk, narrow pathways, abrupt level changes, excessive cross slopes, and overhanging obstructions, as well as improvements to crosswalk access. Upgrades to ramps conducted as part of alterations (such as resurfacing) would be completed outside of this 20% allocation (i.e., in addition to the allocation).

Californians for Disability Rights, Inc. (CDR) et al. v. California Department of Transportation (Caltrans) et al. (2008) is an example where the Court addressed the question of sovereign immunity under the 11th Amendment to the Constitution. Caltrans offered an "invitation to 'overrule' Ninth Circuit precedent" by citing dissenting opinions in two Ninth Circuit decisions as authority, but the Court felt that to do so would be to ignore a host of Ninth Circuit decisions that "expressly find a valid abrogation in claims arising under Title II of the ADA." In other words, the Court has determined that this matter has been satisfactorily settled and ADA suitably trumps the 11th Amendment. As importantly, this case began with CDR's assertion that, because Caltrans had failed to survey its 2,500 miles of sidewalk, it could not know what access barriers exist and had therefore failed systematically to remedy barriers (such as missing or inadequate curb ramps, a lack of detectible warning devices, broken or uneven sidewalks, sidewalks that are too narrow, etc.). In essence, the plaintiffs have argued that the lack of the survey or inventory and the lack of a Transition Plan constitute a violation of ADA by themselves.

Here at home, the July 16, 2004 voluntary settlement between the Community Legal Aid Society, Inc. (CLASI), the United States Department of Justice (USDOJ), and the Delaware Department of Transportation (DelDOT) agreed to retrofit 100 curb ramps each year, in addition to any curb ramps installed or upgraded pursuant to its normal construction practices (which now include curb ramp upgrades whenever pavement alterations take place), until such time as the estimated 1,500 non-conforming sites have been remedied.

Suggested Further Reading and References:

- U.S. Code, Title 42, Chapter 126 (Equal Opportunity for Individuals with Disabilities, ADA): http://www.law.cornell.edu/uscode/42/usc_sup_01_42_10_126.html
- U.S. Access Board: http://www.access-board.gov/
- Remarks of President George H.W. Bush at the signing of the Americans with Disabilities Act, http://www.eeoc.gov/ada/bushspeech.html
- Opinion of the Court, Kenney v. Yerusalim, http://www.access-board.gov/prowac/yerusalim.htm
- Barden v. Sacramento: http://www.dralegal.org/downloads/cases/barden/settlement.txt
- CDR v. Caltrans: http://www.dralegal.org/downloads/cases/caltrans/Caltrans_Order.pdf
- CLASI v. DelDOT settlement: http://www.ada.gov/deldot.htm

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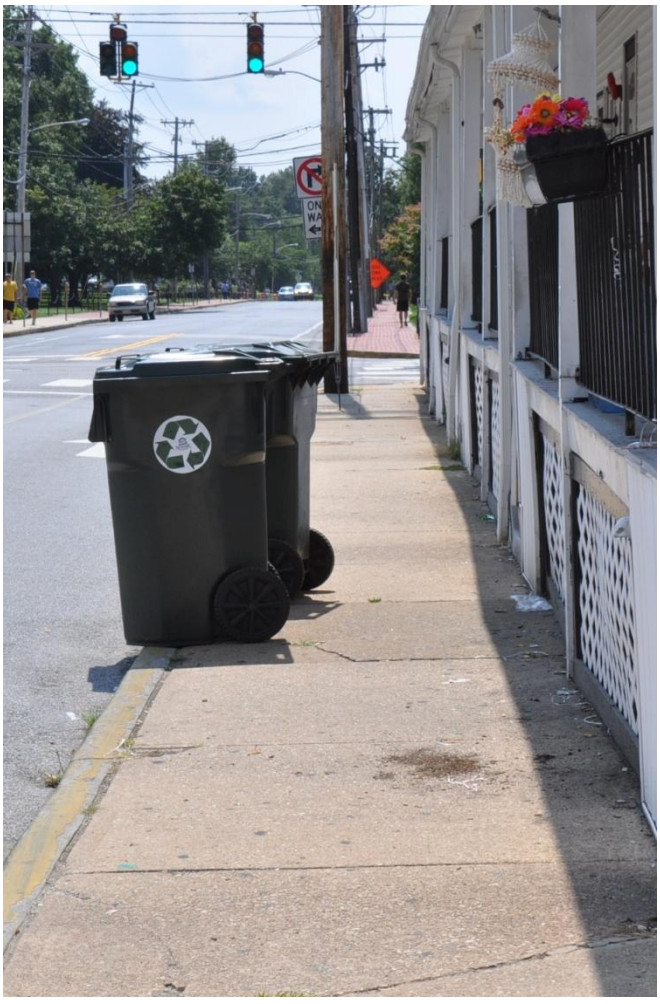
Tech Topic

Pedestrian Passage Corridors for Sidewalks

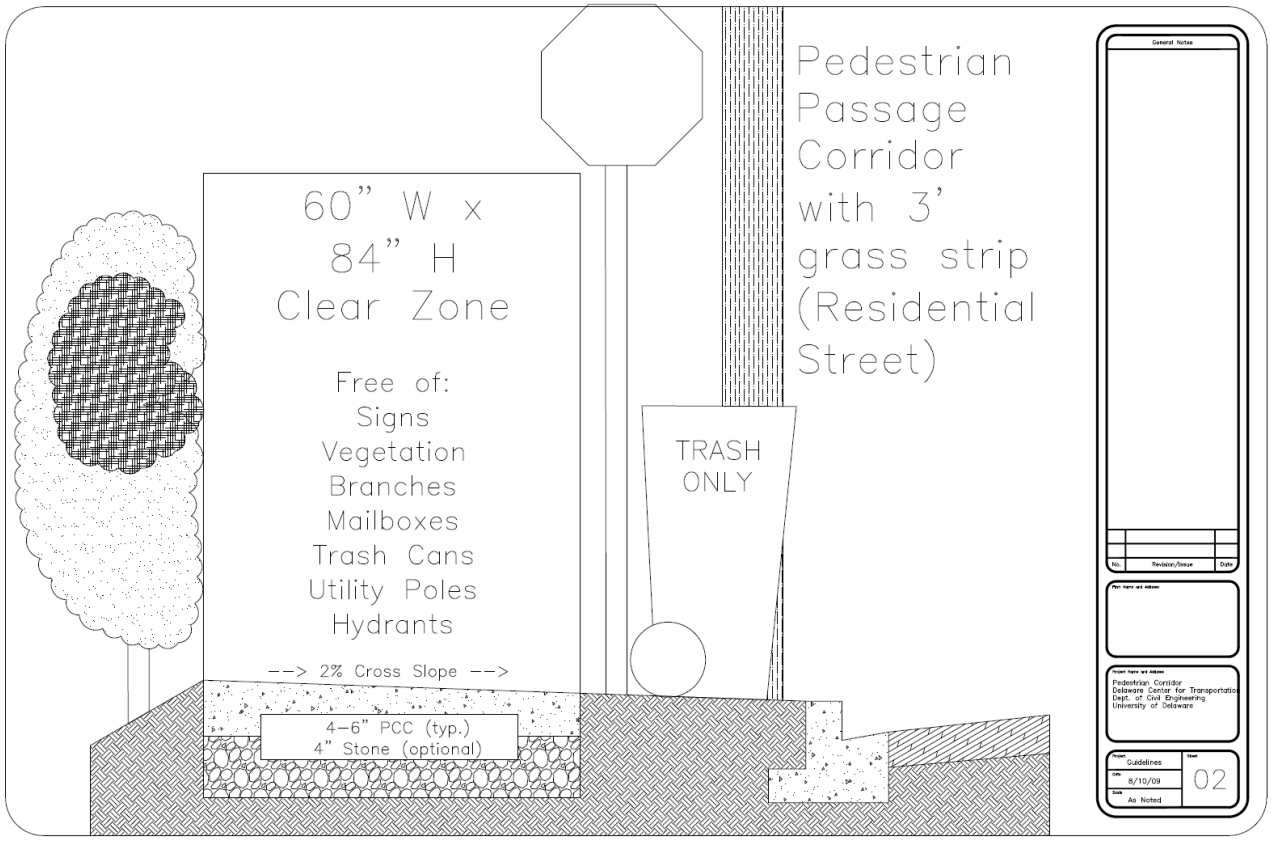
A successful, ideal sidewalk system would be 60” wide throughout its length, would be free of obstructions, and meet all cross slope and longitudinal slope requirements. But even when such a sidewalk system is constructed, it often falls victim to temporary or incremental encroachments that limit its available capacity for pedestrians, particularly those in the disabled community. For example, available sidewalk widths can be lost to trash cans, expanding trees and shrubs, encroaching grass or ground covers, or low mounted signage.

Vegetative encroachments take the form of shade trees, shrubs, ground cover, flowers, and grass. They are often benign when first planted, but over time, they increasingly cover more of the sidewalk or, in the case of grass and flowers, may present a seasonal disruption. Because these happen gradually, they tend to go unnoticed until they are more difficult to manage because they have been entrenched for so long.

Other encroachments are temporary or intermittent, as in the case of trash cans or work zone signage. These can be even less anticipated than some of the vegetative encroachments and can be frustrating to disabled pedestrians who anticipate a clear pathway.



Encroachments can best be understood when we remind ourselves that the disabled community extends well beyond those in wheelchairs. For that matter, electric wheelchairs might be easier to navigate across grass or ground cover encroachment than a manual chair. Low vision or blind persons might find no ground level indications of trees or shrubs with their canes, only to walk into low handing branches, possibly falling in the process. Those with gait impairments may have even other difficulties with some of these encroachments.



To make the most of sidewalk systems, regardless of whether they are ideal or not in their physical construction, a system of local ordinances can be helpful to retain the passage plane or corridor and avoid unnecessary obstructions, even on a temporary basis. Similar to local ordinances that require residents to mow their grass at some point, a local ordinance can prohibit trash cans on sidewalks and can require residents to prune trees and bushes and edge sidewalk grass or ground cover. Similarly, policies for the erection of permanent and temporary signage above 84" can avoid any conflicts.

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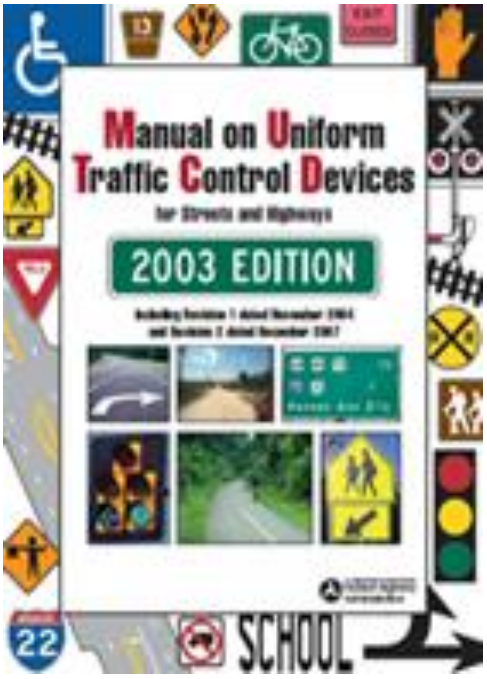
Tech Topic

Manual on Uniform Traffic Control Devices (MUTCD)

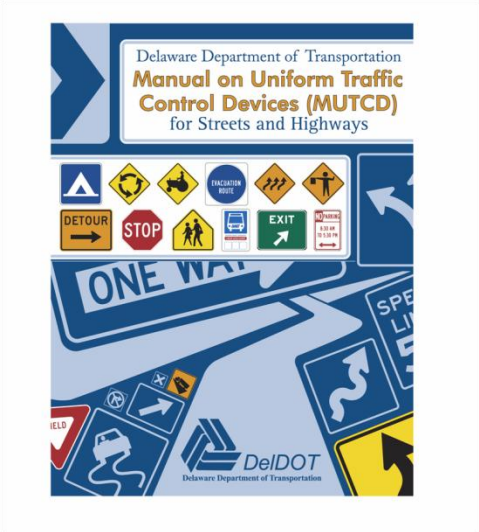
The MUTCD (Manual on Uniform Traffic Control Devices) is a Federal Highway Administration manual, consisting of standards for the installation and maintenance of Traffic Control Devices (TCDs). The MUTCD regulates signage, pavement markings, highway traffic signals, traffic control devices for low volume roads, temporary traffic control (work zones), traffic controls for school areas, traffic controls for highway-rail grade crossings, traffic controls for bicycle facilities, and traffic control for highway-light transit grade crossings.

