



July 2006

PBCAT

PEDESTRIAN & BICYCLE

CRASH ANALYSIS TOOL

VERSION 2.0



U.S. Department of Transportation
Federal Highway Administration

Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 22101-2296



FOREWORD

Every year, scores of pedestrians and bicyclists are killed or injured in collisions with motor vehicles, exacting a terrible toll on individuals, families, businesses, and communities throughout the country. To respond to this national problem, the transportation community continues to develop innovative approaches to enhance the capacity of State and local coordinators, planners, and engineers to address traffic fatalities and injuries. The Pedestrian and Bicycle Crash Analysis Tool (PBCAT): Version 2.0 offers a dynamic and practical method for recording vital information about pedestrian and bicyclist crashes to produce diverse and useful reports. PBCAT also gives access to engineering, education, and enforcement countermeasures that represent promising procedures for mitigating crashes. The details PBCAT captures about crashes between motor vehicles and pedestrians or bicyclists, and the resources it presents, will further efforts of agencies nationwide to identify and select appropriate practices to improve pedestrian and bicyclist safety.

Michael Trentacoste, Director
Office of Safety Research and Development

Notice

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document. This report does not constitute a standard, specification, or regulation.

The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers' names if they appear in the report are here only because they are considered essential to the objective of the document.

Quality Assurance Statement

The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

Technical Report Documentation Page

1. Report No. FHWA-HRT-06-089	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Pedestrian and Bicycle Crash Analysis Tool (PBCAT): Version 2.0 Application Manual		5. Report Date March 2006	
		6. Performing Organization Code:	
7. Author(s): David L. Harkey, Sean Tsai, Libby Thomas, and William W. Hunter		8. Performing Organization Report No.	
9. Performing Organization Name and Address University of North Carolina Highway Safety Research Center 730 ML King Jr. Blvd., CB #3430 Chapel Hill, NC 27599		10. Work Unit No.	
		11. Contract or Grant No. DTFH61-00-R-00034	
12. Sponsoring Agency Name and Address Federal Highway Administration Office of Safety Research and Development 6300 Georgetown Pike McLean, VA 22101-2296		13. Type of Report and Period Covered User's Manual 2001–2005	
		14. Sponsoring Agency Code	
15. Supplementary Notes The PBCAT software and application manual were produced under the FHWA contract "Development, Operation and Maintenance of the Highway Safety Information System (HSIS IV)" directed by Ms. Carol Tan (COTR). LENDIS Corporation was a subcontractor and provided programming support.			
16. Abstract In 2004, 4,641 pedestrians and 725 bicyclists were killed, accounting for 13 percent of all traffic fatalities in the United States. An additional 68,000 pedestrians and 41,000 bicyclists were reported to be injured as a result of collisions with motor vehicles. PBCAT is a software product intended to assist State and local pedestrian and bicycle coordinators, planners, and engineers in addressing pedestrian and bicyclist crash problems. PBCAT accomplishes this goal through the development and analysis of a database containing details associated with crashes between motor vehicles and pedestrians or bicyclists. One of these details is the crash type, which describes the pre-crash actions of the parties involved. With the database developed, the software can then be used to produce reports and select countermeasures to address the problems identified. Features of PBCAT Version 2.0 include: • Form Design—users can customize the data entry form for inputting crash data; the form can be designed to match the local police crash report. • Group Typing – an alternative version of crash typing is available for users who do not wish to have the level of crash type detail offered in the traditional version. • Location Data—users have the option of recording specific location information (e.g., approach leg and travel direction) for pedestrian crashes occurring at intersections. • Crash Reports—users have more table options and the capability to export results to Microsoft® Excel®. • Countermeasures—links are provided to access the engineering, education, and enforcement countermeasures in PEDSAFE and BIKESAFE, which are Websites developed for FHWA that include a number of expert system tools for selecting the most appropriate countermeasures.			
17. Key Words Pedestrian crashes, bicycle crashes, crash typing, crash analysis, pedestrian countermeasures, bicycling countermeasures		18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 241	22. Price

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

TABLE OF CONTENTS

Chapter 1. Product Overview	1
Crash Typing	1
Version 2.0 Features	1
Applications.....	2
Technical Support.....	3
Chapter 2. Software Installation	5
System Requirements	5
Installation Steps	5
Chapter 3. Getting Started: The Basics	7
Layout and Navigation	7
Toolbar	7
Data Entry and Crash Typing Buttons	7
Form Design Buttons	8
Quick Start Steps	8
Step 1—Create New Database	8
Step 2—Select Database and Forms	9
Chapter 4. Application Preferences	11
Data Sources	11
Crash Typing Options	13
Database Fields.....	15
Crash Typing Fields	18
Age Fields	19
User Profiles	19
Passwords.....	20
Editing Options	21
Speed Groups.....	21
Age Groups.....	23
Chapter 5. Form Creation and Design.....	25
Forms and Databases	25
Existing Forms.....	25
Form Creation.....	26
Adding Fields	28
Adding Text and Group Boxes	28
Deleting Fields	29
Indexing Tabs.....	29
Saving and Renaming	30
Form Deletion.....	30
Form Copying.....	31

