

INVESTIGATION OF THE [REDACTED] BICYCLE CRASH

By:

Lance E. Robson, P.E.

April 16, 2010

INVESTIGATION OF THE [REDACTED] BICYCLE CRASH

ENGINEER'S REPORT

April 16, 2010

1. INTRODUCTION

This bicycle crash occurred on June 22, 2006, on Maple Street, in Glens Falls, New York. The crash involved a bicycle operated by [REDACTED], and a grate owned by National Grid. [REDACTED] was injured as a result of the crash.

This investigation was performed to determine if the grate was dangerous in a manner that caused the crash.

2. AVAILABLE INFORMATION

1. Letter of October 18, 2007, with attached:
 - a. Glens Falls Police Department one page report;
 - b. Photocopies of photos of the involved bicycle;
 - c. Photocopies of photos of the grate and the bicycle in the grate;
 - d. Photocopies of photos of the plaintiff's injuries;
 - e. A diagram showing the location of the grate in Maple Street.
2. My October 15, 2009 inspection, measurements and photos of the grate and crash site.

3. THE CRASH

The police report:

... spoke to [REDACTED] who stated that he was riding his bike and his front tire went into the NIMO grate causing him to go over the handlebars.

The photos show [REDACTED]'s bicycle to be a touring type bicycle. There are drop handlebars and multiple gears, a large seat and rear luggage rack. The photos showing [REDACTED] are of his head.

Head injuries are consistent with pitching over the handlebars when the front wheel is suddenly stopped.

4. CRASH SITE

The grate encountered by [REDACTED] is part of two similar installations in the westbound travel lane of Maple Street, between Ridge and Bay Streets. The grate that his tire entered is located across the street from the Adirondack Trust Company.

Maple Street is a 30-foot wide, urban local street. There are curbs and sidewalks, both sides. Parking is permitted, both sides. The surface of Maple Street is asphalt. The surface is marked with a double yellow centerline, white edge lines delineating parking spaces along the curbs, and cross walks. There was an in-street pedestrian sign at the crosswalk immediately west of the incident grate at my inspection. The City library and bicycle racks are located immediately south of the incident grate.

The involved grate is within the concrete top slab of an underground vault. The top slab is flush with the surrounding asphalt pavement and has an embedded steel frame supporting multiple grates. The grates are sized such that there are longitudinal (i.e., parallel to the direction of traffic) gaps. Within the concrete slab there are two rows of grates. For [REDACTED]'s direction of travel, his tire went into a gap in the far grate. The gap is 4' from the edge lines. The grate is 3'3" along the direction of travel. I measured the gap to be 1-1/16" wide. There was a piece of wood in the gap at my inspection. The photos I was provided show the front wheel of [REDACTED]'s bicycle down in the grate. I replicated this entrapment at my inspection with a 27 x 1-1/4" tire. This is not the narrowest of tires.

The following photos show a typical bicycle wheel in the gap and the location of the grate in the street.



Photo 1. Typical bicycle wheel in the gap.



Photo 2. Position of grate in the street.

5. PARALLEL DRAINAGE GRATE GAPS ARE RECOGNIZED AS DANGEROUS TO BICYCLES

The hazard posed to bicyclists by parallel bar drainage grates and recommended methods to minimize that hazard have been recognized since at least 1974.

The USDOT 1974 *Bikeways - State of the Art*¹ discusses the hazard posed by parallel bar grates when the bars are oriented parallel to the normally expected direction of travel,

Drainage grate problems have been well publicized. Most cycle tires and rims will drop through commonly employed parallel-bar grates, damaging wheel rims and giving unwary cyclists a nasty, over the handle-bars spill. [82]

The USDOT report further states:

Some communities have welded transverse bars over existing parallel bar grates to protect cyclists, others have employed transverse bar or honeycomb designs. [82]

Every effort should be made to avoid use of the hazardous parallel bar grates in areas where cyclists are likely to be riding. [84]

The American Association of State Highway and Transportation Officials (AASHTO) 1974 *Guide For Bicycle Routes*², concerning drainage grates, states:

¹ *Bikeways - State of the Art*, U.S. Department of Transportation, Washington, D.C. (1974)

...a factor which must be considered is the hazard presented by drainage grates... In many existing instances, such grates consist of bars running parallel to the curb with separations of three quarter inch or more between bars. This configuration... may entrap narrow bicycle wheels and should not be used where there will be bicycle traffic...

and

At existing installations, parallel bar grates should be replaced with other designs, such as bars perpendicular to the curb, diagonal bar grates or welded cross strips on the parallel bars to minimize the bicycle hazards of the grate...

A 1977 Maryland Department of Transportation report, *A Bikeway Criteria Digest, The ABCD's of Bikeways*³, prepared for the U. S. Department of Transportation (USDOT), states:

The most dangerous grate has bars running parallel with the direction of travel.... it often traps the cycle wheel between the bars, resulting in serious accidents. Any hazardous grate within the bikeway should be altered or replaced with a grate which cyclists can safely traverse. [51]

The American Institute of Architects (AIA) 1988 *Architectural Graphic Standards, Eight Edition*⁴, states:

Grates that will be susceptible to foot or narrow wheel contact must be so constructed as to prevent penetration by...slim tires, but still serve to provide sufficient drainage... Where only narrow wheel use is expected, slotted openings can be used if the slots are oriented transversely to the direction of traffic.