Stemming from the federal MUTCD, Delaware also has a state-wide MUTCD (Delaware Manual on Uniform Traffic Control Devices) that is a set of mandatory regulations for all state owned roads. The federal MUTCD is applicable to all public roadways, regardless of ownership:



"The responsibility for the design, placement, operation, maintenance, and uniformity of traffic control devices shall rest with the public agency or the official having jurisdiction. 23 CFR 655.603 adopts the Manual on Uniform Traffic Control Devices as the national standard for all traffic control devices installed on any street, highway, or bicycle trail open to public travel. When a State or other Federal agency manual or supplement is required, that manual or supplement shall be in substantial conformance with the national Manual on Uniform Traffic Control Devices. 23 CFR 655.603 also states that traffic control devices on all streets and highways open to public travel in each State shall be in substantial conformance with standards issued or endorsed by the Federal Highway Administrator." (federal MUTCD, Section 1A.07)

Specific to signs, the MUTCD addresses every conceivable aspect, including the design, location, placement, quality, and maintenance. Among other topics, it controls size, color, dimensions, words, symbols, borders, location and roadside offsets, orientation, post designs, and maintenance requirements. A somewhat newer set of standards center on retroreflectivity (the ability, over time, of a sign to reflect a light source back at a vehicle at night); see the dedicated Tech Topic on this subject for further information.



Local governments often mistakenly imagine that the MUTCD does not apply to their roadways and/or they need not worry about its details. This is incorrect on several fronts:

- These same local agencies are responsible for local and visiting motorists and pedestrians, and the details within the MUTCD provide enhanced safety for these populations.

- Driver expectation is a significant factor in preventing crashes, and consistency in signage is an important element in driver expectancy.
- The MUTCD, by virtue of the language in Section 1A.07, is the law and local agencies are indeed bound by it.
- Civil (tort) liability lawsuits affect small jurisdictions as well as large ones and such a lawsuit, with or without apparent merit, can bring a large financial burden to a small town just in legal fees. Compliance with the MUTCD can often be an important element of an affirmative defense for such a defendant.

Suggested Further Reading and References:

- Federal Highway Administration MUTCD: http://mutcd.fhwa.dot.gov/pdfs/2003r1r2/mutcd2003r1r2complet.pdf
- State of Delaware MUTCD: http://www.deldot.gov/information/pubs_forms/manuals/de_mutcd/index.shtml

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Tech Topic

Sign Retroreflectivity

The Federal Highway Administration (FHWA) has enacted changes to the Manual on Uniform Traffic Control Devices (MUTCD) that require new retroreflectivity (a measure of a sign's ability to be read by sensitive driving populations during nighttime and other non-optimal conditions) maintenance standards for signs. Since the MUTCD applies to "any street, highway, or bicycle trail open to public travel," local governments should begin preparing for compliance now. By January 2012, local jurisdictions must establish and implement a sign assessment or a sign management method and all regulatory, warning, and ground mounted signs must be in compliance by January 2015.

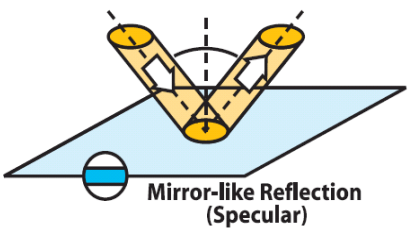
The importance of sign retroreflectivity is seen in these two photographs of the same sign array during the day and then again at night. Notice the variable clarity of the different signs and how one sign has disappeared altogether.

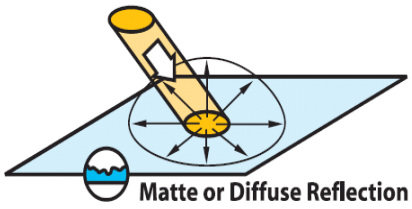
Retroreflectivity is often confused with reflectivity and, indeed, transportation professionals commonly apply the second term incorrectly. And, for our purposes, the difference matters.

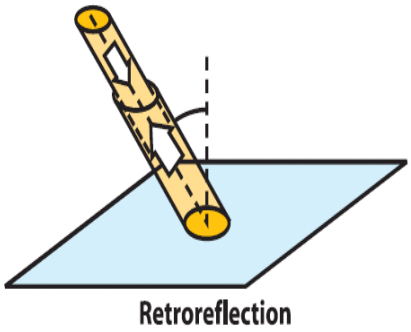
For many, the figures below help de-mystify this cumbersome word that we in the transportation arena have begun to hear at every turn. In this context, light can reflect in three primary ways. The first is the very familiar mirror reflection—if we look directly perpendicular at a mirror surface we see ourselves, but if we look at an angle, we see those objects to the left or the right, up or down. The light source does not return to the source; instead it bounces at an angle equal to the angle it entered the mirror surface.

Diffuse reflection is a phenomenon of light when it hits a matte or dull or other less than reflective surface and, instead of reflecting, tends to scatter or diffuse. For example, we would not see our reflection if we looked into the vinyl siding of our house.

Neither of these reactions is helpful to us for seeing traffic signs at







night. That is why sign sheeting materials are designed to be retroreflective, wherein the light source (in this case, from our headlights) is reflected back along the same axis with a minimum of scattering. This allows the sign to be located safely out of the line of travel and yet be visible at night.

The importance of sign retroreflectivity can be seen again in the photographs below. The chevron signs along this harsh curve are only one of the several visual clues the driver has during the day, when the guardrail, the pavement markings, and the vegetation beyond the curve all provide indications of the curve. But at night on this same curve, only the chevrons remain as visible evidence. Imagine if one or more had poor retroreflectivity and you were a stranger to this curve.

Because of an increasing older driver population in the United States, the MUTCD includes new standards for minimum retroreflectivity levels for most signs. The first compliance date is January 2012, when all state and local agencies must adopt and implement a management or maintenance method (or combination of methods) for sign retroreflectivity. These can be selected from the following:

- Visual Nighttime Inspections. Each of these three methods requires that trained inspectors conduct visual inspections of signs at night at roadway speeds with properly aimed headlamps (low beam).
    - Calibration Signs. Inspectors calibrate their eyes by viewing control signs that are near minimum retroreflective levels and then view roadside signs to spot less retroreflective materials.
    - Comparison Panels. Small sample panels of sheeting material near minimum retroreflective levels are clipped to roadway signs for comparison.
    - Consistent Parameters. A trained inspector greater than 60 years old travels the roadways in an SUV type vehicle with "cut-off" headlamps; this is the method used to establish the minimum retroreflective levels in the supporting research.
- Measured Sign Retroreflectivity. A specialized instrument called a retroreflectometer is used to directly assess a sign for compliance.
- Expected Sign Life. Using various measures of demonstrated sheeting life, signs are replaced when they reach

a certain age, usually through the use of stickers placed on the back of the signs.

- Blanket Replacement. This is similar expected sign life, except that individual signs are not tracked; instead whole groups of signs are replaced based on location or type of sign.
- Control Signs. Groups of representative signs are arranged in a controlled location representative of the in-service location of similar signs; the control signs are measured for retroreflectivity periodically and when they near minimum retroreflective levels, their in-service companions are replaced.
- Future Methods Based on Engineering Study. Consideration was made that other methods might yet be proven in engineering studies.

- Combination of any of the above. The MUTCD permits the combination of these methods in any responsible program that reasonably assures compliance.

The new minimum retroreflectivity levels are shown below (Table 2A-3 from the MUTCD). For the uninitiated, this table appears complicated, with specialty jargon that is unfamiliar. But with a minimum of training, the requirements will be significantly less foreign for most people. For example, the "white on green," "black on orange," etc. sign colors become instantly recognizable by looking at the examples on the next page.

New MUTCD Table 2A-3. Minimum Maintained Retroreflectivity Levels (1)

Sign Color	Sheeting Type (ASTM D4956-04)				Additional Criteria
	Beaded Sheeting			Prismatic Sheeting	
	I	II	III	III, IV, VI, VII, VIII, IX, X	
White on Green	W*; G ≥ 7	W*; G ≥ 15	W*; G ≥ 25	W ≥ 250; G ≥ 25	Overhead
	W*; G ≥ 7	W ≥ 120; G ≥ 15			Ground-mounted
Black on Yellow or Black on Orange	Y*; O*	Y ≥ 50; O ≥ 50			(2)
	Y*; O*	Y ≥ 75; O ≥ 75			(3)
White on Red	W ≥ 35; R ≥ 7				(4)
Black on White	W ≥ 50				—

1 The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m2 measured at an observation angle of 0.2 ° and an entrance angle of -4.0 °.
2 For text and fine symbol signs measuring at least 1200 mm (48 inches) and for all sizes of bold symbol signs
3 For text and fine symbol signs measuring less than 1200 mm (48 inches)
4 Minimum Sign Contrast Ratio ≥ 3:1 (white retroreflectivity ÷ red retroreflectivity)
* This sheeting type should not be used for this color for this application.

Bold Symbol Signs		
• W1-1, -2 – Turn and Curve • W1-3, -4 – Reverse Turn and Curve • W1-5 – Winding Road • W1-6, -7 – Large Arrow • W1-8 – Chevron • W1-10 – Intersection in Curve • W1-15 – 270 Degree Loop • W2-1 – Cross Road • W2-2, -3 – Side Road • W2-4, -5 – T and Y Intersection • W2-6 – Circular Intersection	• W3-1 – Stop Ahead • W3-2 – Yield Ahead • W3-3 – Signal Ahead • W4-1 – Merge • W4-2 – Lane Ends • W4-3 – Added Lane • W4-6 – Entering Roadway Added Lane • W6-1, -2 – Divided Highway Begins and Ends • W6-3 – Two-Way Traffic • W10-1, -2, -3, -4, -11, -12 – Highway-Railroad Advance Warning • W11-2 – Pedestrian Crossing	• W11-3 – Deer Crossing • W11-4 – Cattle Crossing • W11-5 – Farm Equipment • W11-6 – Snowmobile Crossing • W11-7 – Equestrian Crossing • W11-8 – Fire Station • W11-10 – Truck Crossing • W12-1 – Double Arrow • W16-5p, -6p, -7p – Pointing Arrow Plaques • W20-7a – Flagger • W21-1a – Worker

Fine Symbol Signs – Symbol signs not listed as Bold Symbol Signs.

Special Cases

- W3-1 – Stop Ahead: Red retroreflectivity ≥ 7
- W3-2 – Yield Ahead: Red retroreflectivity ≥ 7; White retroreflectivity ≥ 35
- W3-3 – Signal Ahead: Red retroreflectivity ≥ 7; Green retroreflectivity ≥ 7
- W3-5 – Speed Reduction: White retroreflectivity ≥ 50
- For non-diamond shaped signs such W14-3 (No Passing Zone), W4-4p (Cross Traffic Does Not Stop), or W13-1, -2, -3, -5 (Speed Advisory Plaques), use largest sign dimension to determine proper minimum retroreflectivity level.

In representative samples of street signs in Delaware, it is not unusual to find a third or more near or less than minimum retroreflective levels that will become effective January 2012. Stop signs are particularly troublesome, in that they tend to "wash out," a condition where the red overlay fades and the white sheeting underneath dominates and even when the levels of both colors remain above minimum, the contrast ratio (3 to 1) specific to white on red signs fails and the sign is in noncompliance. In-service signs with a southern exposure tend to fail sooner as well.

While no one expects that a Federal Highway Administration sign inspector will visit in January 2012, vehicle and pedestrian incidents of minor and grave consequences can happen on any street and tort liability suits often follow. All local agencies would be wise to move towards compliance now, since compliance does have budgetary implications at all levels. The first step is inventory and some form of assessment of a representative group of signs. Then, a method or methods should be chosen and documented and implementation should begin (including documentation). The Delaware T^2 Center can help with training and one on one guidance.

Suggested Further Reading and References:

- Federal Highway Administration MUTCD: http://mutcd.fhwa.dot.gov/pdfs/2003r1r2/mutcd2003r1r2complet.pdf
- FHWA Know Your Retro website: http://safety.fhwa.dot.gov/roadway_dept/night_visib/policy_guide/fhwasa07020/
- ATSSA Retroreflectivity Clearinghouse: http://www.atssa.com/cs/root/retroreflectivity/what_is_retroreflectivity/basics
- Delaware T^2 Center Retroreflectivity Overview (Power Point Presentation): http://www.ce.udel.edu/dct/t2/Technical%20Briefs%20&%20Case%20Studies.htm

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Tech Topic

Signage and Placement Standards

The Manual on Uniform Traffic Control Devices (MUTCD) specifies all elements of the design, placement, and maintenance of traffic signs. The level of detail spans hundreds of pages, but some key physical characteristics are primary drivers for compliance. Some of those characteristics are described below.

Sign Design. Each sign permitted by the MUTCD is specified in exacting detail, including its background and legend (lettering) colors, the fonts to be used, the symbols to be used, and the dimensions of the sign background material.

Mounting. Ground-mounted signs (versus Overhead signs, normally restricted to state or interstate highways) must be mounted a minimum of five feet or seven feet above the paved surface in the case of rural or business/residential areas, respectively. All signs within the Clear Zone (generally, a roadside area free of obstacles that may pose a threat when a vehicle leaves the paved surface) must be mounted on a yielding or breakaway anchor. Edge of signs must be placed a minimum of two feet from the edge of pavement in the case of closed section (curb and gutter) streets and six feet from the edge of pavement for open section designs (MUTCD, Section 2A.19). Visibility can be affected by trees, bushes, a bent sign post, and many other deficiencies. Providing for a driver to see a sign from the greatest distance enables a driver to know what to expect at an intersection or along a stretch of roadway.

Retroreflectivity. Most signs are now required (effective January 2012) to be constructed with minimum retroreflectivity and be maintained or replaced in accordance with those levels (MUTCD, Section 2A.08, et seq.). For more information on retroreflectivity, see the Tech Topic on this issue.

Suggested Further Reading and References:

- Federal Highway Administration MUTCD: http://mutcd.fhwa.dot.gov/pdfs/2003r1r2/mutcd2003r1r2complet.pdf
- State of Delaware MUTCD: http://www.deldot.gov/information/pubs_forms/manuals/de_mutcd/index.shtml

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Tech Topic

Sign Data Overlay for Google Earth

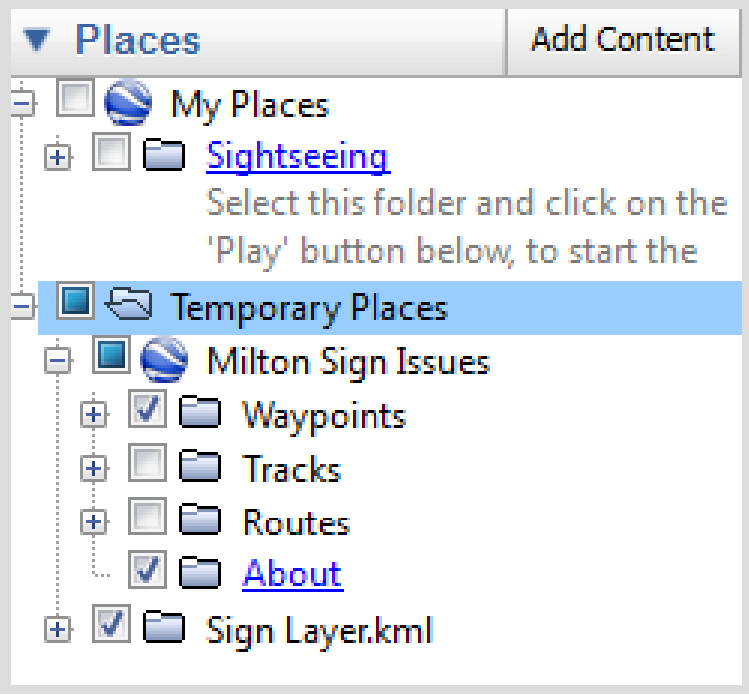
The Delaware T^2 Center's RoadVista 922 retroreflectometer stores a great deal of information for each inventoried sign. It saves the date and time the information was recorded, the various retroreflectivity levels (for both observation angles, α=0.2 and α=0.5), the GPS coordinates (latitude and longitude), it can scan a bar code so that a unique sign identification number can be used for each sign, and it also has the option to add user comments. Once the information is collected, the device can be connected by a USB cord to a computer where the information can be easily imported. The data can then be viewed and analyzed in a spreadsheet style format. But, since the retroreflectometer collects GPS locations of each sign, the data can also be viewed in a graphical view for those more comfortable with data in that format. We transferred the data for this project into an overlay file that can be easily viewed with Google Earth.

Along with retroreflectivitiy levels, there was some important physical damage to some signs that are important to take notice of. A camera with a GPS coding device was used to take pictures of these damaged signs. Just like the user would click on a sign icon to get all the data, the camera icon can be clicked on to show the user a picture of a damaged sign.

Google Earth is a free program that is simple to download onto most computers. In an Internet search engine, a user should search "Google Earth" and follow the link to a down load screen. The link for the most recent version of Google Earth is: http://earth.google.com/download-earth.html.

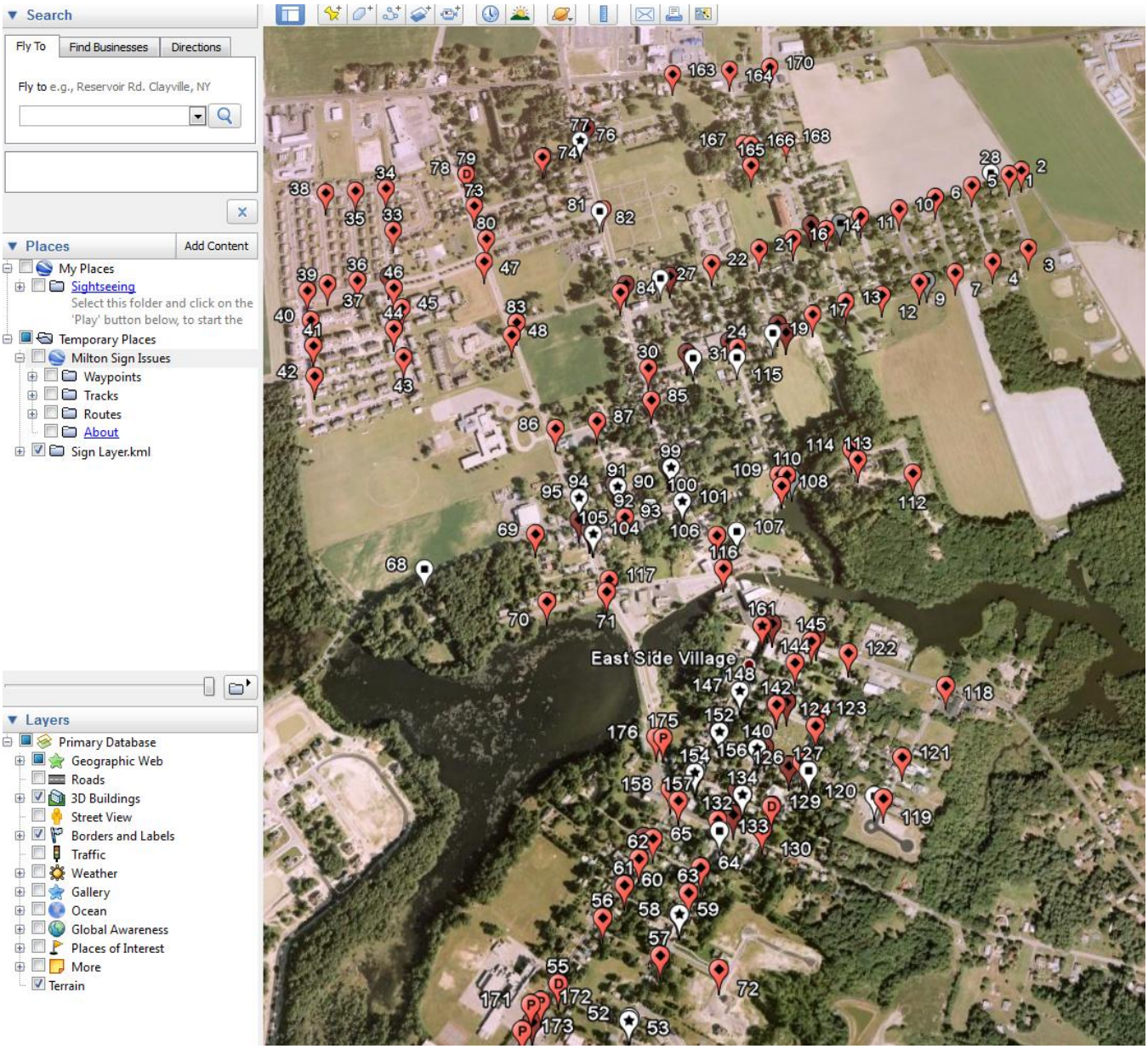
After saving the imported information from the retroreflectometer, it can be opened in an Excel file. With a little manipulation and converting the file to a .csv format and further conversion to a .kml file, each sign and picture in Google Earth can be clicked on to see its specific conditions. Similarly, geocoded digital photographs can be layered by creating a .kmz file as an overlay for Google Earth. The screen shot above shows what Google Earth looks like with the signs and their ID numbers, as well as each picture and their file name once imported.

This can get very cluttered with all of the information in a large area like the above screen shot. The best way to handle the information is to zoom in (double click the left mouse button or use the zoom button on the top right of the Google Earth screen). Another way is to hide layers on the Google Earth map. There are different layers of signs and pictures. On the left hand panel, under "Places", the files are opened and can be shown under "Temporary Places". The check boxes indicate whether a layer is turned on or off.

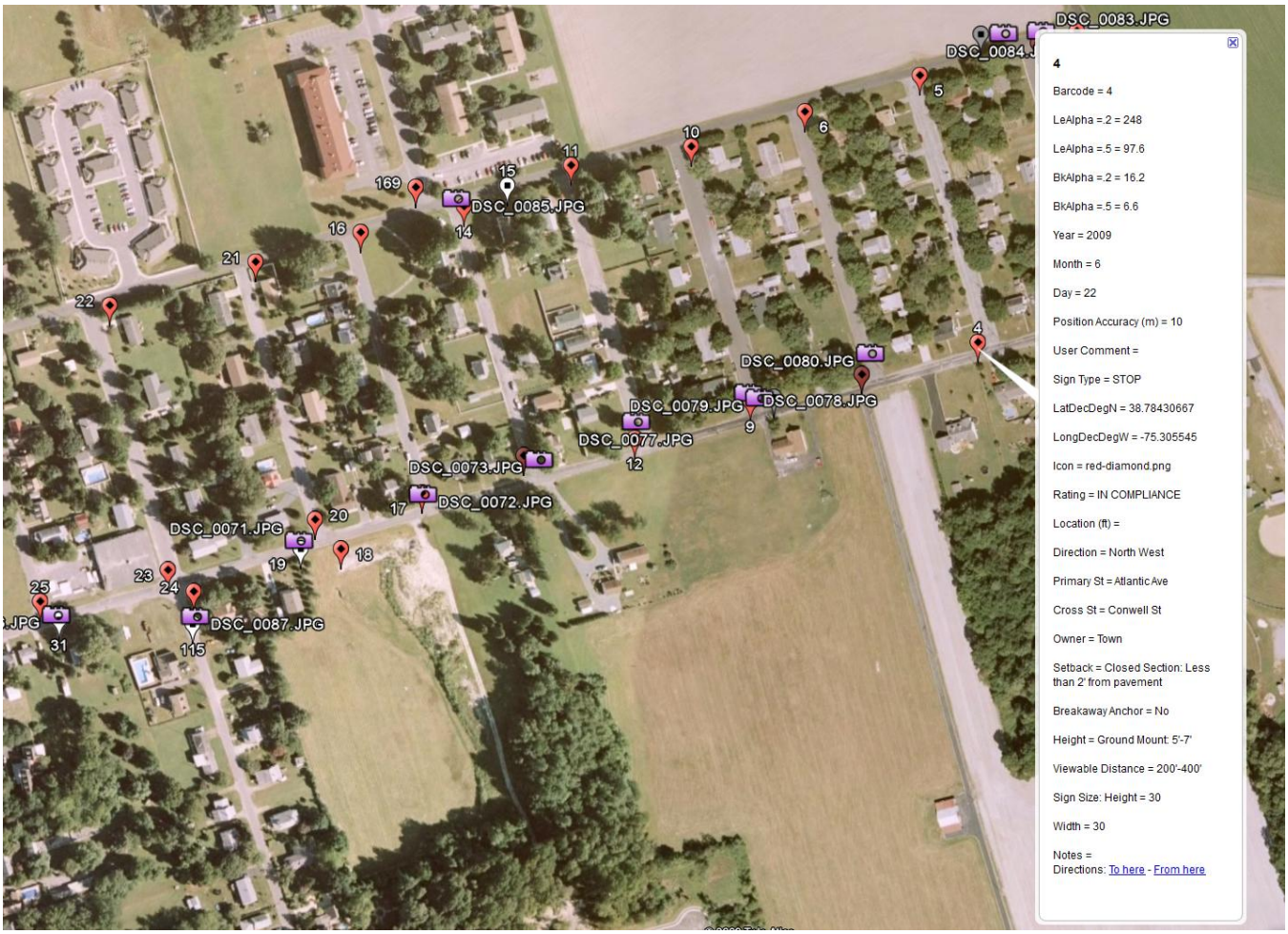


When some of these multiple boxes are "unclicked" and only one set of information is shwon, the map is a lot less cluttered and the user is able to see information better. For example, if the user were to unclick the picture file, the map would just show the signs like the screen shot below.