The New York State Department of Transportation (NYSDOT) states⁵:

² *Guide For Bicycle Routes*, American Association of State Highway and Transportation Officials, Washington, D.C. (1974)

³ *A Bikeway Criteria Digest, The ABCD's of Bikeways*, Maryland Department of Transportation, Baltimore, MD (1977)

⁴ *Architectural Graphic Standards, Eight Edition*, American Institute of Architects (1988)

⁵ *Highway Design Manual*, New York State Department of Transportation, Chapter 18, 1996 edition.

18.7 FACILITIES FOR BICYCLING

Bicyclists have the same rights and responsibilities as the operators of motor vehicles, except as provided in Sections 1230-1236 of the "New York State Vehicle and Traffic Law".

When designing highway projects, it is essential to consider physical improvements for bicycles just as for other vehicles in the traffic mix. Therefore, all state highways should be designed and constructed to safely accommodate known and anticipated bicycle traffic consistent with the needs identified during project scoping or during preliminary design. If the scoping and Design Approval Documents indicate that bicycle facilities are needed, but cannot be provided, an explanation should be provided in the Design Approval Documents.

And,

FACILITIES FOR PEDESTRIANS AND BICYCLISTS

18-41

18.7.2 Bicycle Facilities Design Policy

Highways and streets where bicyclists are permitted should provide for safe and convenient bicycling. However, not every highway or street requires the provision of specific bicycle facilities

18.7.3 Roadway Improvements

Many existing highways were not designed with bicycle travel in mind. However, there are usually reasonable ways in which they may be improved to more safely accommodate bicycle traffic. Therefore, roadway conditions should be examined during scoping and design whenever highways are being constructed, reconstructed or resurfaced. The need for drainage grates, railroad crossings, pavements, traffic control devices, railings and other roadway adaptations that are responsive to bicyclists' requirements should be discussed in the scoping and design approval documents. These documents should discuss any decisions made regarding whether or not improvements that would better accommodate bicycling are incorporated into projects.

Roadway improvements that enhance bicycling can be implemented in many highway projects. When the project scoping and design approval documents identify the need for bicycle facilities, design alternatives that provide roadway improvements such as adequate shoulders, wide curb lanes or bicycle lanes should be developed and considered. Designers should consult with the Regional Bicycle and Pedestrian Coordinator; and refer to the current AASHTO "Guide for the Development of Bicycle Facilities", the information provided below, and other sources identified in this chapter. For specific guidance related to drainage grates, railroad crossings, pavement surfaces and traffic control devices, designers should refer to the current AASHTO "Guide for the Development of Bicycle Facilities".

Regarding drainage grates, the NYSDOT refers to AASHTO. AASHTO, the American Association of State Highway and Transportation Officials, is a nonprofit, nonpartisan association representing highway and transportation departments in the 50 states, the District of Columbia, and Puerto Rico. AASHTO has committees which formulate and recommend highway engineering policies. The committees assemble and analyze relative data and prepare a tentative draft publication. The draft is extensively reviewed by the member states and the

Federal Highway Administration (FHWA) and other interested parties, and adopted by a two-thirds vote of the member states before publication⁶.

As to where bicyclists should be anticipated, the AASHTO *Guide for Development of New Bicycle Facilities*⁷ states:

The majority of bicycling will take place on ordinary roads with no dedicated space for bicyclists. Bicyclists can be expected to ride on almost all roadways; and sometimes they use sidewalks as joint bicycle and pedestrian facilities. [1]

and:

All highways, except those where cyclists are legally prohibited, should be designed and constructed under the assumption that they will be used by cyclists. [1]

Shared Roadways

To varying extent, bicycles will be used on all highways where they are permitted. Bicycle-safe design practices, as described in this guide, should be followed during initial roadway design to avoid costly subsequent improvements. Because most existing highways have not been designed with bicycle travel in mind, roadways can often be improved to more safely accommodate bicycle traffic. Design features that can make roadways more compatible to bicycle travel include bicycle-safe drainage grates and bridge expansion joints... [16]

As stated in the USDOT 1995 *Bicycle Safety-Related Research Synthesis*⁸:

Every street and highway should be designed and maintained for shared use by motor vehicles and bicycles. [70]

Bicyclists should have been an anticipated user of Maple Street. As such, the National Grid grating facility should have been designed, constructed, operated and maintained so as to be “bicycle safe”.

⁶ *A Policy on Geometric Design of Streets and Highways*, AASHTO. 2004.

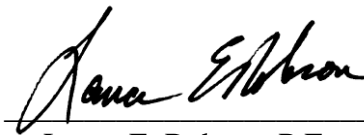
⁷ *Guide for Development of New Bicycle Facilities*, American Association of State Highway and Transportation Officials, Washington, D.C. (1999)

⁸ *Bicycle Safety-Related Research Synthesis*: U.S. Department of Transportation, Washington, D.C. (1995)

6. FINDINGS

Within the bounds of reasonable engineering certainty, and subject to change if additional information becomes available, it is my professional opinion that:

1. [REDACTED] was injured when the front wheel of his bicycle was entrapped in a gap in a National Grid grated facility.
2. The gap was 39 inches long by 1-1/16 inches wide, oriented parallel to the direction of traffic and at a location in the street where bicyclists should be expected to ride.
3. The gap in the National Grid grate created a condition long recognized as dangerous to cyclists, and made the National Grid grated facility dangerous in a manner that caused this crash.
4. Those responsible for the design, operation, and maintenance of the National Grid grated facility in Maple Street, should have recognized the unsafe condition created by the gap in the grates with the opening parallel to the direction of travel, and should have corrected same.
5. Failure to design, construct and maintain the National Grid grate without a gap that would predictably entrap bicycle wheels was contrary to established national and state standards and made the National Grid grated facility dangerous in a manner that caused this crash.



Lance E. Robson, P.E.