Conversely, the sign information layers could be clicked off and the photographs could be shown.

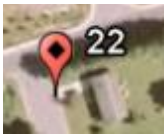


If a user is to click on one of the signs, all of its information will show up right on the screen. The following screen shot shows an example of this.



The screen shot above shows:

- Barcode. The barcode number scanned for that specific sign.
- LeAlpha=.2, LeAlpha=.5, BkAlpha=.2, and BkAlpha=.5. These are the retroreflectivity readings from two different observation angles; the federal MUTCD requires the use of an observation angle α=0.2.
- Position Accuracy. The accuracy of the GPS reading, in meters.
- User Comment. If a comment was entered in the retroreflectometer by the user when recording readings for the sign, it will appear here. For example, if the sign was hidden by a tree and comment entered to that effect, that comment would appear in this spot.
- LatDecDegN. The latitude in order of decimal then degrees north.
- LongDecDegW. The longitude in order of decimal then degrees west.
- Rating. Registers if the retroreflectivity readings were in or out of compliance with the current standards of the MUTCD.
- Sign Type: The type of sign that was monitored, also shown by the symbol on the screen.

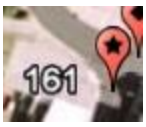


Red bubble with a black diamond inside is a Stop sign.

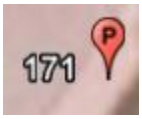
White bubble with a black square inside is a Speed Limit sign.

White bubble with a black star inside of it is a One Way sign.

Red bubble with a “D” inside of it is a Do Not Enter sign.



Red bubble with a black star inside of it is a Yield sign.



Red bubble with a black “P” inside of it is a Pedestrian Crossing sign.

The purple camera icon indicates that there is a picture of a nearby sign. Each camera icon is tagged with the file name of the picture in the picture file so that it can be easily found. Signs that have physical damage are shown on the map by a picture icon so that they can be easily identified while browsing the map. Simply clicking on the picture icon will show the user the picture of that sign.

Clicking on a camera icon, the user would see a picture like the following, which includes the file name at the top and a small description underneath of what the picture is showing:

These Google Earth overlays makes it easy for anyone to browse where and which signs are out of compliance, which can be very helpful into deciding which signs should be replaced. Indeed, with limited budgets, this type of browsing tool can help prioritize sign replacement and monitoring activities over a several year period.

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Tech Topic

Technology Transfer (T^2) Centers

National LTAP Program. The T^2 Program, known in many states as LTAP (Local Technical Assistance Program), has existed for over 25 years and is comprised of 58 Centers nationwide. Each of the states has a Center, in addition to Puerto Rico and seven regional tribal Centers. The mission of the program is to "foster a safe, efficient, and environmentally sound surface transportation system by improving skills and increasing knowledge of the transportation workforce and decision makers." The Centers assist local counties, parishes, townships, cities, and towns improve their roads, bridges, sidewalks, and signage through information resources, training, technology updates, newsletters, and one-on-one consultations with local government agencies. The Centers are truly partnerships between the Federal Highway Administration, state departments of transportation, universities, and the local agencies that we seek to serve.

Delaware T^2 Center. Delaware's Center is located at the University of Delaware within the Delaware Center for Transportation (DCT) and the College of Engineering's Department of Civil and Environmental Engineering. The DCT acts as the research and education arm of the Delaware Department of Transportation (DelDOT), providing the T^2 Center a meaningful linkage between the academic and research elements of the University, DelDOT's innovative and emerging practices, and the training needs expressed by DelDOT and other local agencies, including Delaware's 57 municipalities. Workshops and other training opportunities sponsored by the T^2 Center are often excellent venues for engineers, planners, scientist, and contractors to share their experiences, including both their successes and failures, for the benefit of others facing similar challenges. Delaware's public transportation agencies of all sizes are encouraged to call on the resources of the T^2 Center whenever and however they think we might be helpful.

Suggested Further Reading and References:

- National LTAP/TTAP website: http://www.ltapt2.org/about/
- Delaware T^2 Center website: http://www.ce.udel.edu/dct/t2/t2.htm
- Delaware Center for Transportation: http://www.ce.udel.edu/dct/

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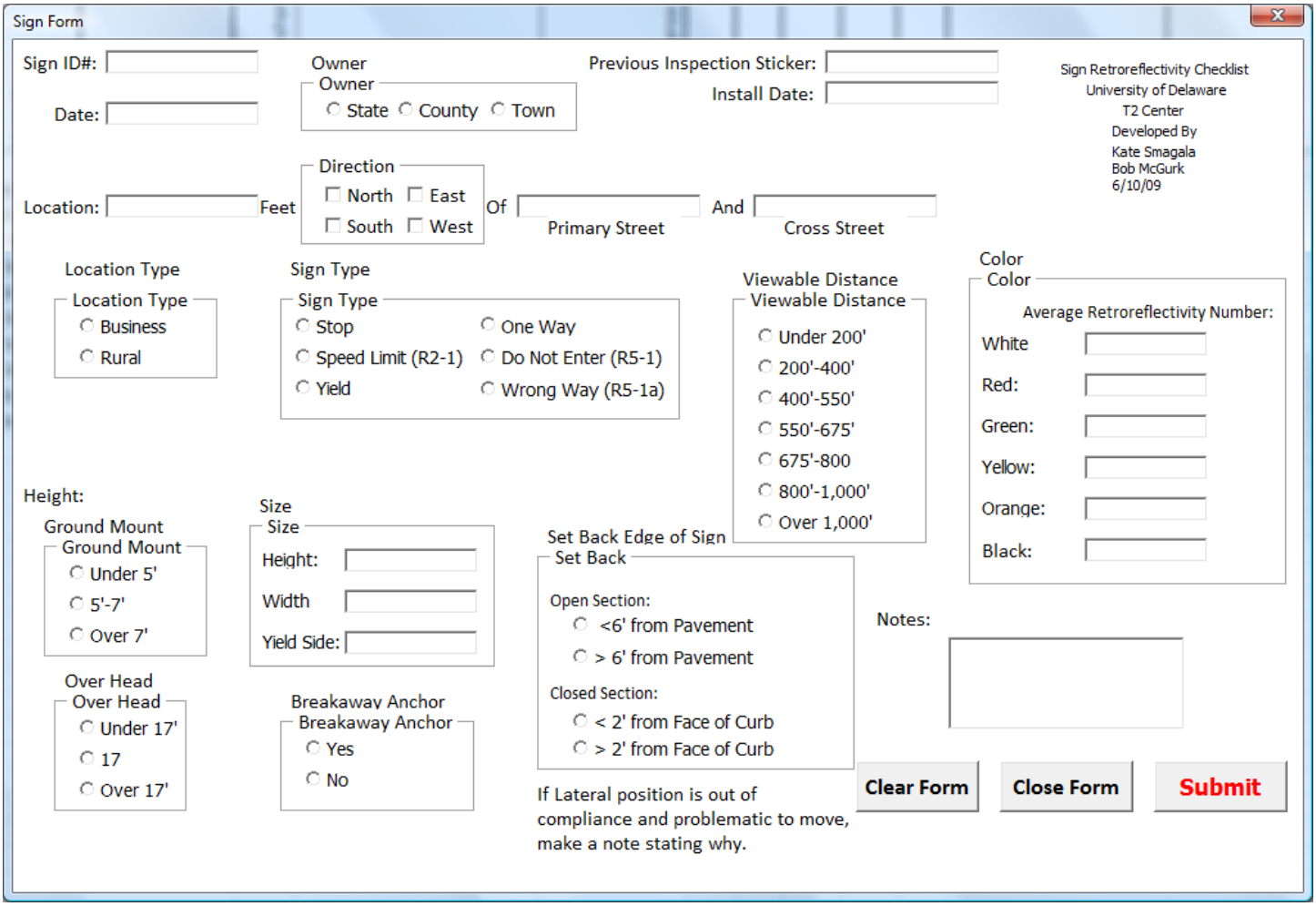
Appendix D
Data Collection Sheets & Methodologies

Methodologies
Pavement Checklist
PCR Rating Sheet
PCR Guidance Sheet
Curb/Sidewalk Checklist
Sign Checklist

Data Collection Sheets and Methodology

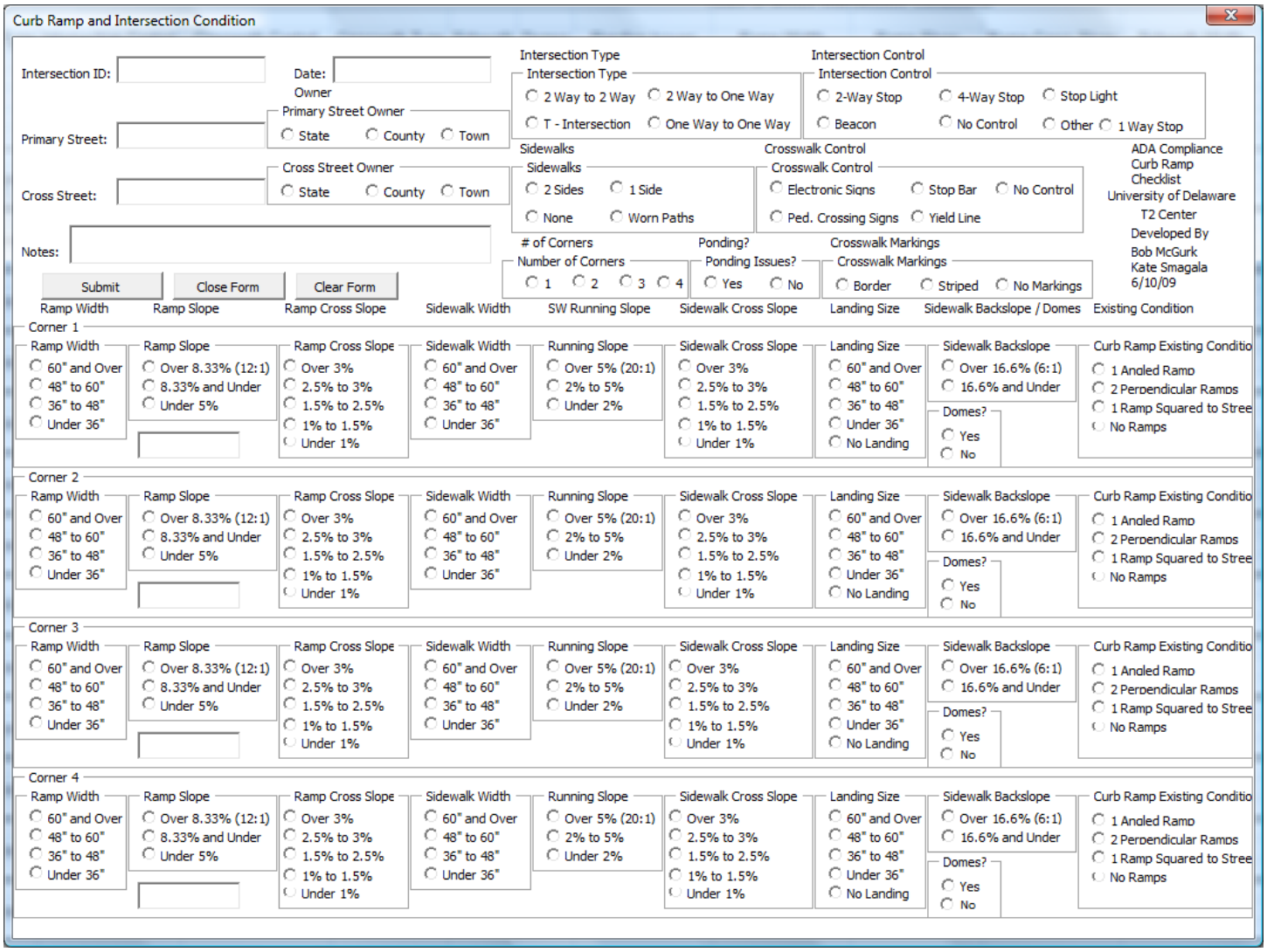
Sign Checklist



- **Sign ID #:** When using the retroreflectometer, it allows the user to scan a bar code. The bar code is referred to as the sign identification number.
- **Owner:** The owner of a sign is the state, the county, or the town.
- **Primary Street vs. Cross Street:** The primary street is the street which most traffic runs along. In the case of a T-intersection, the primary street is the street at the top of the T.
- **Direction:** If a sign is located on a corner, this section should be filled in such that it is located on the direction of that corner of the primary and the cross street. If a sign is located anywhere else, this section should be filled in with respect to how many feet it is away from the closest intersection.
- **Viewable Distance:** The viewable distance of a sign is how far it can be seen when approaching it.

- **Color:** The average retroreflectivity number is read right off of the retroreflectometer. After taking multiple measurements (at least three on different areas of a sign), it averages them altogether. It gives two different readings, one under α=0.2 and another under α=0.5. These different numbers are the Observation Angle that the retroreflectivity is being measured at. The required retroreflectivity levels in the MUTCD are followed using α=0.2 reading; therefore, the average of those readings should be recorded. First measure and record the legend reading, then measure and record the background reading. More information can be found regarding retroreflectivity and the use of the retroreflectometer in the Tech Topics section of this report.
- **Height:** Ground Mount vs. Over Head – A ground mount sign is when a sign is on a post in the ground and an over head sign is when it hangs over the road. Small towns usually have few, if any over head signs. The height of a sign must be measured from the pavement to the bottom of the sign.
- **Sign Size – Height, Width, Yield Side:** Height and width are the dimensions of the sign itself (e.g. 30" h x 24" w). In the case of pennant shape signs (e.g., Yield), the lengths of all three sides are measured.
- **Breakaway Anchor:** All signs within the Clear Zone must now be installed on breakaway or yielding anchorages.
- **Lateral Offset – Set Back Edge of Sign: open section vs. closed section:** The Delaware MUTCD and the FHWA MUTCD both dictate that the nearest edge of a sign be greater than 6' from the edge of pavement on open section roads or greater than 2' from the face of the curb on closed section roads. No maximum distance is mentioned, but as distance increases, sign effectiveness decreases. Engineering judgment may be used to place signs in more effective locations, sometimes as close as 1' offset (see Section 2A.19 of the MUTCD), but must be documented with the reasons as to the deviation.

- **Intersection Checklist**



- **# of Corners:** One corner would be a situation where a road makes a 90 degree turn. Two corners would be a T-intersection. Three corners would be a Y-intersection. Four corners is the intersection of two through streets.
- **Ponding:** In order to determine if there is ponding at the intersection, look for low spots and/or signs of sediment or debris.

For each of the four rows for sidewalk/ramp infoamtion, designate a position to each corner (NW, SW, SE, NE)

- **Ramp width:** ADAAG[1] requires a 36” minimum curb ramp. DelDOT DGM 1-16 (Curb Ramp Specifications) requires a 48” minimum with 60” preferred curb ramp. Width is the width of

[1] Americans with Disabilities Act Accessibility Guidelines

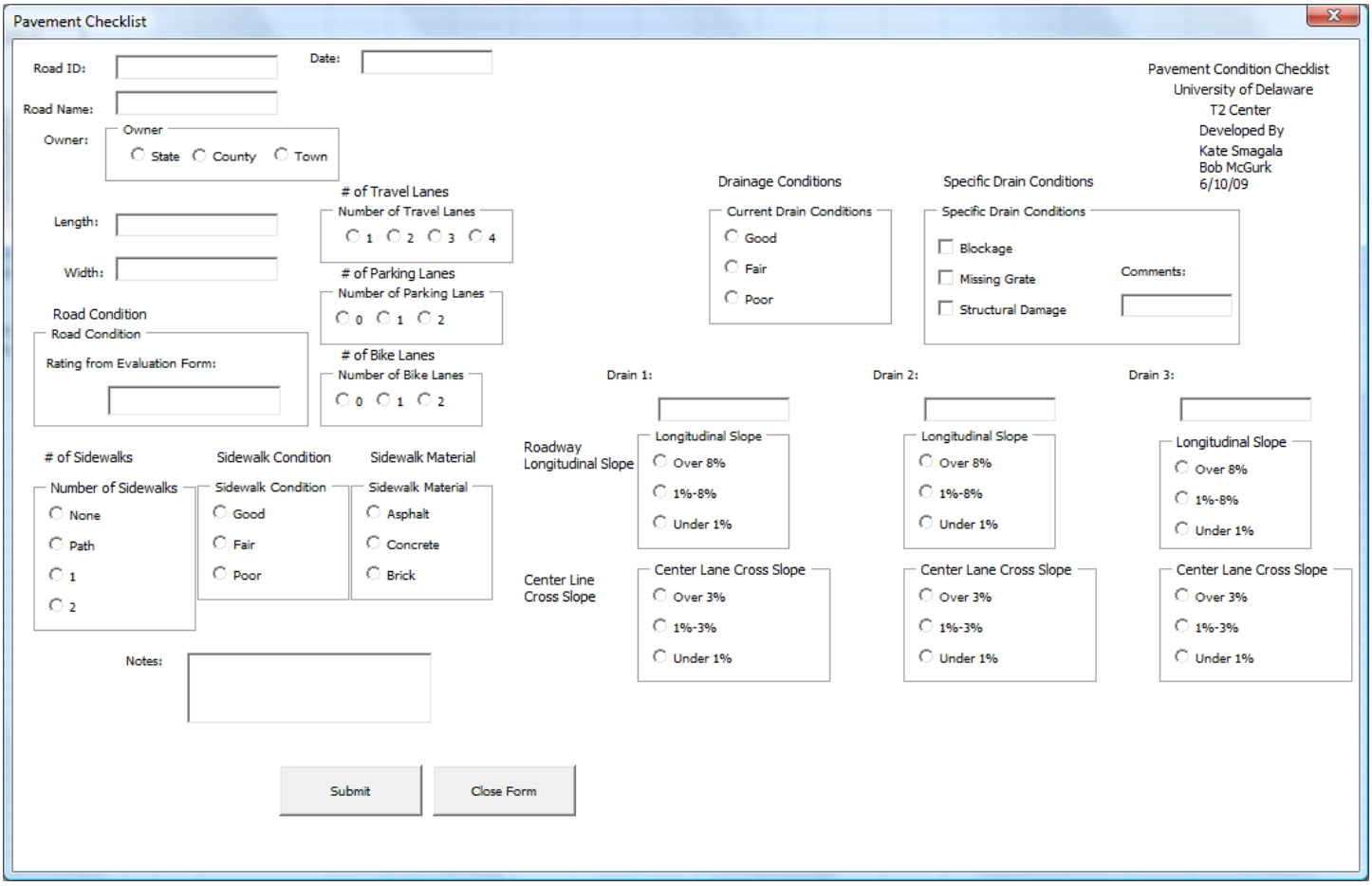
the ramp itself as it slopes to the pavement. In the case of an angled ramp, measure the arc length of the intersection of the ramp and the pavement.

- **Ramp Running Slope:** According to ADAAG, any section of sidewalk greater than 5% is considered a ramp, and therefore it is limited to a maximum rise of 30". A landing of at least 60" in length is to be provided at the top and bottom of ramps, unless a change of direction is required; then, the landing shall be a minimum of 60"x60". The maximum longitudinal (running) slope for a ramp is 8.33% (12:1). Slopes may increase to 10:1 for a maximum rise of 6" when there is inadequate distance for a 12:1 ramp.
- **Ramp Cross Slope:** ADAAG and DelDOT DGM 1-16 state that the cross slope shall be a maximum of 2% (50:1). However, other documents from ADAAG and DelDOT either confuse or contradict the matter and some clarification is needed, since construction requires some tolerance limits. We approximated a reasonable range (1.5% - 2.5%) that could be expected in field conditions as meeting the requirement; we have not authority to do so, but we needed some range for practical reasons, since one can place a level in three places on a ramp and get at least somewhat different slopes. Higher ranges risk a slippery surface when wet and more energy required for people with mobility impairments. Lower ranges indicate a lack of proper drainage, allowing for ponding and ice formation in cold weather.
- **Sidewalk Width:** Measure the sidewalk on both streets (if sidewalks exist on both) at each corner. Measure from edge to edge of the sidewalk, but do not include the curb in your measurement. We were very literal in our measurement of this criterion – for example, DelDOT requires a 60" sidewalk for new construction, not a 59.5" sidewalk, so if it came up short it came up short and we dropped it in the literal range on our data sheets. Hence, there may be many sidewalks we measured that are very close to 60" or 48" or 36", etc.
- **Sidewalk Running Slope:** Measure the longitudinal slope of the sidewalk. Sidewalks may be graded in line with the street, but should be less than 5% (20:1). Anything over 5% is considered a ramp.
- **Sidewalk Cross Slope:** Measure the slope across the sidewalk on the primary street. See Ramp Cross Slope for discussion.
- **Landing Size:** Turning maneuvers are required at curb ramps, so the minimum size of a landing shall be 60"x60", as per ADAAG. Measure and record the shortest side.
- **Sidewalk Backslope:** 6:1 maximum is required unless the sidewalk is against a building. This is important at landings that do not meet minimum dimensions so that turning maneuvers can occur.
- **Truncated Domes:** At the bottom of the ramp look for a patch of different material or different color then the sidewalk with raised bumps on it. Domes must in place for the 24" leading up to an at-grade entry into the roadway (ramp). Domes must extend over the entire width of the ramp. Driveways are excluded.
- **Existing Condition:** See DelDOT Standard Construction Drawings for Ramp Types.
  1 Angled Ramp: This is where the center of the ramp leads into the street and is facing the center of the intersection; typical at small radius intersections.
  2 Perpendicular Ramps: This is where the corner has two cross walks leading off in both directions, one for each street.

1 Ramp Squared to Street: This ramp is parallel with the primary street and the ramps enter the cross street in a perpendicular fashion; i.e., there is no crosswalk in the primary street.

No Ramps: The corner does not have any ramps.

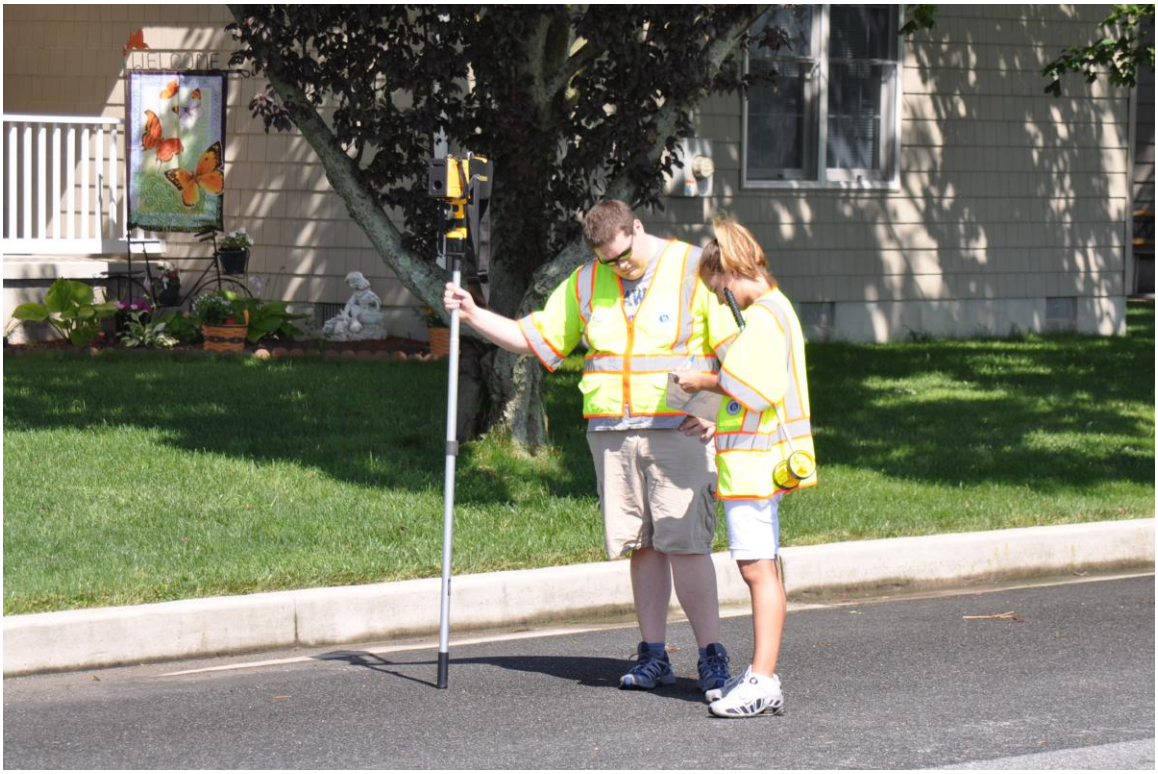
Road Checklist



- **Travel Lanes, Parking Lanes:** This should reflect what the street can actually support; i.e., if a street has a paved width of only 30', it isn't suitable for parking on both sides of the street, regardless of whether that is what is observed (even if you allow only 9' for travel lanes and 7' for parking areas, which would all be rather narrow, this is too narrow for most applications). Except for one way streets, you'll typically see two travel lanes and then if there is adequate space for parking on one side or both, that should be reflected. For municipal streets (except for collector streets), you would generally like to see at least 10' wide travel lanes and 7-8' for parking on each side.
- **Bike Lanes:** If they exist (marked in some fashion), note them.
- **Length:** Measure down the centerline of a road to get its length. For cul-de-sac streets, stop at the entrance to the cul-de-sac bulb.
- **Width:** Measure across a road to get its width; do not include gutter pan measurements in the recorded width, but do note them and their size in the section "Notes". Take at least two measurements of the width, each at two different spots in the road. If the road is noticeably a different width, measure the length that the road is at one width, and the

length the road is at another width. Your goal here is to get representative widths that will yield an approximate surface quantity take off.

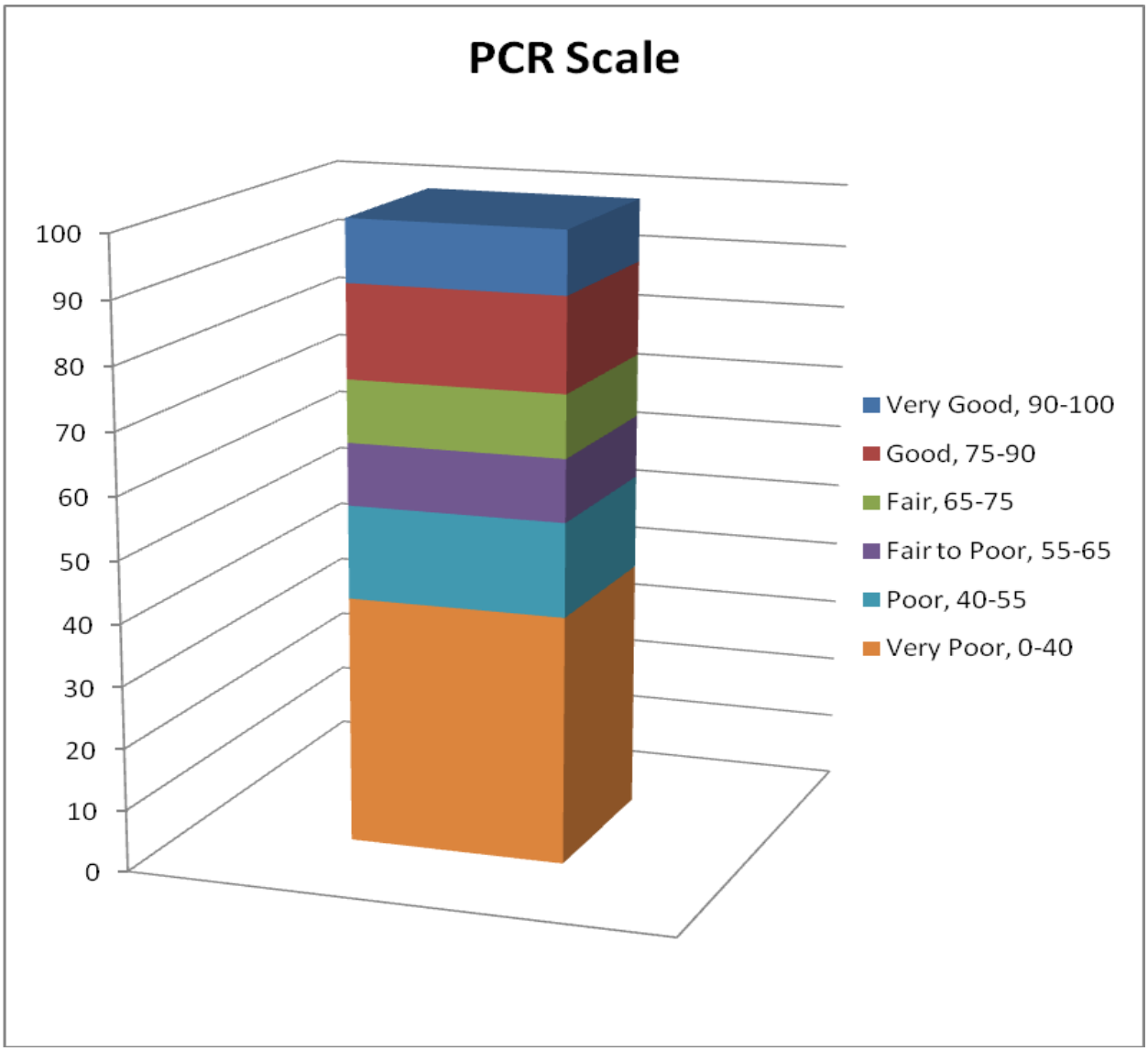
- **Rating from Evaluation Form:** To asses the pavement condition, you must evaluate the road using the PCR form (described on the following page). After the pavement rating is calculated, the number should be entered in this box.
- **Number of Sidewalks:** "None" represents no or only a small stretch of sidewalk on the road. "Path" represents a worn path on the side of the road. "One" and "two" represent a sidewalk on one side of the road or sidewalks on each side of the road, respectively.
- **Sidewalk Condition:** Condition of a sidewalk can be determined just by looking; "good" meaning it is in a condition that it does not need to be replaced, "fair" being in a condition that it is near needing to be replaced, and "poor" being that it should be replaced in the near future.
- **Drainage Conditions:** "Good" meaning the drainage is in a condition that does not need to be fixed, "fair" being a condition that should be examined more in-depth because it is causing potential problems to the road, and "poor" being that it should definitely be evaluated for correction because problems with the road or sidewalk ramps are evident.
- **Roadway Longitudinal Slope:** Measured along the centerline of a road. It is important to get a representative measurement of what the longitudinal slope is for a road because it will vary at different sections.
- **Center Line Cross Slope:** Measured perpendicular to the centerline of the road. Measuring at the crown of the road will produce a sample that is not representative of the entire road. Usually, measurements of slopes to each side of the centerline at two or more locations along the width are necessary to obtain a representative average.



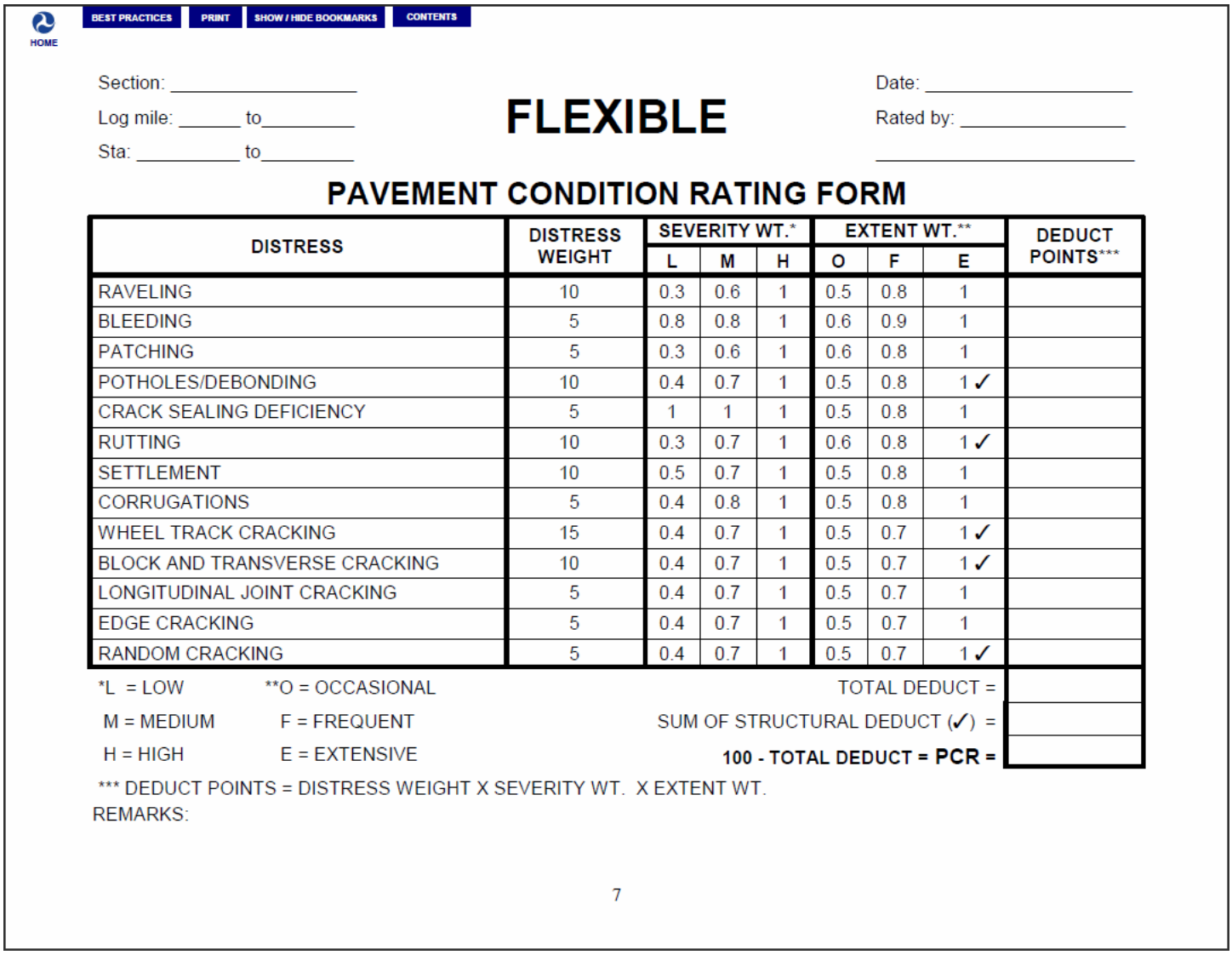
PCR form

In order to check pavement conditions of the roads, we adopted a flexible Pavement Condition Rating (PCR) form that was created by the Ohio Department of Transportation. To be most accurate, we used some of our own methods to personalize the PCR form specifically for use in Delaware. The rating form gave 13 types of distresses to look for to assess the condition the road is currently in.

Referencing the key to the PCR form, you will see that under Severity Weight for Wheel Track Cracking, Alligator Cracking is mentioned. When looking for Wheel Track Cracking, we focus on the presence of Alligator Cracking. This was important because, in Delaware, we see a lot of Alligator Cracking, which is known to easily allow water intrusion, therefore leading to greater distresses, such as potholes.



In developing the PCR, Ohio DOT was focused on heavier traffic conditions and because of the size of their network, the PCR envisioned looking at 2-3 mile stretches of roads at a time. The person who was rating the road was expected to be driven along the stretch of road at 40 miles per hour to see and feel visible distresses, then stop at one mile intervals and look for representative distresses that are easier to see up close.



HOME | BEST PRACTICES | PRINT | SHOW / HIDE BOOKMARKS | CONTENTS

Section: _____ Date: _____

Log mile: _____ to_____ **FLEXIBLE** Rated by: _____

Sta: _____ to_____ _____

PAVEMENT CONDITION RATING FORM

DISTRESS	DISTRESS WEIGHT	SEVERITY WT.*			EXTENT WT.**			DEDUCT POINTS***
		L	M	H	O	F	E	
RAVELING	10	0.3	0.6	1	0.5	0.8	1	
BLEEDING	5	0.8	0.8	1	0.6	0.9	1	
PATCHING	5	0.3	0.6	1	0.6	0.8	1	
POTHOLES/DEBONDING	10	0.4	0.7	1	0.5	0.8	1 ✓	
CRACK SEALING DEFICIENCY	5	1	1	1	0.5	0.8	1	
RUTTING	10	0.3	0.7	1	0.6	0.8	1 ✓	
SETTLEMENT	10	0.5	0.7	1	0.5	0.8	1	
CORRUGATIONS	5	0.4	0.8	1	0.5	0.8	1	
WHEEL TRACK CRACKING	15	0.4	0.7	1	0.5	0.7	1 ✓	
BLOCK AND TRANSVERSE CRACKING	10	0.4	0.7	1	0.5	0.7	1 ✓	
LONGITUDINAL JOINT CRACKING	5	0.4	0.7	1	0.5	0.7	1	
EDGE CRACKING	5	0.4	0.7	1	0.5	0.7	1	
RANDOM CRACKING	5	0.4	0.7	1	0.5	0.7	1 ✓	

*L = LOW **O = OCCASIONAL TOTAL DEDUCT =

M = MEDIUM F = FREQUENT SUM OF STRUCTURAL DEDUCT (✓) =

H = HIGH E = EXTENSIVE **100 - TOTAL DEDUCT = PCR =**

*** DEDUCT POINTS = DISTRESS WEIGHT X SEVERITY WT. X EXTENT WT.

REMARKS:

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Since we were only looking at an average of 500-600' roadways, we made the ratings more robust by walking the entire stretch of each road. We also adjusted our thresholds with regards to the extent of the distress. For example, the patching distress lists occasional at <10/mile, frequent at 10-20/mile, and extensive at >20/mile. If we were to directly relate this to a 500ft section of roadway, 2 patches would put the road at an extensive rating. This scenario would leave us with no differentiation between streets that have 3 patches versus streets that have 15 patches. For this distress we looked at the entire stretch of road and quantified the adverse

HOME | BEST PRACTICES | PRINT | SHOW / HIDE BOOKMARKS | CONTENTS

Section:_____ **KEY** Date: _____

Log Mile: _____ to _____ **FLEXIBLE PAVEMENT CONDITION** Rated by: _____

Sta:_____ to_____ **RATING FORM** _____

DISTRESS	Distress Weight	SEVERITY*			EXTENT**			STR ***
		L	M	H	O	F	E	
RAVELING	10	Slight Loss of Sand	Open Texture	Rough or pitted	<20%	20-50%	>50%	
BLEEDING	5	not rated	Bit and Agg visible	Black Surface	<10%	10-30%	>30%	
PATCHING	5	<1 ft^2.	<1 yd^2	>1 yd^2	<10/mile	10-20/mile	>20/mile	
POTHOLES/DEBONDING	10	depth <1" area <1 yd^2	<1", >1 yd^2 >1",<1 yd^2	>1" and >1 yd^2	<5/mile	5-10/mile	>10/mile	✔
CRACK SEALING DEFIC.	5	Not considered			<20%	20-50%	>50%	
RUTTING	10	<1/4"	1/4-1"	>1"	<20%	20-50%	>50%	✔
SETTLEMENTS	10	Noticeable effect on ride	Some Discomfort	Poor Ride	<2/mi	2-4/mi	>4/mi	
CORRUGATIONS	5	Noticeable effect on ride	Some Discomfort	Poor Ride	<10%	10-30%	>30%	
WHEEL TRACK CRACKING	15	Single/multiple cracks <1/4"	Multiple cracks >1/4"	Alligator >1/4" Spalling	<20%	20-50%	>50%	✔
BLOCK & TRANSVERSE CRACKING	10	<1/4" wide, no Spalling	1/4-1" along min .5 length	>1" along min .5 length	<20%	20-50%	>50%	✔
LONGITUDINAL JOINT CRACKING	5	Single, <1/4", no Spalling	single/multiple 1/4-1", some Spalling	Multiple, >1", Spalling	<50' per 100'	50-100' per 100'	>150' per 100'	
EDGE CRACKING	5	Tight, <1/4"	>1/4", some Spalling	>1/4", moderate Spalling	<20%	20-50%	>50%	
RANDOM CRACKING	5	<1/4"	1/4-1"	>1"	<20%	20-50%	>50%	✔

*L = LOW
M = MEDIUM
H = HIGH

**O = OCCASIONAL
F = FREQUENT
E = EXTENSIVE

***STR = DISTRESS INCLUDED IN STRUCTURAL DEDUCT CALCULATIONS.

6

effects on the driver. Typically streets with 1-2 patches were occasional, 3-7 patches were frequent, and 8 or more patches were extensive. The settlement and pothole distress extents were similarly scaled down.

These modifications do not limit the effectiveness of applying the PCR system in Delaware. Consistency is terribly important when rating a given system of roads (e.g., within a town network), because the ratings for a system of roads are relative. In other words, it is less important that we focus on whether a road is termed Good, Poor, Fair, etc. than it is to view the condition of one road relative to another through an objective rating system. For municipal systems in many Delaware towns, it will typically show few roads in the <40 PCR category, as there are not sufficient combinations of distresses to bring the rating down into the 30s; any road rated that low is indeed a Very Poor roadway.

Road ID:

Date:

Road Name:

Owner:

Pavement Condition Checklist
University of Delaware
T2 Center
Developed By
Kate Smagala
Bob McGurk
6/10/09

Length:

Width:

# of Travel Lanes

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4

# of Parking Lanes

- [ ] 0
- [ ] 1
- [ ] 2

# of Bike Lanes

- [ ] 0
- [ ] 1
- [ ] 2

Road Condition

Rating from Evaluation Form:

Drainage Conditions

- [ ] Good
- [ ] Fair
- [ ] Poor

Specific Drain Conditions

- [ ] Blockage
- [ ] Missing Grate:
- [ ] Structural Damage:

Drain 1:

Drain 2:

Drain 3:

Roadway Longitudinal Slope

Drain 1	Drain 2	Drain 3
[ ] Over 8%	[ ] Over 8%	[ ] Over 8%
[ ] 1%-8%	[ ] 1%-8%	[ ] 1%-8%
[ ] Under 1%	[ ] Under 1%	[ ] Under 1%

Center Line Cross Slope

Drain 1	Drain 2	Drain 3
[ ] Over 2%	[ ] Over 2%	[ ] Over 2%
[ ] 2%	[ ] 2%	[ ] 2%
[ ] Under 2%	[ ] Under 2%	[ ] Under 2%

# of Sidewalks

- [ ] None
- [ ] Path
- [ ] 1
- [ ] 2

Sidewalk Condition

- [ ] Good
- [ ] Fair
- [ ] Poor

Sidewalk Material

- [ ] Asphalt
- [ ] Concrete
- [ ] Brick

Notes:

Submit

Close Form

Section: _____ Date: _____

Log mile: _____ to_____ Rated by: _____

Sta: _____ to_____ _____

FLEXIBLE

PAVEMENT CONDITION RATING FORM

DISTRESS	DISTRESS WEIGHT	SEVERITY WT.*			EXTENT WT.**			DEDUCT POINTS***
		L	M	H	O	F	E	
RAVELING	10	0.3	0.6	1	0.5	0.8	1	
BLEEDING	5	0.8	0.8	1	0.6	0.9	1	
PATCHING	5	0.3	0.6	1	0.6	0.8	1	
POTHOLES/DEBONDING	10	0.4	0.7	1	0.5	0.8	1 ✓	
CRACK SEALING DEFICIENCY	5	1	1	1	0.5	0.8	1	
RUTTING	10	0.3	0.7	1	0.6	0.8	1 ✓	
SETTLEMENT	10	0.5	0.7	1	0.5	0.8	1	
CORRUGATIONS	5	0.4	0.8	1	0.5	0.8	1	
WHEEL TRACK CRACKING	15	0.4	0.7	1	0.5	0.7	1 ✓	
BLOCK AND TRANSVERSE CRACKING	10	0.4	0.7	1	0.5	0.7	1 ✓	
LONGITUDINAL JOINT CRACKING	5	0.4	0.7	1	0.5	0.7	1	
EDGE CRACKING	5	0.4	0.7	1	0.5	0.7	1	
RANDOM CRACKING	5	0.4	0.7	1	0.5	0.7	1 ✓	

*L = LOW **O = OCCASIONAL TOTAL DEDUCT =

M = MEDIUM F = FREQUENT SUM OF STRUCTURAL DEDUCT (✓) =

H = HIGH E = EXTENSIVE **100 - TOTAL DEDUCT = PCR =**

*** DEDUCT POINTS = DISTRESS WEIGHT X SEVERITY WT. X EXTENT WT.

REMARKS:

Section:_____ Date: _____

Log Mile: _____ to _____ Rated by: _____

Sta:_____ to_____ _____

KEY

FLEXIBLE PAVEMENT CONDITION

RATING FORM

DISTRESS	Distress Weight	SEVERITY*			EXTENT**			STR ***
		L	M	H	O	F	E	
RAVELING	10	Slight Loss of Sand	Open Texture	Rough or pitted	<20%	20-50%	>50%	
BLEEDING	5	not rated	Bit and Agg visible	Black Surface	<10%	10-30%	>30%	
PATCHING	5	<1 ft^2.	<1 yd^2	>1 yd^2	<10/mile	10-20/mile	>20/mile	
POTHOLES/DEBONDING	10	depth <1" area <1 yd^2	<1", >1 yd^2 >1",<1 yd^2	>1" and >1 yd^2	<5/mile	5-10/mile	>10/mile	✔
CRACK SEALING DEFIC.	5	Not considered			<20%	20-50%	>50%	
RUTTING	10	<1/4"	1/4-1"	>1"	<20%	20-50%	>50%	✔
SETTLEMENTS	10	Noticeable effect on ride	Some Discomfort	Poor Ride	<2/mi	2-4/mi	>4/mi	
CORRUGATIONS	5	Noticeable effect on ride	Some Discomfort	Poor Ride	<10%	10-30%	>30%	
WHEEL TRACK CRACKING	15	Single/multiple cracks <1/4"	Multiple cracks >1/4"	Alligator >1/4" Spalling	<20%	20-50%	>50%	✔
BLOCK & TRANSVERSE CRACKING	10	<1/4" wide, no Spalling	1/4-1" along min .5 length	>1" along min .5 length	<20%	20-50%	>50%	✔
LONGITUDINAL JOINT CRACKING	5	Single, <1/4", no Spalling	single/multiple 1/4-1", some Spalling	Multiple, >1", Spalling	<50' per 100'	50-100' per 100'	>150' per 100'	
EDGE CRACKING	5	Tight, <1/4"	>1/4", some Spalling	>1/4", moderate Spalling	<20%	20-50%	>50%	
RANDOM CRACKING	5	<1/4"	1/4-1"	>1"	<20%	20-50%	>50%	✔

*L = LOW
M = MEDIUM
H = HIGH

**O = OCCASIONAL
F = FREQUENT
E = EXTENSIVE

***STR = DISTRESS INCLUDED IN STRUCTURAL DEDUCT CALCULATIONS.

Intersection ID: ______ Date: ______

Owner

Primary Street: ______ State / County / Town

Cross Street: ______ State / County / Town

Notes: ______

Submit | Close Form | Clear Form

Intersection Type: 2 Way to 2 Way / 2 Way to One Way / T - Intersection / One Way to One Way

Intersection Control: 2-Way Stop / 4-Way Stop / Stop Light / Beacon / No Control / Other / 1 Way Stop

Sidewalks: 2 Sides / 1 Side / None / Worn Paths

Crosswalk Control: Electronic Signs / Stop Bar / No Control / Ped. Crossing Signs / Yield Line

# of Corners: 1 / 2 / 3 / 4

Ponding?: Yes / No

Crosswalk Markings: Border / Striped / No Markings

ADA Compliance
Curb Ramp
Checklist
University of Delaware
T2 Center
Developed By
Bob McGurk
Kate Smagala
6/10/09

Ramp Width	Ramp Slope	Ramp Cross Slope	Sidewalk Width	SW Running Slope	Sidewalk Cross Slope	Landing Size	Sidewalk Backslope / Domes	Existing Condition
60" and Over 48" to 60" 36" to 48" Under 36"	Over 8.33% (12:1) 8.33% and Under Under 5%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36"	Over 5% (20:1) 2% to 5% Under 2%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36" No Landing	Over 16.6% (6:1) 16.6% and Under Yes No	1 Angled Ramp 2 Perpendicular Ramps 1 Ramp Squared to Stree No Ramps
60" and Over 48" to 60" 36" to 48" Under 36"	Over 8.33% (12:1) 8.33% and Under Under 5%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36"	Over 5% (20:1) 2% to 5% Under 2%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36" No Landing	Over 16.6% (6:1) 16.6% and Under Yes No	1 Angled Ramp 2 Perpendicular Ramps 1 Ramp Squared to Stree No Ramps
60" and Over 48" to 60" 36" to 48" Under 36"	Over 8.33% (12:1) 8.33% and Under Under 5%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36"	Over 5% (20:1) 2% to 5% Under 2%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36" No Landing	Over 16.6% (6:1) 16.6% and Under Yes No	1 Angled Ramp 2 Perpendicular Ramps 1 Ramp Squared to Stree No Ramps
60" and Over 48" to 60" 36" to 48" Under 36"	Over 8.33% (12:1) 8.33% and Under Under 5%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36"	Over 5% (20:1) 2% to 5% Under 2%	Over 3% 2.5% to 3% 1.5% to 2.5% 1% to 1.5% Under 1%	60" and Over 48" to 60" 36" to 48" Under 36" No Landing	Over 16.6% (6:1) 16.6% and Under Yes No	1 Angled Ramp 2 Perpendicular Ramps 1 Ramp Squared to Stree No Ramps

Sign ID#:

Date:

Owner

☐ State ☐ County ☐ Town

Previous Inspection Sticker:

Install Date:

Sign Retroreflectivity Checklist
University of Delaware
T2 Center
Developed By
Kate Smagala
Bob McGurk
6/10/09

Location: Feet ☐ North ☐ East ☐ South ☐ West Of Primary Street And Cross Street

Location Type

☐ Business
☐ Rural

Sign Type

☐ Stop
☐ Speed Limit (R2-1)
☐ Yield
☐ One Way
☐ Do Not Enter (R5-1)
☐ Wrong Way (R5-1a)

Viewable Distance

☐ Under 200'
☐ 200'-400'
☐ 400'-550'
☐ 550'-675'
☐ 675'-800
☐ 800'-1,000'
☐ Over 1,000'

Color

Average Retroreflectivity Number:

White
Red:
Green:
Yellow:
Orange:
Black:

Height:

Ground Mount

☐ Under 5'
☐ 5'-7'
☐ Over 7'

Over Head

☐ Under 17'
☐ 17
☐ Over 17'

Size

Height:
Width
Yield Side:

Breakaway Anchor

☐ Yes
☐ No

Set Back Edge of Sign

Open Section:
☐ <6' from Pavement
☐ > 6' from Pavement

Closed Section:
☐ < 2' from Face of Curb
☐ > 2' from Face of Curb

If Lateral position is out of compliance and problematic to move, make a note stating why.

Notes:

Clear Form | Close Form | Submit

Appendix E
SRTS Coordination Summary

Safe Routes To School (SRTS) Interaction Summary With Preliminary Recommendations Summary From Toole Design Group

Milton SRTS Coordination Summary

To: File
From: Bob McGurk, DCT Intern
CC: Matheu Carter, T^2 Engineer, Kate Smagala, DCT Intern
Date: 8/10/09
Re: Milton SRTS Summary

Over the course of our research this summer, we were made aware of a Safe Routes to School program for Milton Elementary School that was being completed throughout the summer. We contacted Sarah Coakely, the DelDOT SRTS Coordinator and she put us in touch with Katie Mencarini of Toole Design Group, the consultants working on the Milton ES SRTS project. Following a brief phone call with Katie, we agreed that it was helpful to the Town of Milton and Milton ES for the T^2 Center to work with Toole Design Group on an ongoing basis. Three objectives were achieved through this relationship:

- Data was shared between the two groups, facilitating a more detailed set of recommendations;
- Communication with Toole Design Group enabled the T^2 Center to focus our recommendations elsewhere in Milton, so we would not duplicate efforts;
- Communication through the field meeting provided an opportunity for improved communication between the Town of Milton and administrators at Milton Elementary School.

Toole Design Group developed a comprehensive list of recommendations, and along with Parsons-Brinckerhoff associates, they will refine and implement those recommendations. Members of the T^2 Center attended the August 5, 2009 Milton ES SRTS field meeting prepared to share information gathered from our time in Milton throughout the summer. We provided additional information on a variety of topics that became evident to us as we were collecting data earlier in the summer.

We hope that the coordination between the T^2 Center and Toole Design Group will result in a more effective product for Milton ES, and that communication links between the Town of Milton and Milton ES administration will continue to evolve to ensure the safety of students and the efficient use of assets in the future.

The Toole Design Group attachment is draft that reflects the likely scope of SRTS activities that may occur on an immediate, medium term, and long term basis. Principal Mumford or the Toole Design Group will be the best contacts for updates going forward.

Milton Elementary Infrastructure Rec's [DRAFT]

Map ID	Location	Issue	Recommendation	Phasing/Comments
L	Federal Street, crosswalk west of Church Street.	This crosswalk leads to the main entrance of school.	Consider removing this crosswalk. Concerns are that parents parking their cars along New Street and Church street use this to access the school. This is an uncontrolled crossing. Removing the crosswalk would encourage pedestrians to cross Federal Street at safer crossings.	**REMOVE THIS REC**
H	Federal Street 	School speed limit signage should be consistent with DelDOT standards	Replace existing sign with yellow-green signage, standard for DelDOT	Early Action
K	Sidewalks along Federal Street (both sides) between New Street and Wharton/Atlantic Street	Sidewalk surface is poor in many areas and would not meet ADA standards	Improve sidewalks as needed	Short Term

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Map ID	Location	Issue	Recommendation	Phasing/Comments
M	Intersection of Federal Street and Wharton Street	Sightlines are poor for pedestrians crossing. Also, relatively high speed traffic was observed.	- Construct curb extension on southeast and southwest corners.	Short/Medium Term
E	Chestnut Street – East side	Many cars park on the sidewalks. Parking restrictions not clear.	- Enforce parking restrictions	MOVE THIS REC TO NON-INFRASTRUCTURE
O	Poplar Street	Narrow sidewalk on north side of Poplar Street. Sidewalk ends at 106 Poplar Street.	- Widen sidewalk on north side of Poplar Street. - Extend sidewalk on east side of Poplar Street to Federal Street. - Drainage issues may factor into the design.	Short/Medium Term
N	Intersection of Hickory Boulevard and Chestnut Street	This intersection is a key crossing for students who may live off of Hickory Boulevard. Pedestrians crossing Chestnut Street may not be visible to drivers.	- Install high visibility crosswalks across Chestnut Street on northeast side - Repair sections of sidewalk at this intersection where possible	Early Action

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Map ID	Location	Issue	Recommendation	Phasing/Comments
P	Sand Street	It is likely that pedestrians will choose to walk along Sand Street to access Federal Street.	- Consider pedestrian improvements along Sand Street - Consider crossing treatments at the uncontrolled intersection of Sand Street and Federal Street.	REMOVE THIS REC
G	Intersection of Chestnut Street and Church Street	This is an unmarked crosswalk that conceivably will be a common choice for students walking from the neighborhood located off of Hickory Road.	Install High visibility crosswalk across Chestnut Street	REMOVE THIS REC (replaced with new recommendation "Q"
D	Chestnut Street between Atlantic Street and sidewalk end at rail-trail – both sides	Sidewalk surface is severely cracked and crumbled in several spots between Atlantic and New Street.	Improve sidewalks as needed	Short term
F	Church Street	This needs a sidewalk as many parents park and walk their children from this street.	Install sidewalks west side of the street.	Short/Medium term

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Map ID	Location	Issue	Recommendation	Phasing/Comments
I	Federal Street 	On the east side of Federal Street, several driveways interrupt the sidewalk. This creates conflict points between pedestrians and drivers.	Close of the driveways and continue the sidewalk along the west side of Federal Street between the medical center and Church Street.	Long term
B	Federal Street/ School site 	Driveway entrances to school parking lot are relatively wide. Vehicles were observed entering and exiting the parking lot at relatively high speeds from both driveways. The unpredictable travel pattern, combined with the vehicle speeds, increases the potential for conflicts with pedestrians entering the school campus.	Reduce the crossing distance across the driveways and designate specific entrances and exits for vehicles.	Consider for early action - Would need to know the width of the driveways to ensure that buses are able to still enter/exit the parking lot - Solution may be procedural rather than engineering (**still researching feasibility**)

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Map ID	Location	Issue	Recommendation	Phasing/Comments
A	School site/front of school – parking lot/bus loading and unloading	Students were observed walking in front of idling buses when arriving and leaving the school. Students are walking along a painted "walk zone" but there is no physical buffer between the students and the buses.	To reduce the conflicts between the pedestrians and vehicles, install a curbed sidewalk off of Federal Street toward and also along the school building to make a clear, buffered pedestrian path.	Early Action
C	Atlantic Street (west side)	Sidewalks are present on the north side of Atlantic Street	Install sidewalks on south side of Atlantic Street	Long term

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Map ID	Location	Issue	Recommendation	Phasing/Comments
J	Federal Street (entrance to Milton Medical Center) 	Located behind the medical center is a paved pathway that connects to Chestnut Street. With the new development of Cannery Crossing being developed, the number of pedestrians who would conceivably use this path will increase. Students should be encouraged to cross Federal Street here rather than continue walking toward the school on the eastern side of Federal Street due to the numerous driveways located on this side of the street. Drivers need warning that students are crossing Federal Street to reach the school. With the trees lining the street, visibility can be poor for both the students walking and the adults driving.	Improve the crossings near the path behind the Milton Medical Center. - Install a rapidly flashing beacon that is push-button activated. This will alert drivers to students entering the crosswalk.	REMOVE THIS REC

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Map ID	Location	Issue	Recommendation	Phasing/Comments
Q	**Intersection of Chestnut Street and Dogfish Head Brewery** (6 Cannery Village Center)	**Students living in the new development, Cannery Village, will most likely use this driveway to access Chestnut Street and Church Street. This is a direct pathway from the neighborhood and the community center to the school site.**	- **Install high visibility crosswalks across Chestnut Street** - **Install curb ramps on west side of Chestnut Street to line up with the crosswalks.** - **Install curb extensions on northeast and southeast sides of Chestnut Street to provide more gathering space and do reduce the crossing distance across the driveway.** - **Repair sidewalks on either side of the intersection where needed and where possible**	**Early Action**
R	**Intersection of Federal Street and Medical Center driveway**	**The now obsolete road markings for the non-functioning rail road is confusing for drivers and may be distracting from the stop bars and other pedestrian crossing infrastructure.**	- **Remove the railroad lane markings** - **Install high visibility crosswalks across Federal Street**	**Early Action**

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Map ID	Location	Issue	Recommendation	Phasing/Comments
R	Intersection of Chestnut Street and Rail Trail	Students living in the new development, Cannery Village, as well as the apartment buildings located along Chestnut Street will most likely use this driveway to access Chestnut Street and Church Street. This is a direct pathway from the neighborhood and the community center to the school site.	- Install high visibility crosswalks across Chestnut Street - Repair sidewalk on either side of the intersection where needed and where possible	Early Action

This is a table of draft recommendations. These are subject to change. DelDOT SRTS funding may not be able to cover all recommendations.

Appendix F
Milton Town Agreements Summary

Summary (Only) Of "Town Agreements" Obtained From DelDOT (Actual Scanned Agreements Are Contained In The Electronic Deliverables For This Report)

Milton Town Agreements

Page *	Date	Affected Streets	Services
65	June 12, 1923	Federal and Union	60' ROW and Construction
56	June 12, 1933	Federal and Union	60' ROW and Construction
1	September 12, 1935	Rt 16	60' ROW and paving, to be maintained by state in perpetuity
43	May 25, 1936	Chestnut St	50' ROW and Construction
36	October 17, 1951	Federal and Union	Resurfacing and installation of curbs and sidewalks, establishes curb to curb maintenance for DelDOT, Sidewalks to Milton
23	December 13, 1956	SR 16	Upgrade and widening
29	March 11, 1957	Federal and Union	Resurfacing, curb to curb responsibility of state, town assumes sidewalk and stormwater/sewer responsibility and ownership
17	May 24, 1958	SR 16	Upgrade and widening
14	July 27, 1961	Various, State maintained streets	Repaving by state due to town's sewer upgrade. Town reimburses DelDOT. Town accepts maintenance responsibility for Atlantic and Mulberry
114	January 11, 1962	Various	Town Agreement Amendment for Repayment, limit $70,000
103	May 6, 1991	Union St Bridge	Bridge 3-809 Reconstruction
100	June 23, 1993	Mulberry St	Curb and Sidewalk repairs
97	December 15, 1993	Benett, Palmer, Coulter, Carey, Orchard, Clifton, Reed, Parker, Church, Sand, Manship	Paving Funding
92	January 21, 1994	Mulberry St	Street, sidewalk, and drainage upgrades
83	May 2, 1994	Governors Walk II	ROW and Construction, Mulberry to Magnolia, along Broadkill River
80	September 6, 1994	Behringer, Bennett, Holland, Bay, Palmer	Paving and Drainage

* Page numbers refer to the page in the scanned Agreement PDF file.