Chapter 6. Data Entry and Crash Typing	33
Data Entry.....	33
Basic Functions	33
Other Functions.....	35
Crash Typing Options and Database Fields	36
Pedestrian Location.....	36
Standard versus Group Typing.....	37
Database Fields	37
Crash Typing Screens and Definitions	39
Crash Typing Examples	40
Example 1—Bicyclist Crash (Standard Typing).....	40
Example 2—Pedestrian Crash (Standard Typing, Location Option Enabled).....	49
Example 3—Bicyclist Crash (Group Typing).....	60
Chapter 7. Analysis Reports	65
Crash Type Frequency.....	65
Tables and Graphs	66
Examples	67
Example 1—Bicyclist Crashes—Light Conditions	67
Example 2—Pedestrian Crashes—Crash Types and Pedestrian Age	69
Chapter 8. Database Options	71
Import A Database.....	71
Export A Database.....	72
Chapter 9. Countermeasures	75
Pedestrian Countermeasure Matrix	77
Bicyclist Countermeasure Matrix.....	78
Countermeasure Descriptions.....	80
Appendix A: Installation Instructions	83
Appendix B: Pedestrian Location Scenarios	91
Appendix C: Crash Types and Crash Groups	95
Appendix D: Database Structure	103
Appendix E: Data Entry Forms	123
Appendix F: Crash Typing Definitions	135
Appendix G: Crash Typing Examples	155
Appendix H: Pedsafe and Bikesafe Groups	223
References	231

LIST OF FIGURES

Figure 1. Image. Extract the installation files.	5
Figure 2. Image. Use pull-down menus and toolbars for navigation.	7
Figure 3. Image. Step 1.	9
Figure 4. Image. Step 2.	9
Figure 5. Image. Set default database and choose default data entry forms.	10
Figure 6. Image. Step 3.	10
Figure 7. Image. Set database options and user profiles.	11
Figure 8. Image. Create, add an existing, or remove a database.	12
Figure 9. Image. Search for and open a database to be added.	12
Figure 10. Image. Enable or disable pedestrian location option and group typing options.	13
Figure 11. Image. Add, delete, or edit fields in the database.	15
Figure 12. Image. Enter field name, alias, data type, field length, entry type, and default value.	16
Figure 13. Image. Select a field entry type.	16
Figure 14. Image. Edit a field.	17
Figure 15. Image. Set user profiles, passwords, and editing options.	19
Figure 16. Image. Create a new profile.	20
Figure 17. Image. Select a profile.	20
Figure 18. Image. Enter a password and hint information.	20
Figure 19. Image. Enter a password.	21
Figure 20. Image. Set values for speed groups and choose units of measurement.	22
Figure 21. Image. Establish as few as two groups.	22
Figure 22. Image. Set values for pedestrian, bicyclist, and motorist age groups.	23
Figure 23. Image. Set values and numbers of groups for three modes.	24
Figure 24. Image. Create, edit, delete, and copy forms.	25
Figure 25. Image. Select forms for editing.	25
Figure 26. Image. Create a form using the <i>New Form</i> function.	27
Figure 27. Image. Create a form using the <i>Edit Form</i> function.	27
Figure 28. Image. Insert a field on a form.	28
Figure 29. Image. Insert text and group boxes on a form.	28
Figure 30. Image. Resize a box.	29
Figure 31. Image. Set the sequence of tabs for a new or existing form.	29

Figure 32. Image. Rename and save a form.....	30
Figure 33. Image. Overwrite an existing form.....	30
Figure 34. Image. Delete a form.	30
Figure 35. Image. Copy a form.	31
Figure 36. Image. Enter pedestrian or bicyclist crash data.	33
Figure 37. Image. Access the <i>Crash Typing</i> function.....	34
Figure 38. Image. Save a data entry record.	34
Figure 39. Image. Open a new data entry form.	35
Figure 40. Image. Navigate to, delete, search, and browse records in a table.	35
Figure 41. Image. Search the database for specific records.....	35
Figure 42. Image. Browse all records in the database.	36
Figure 43. Image. Preview the data form that can be printed.	36
Figure 44. Image. Start the crash typing process.	39
Figure 45. Image. Identify where the crash occurred.	39
Figure 46. Image. Page 1 of Florida Crash Report for example 1.	41
Figure 47. Image. Page 2 of Florida Crash Report for example 1.	42
Figure 48. Image. Page 3 of Florida Crash Report for example 1.	43
Figure 49. Image. Open a bicyclist crash data entry form then begin the crash typing process.....	44
Figure 50. Image. Click on Intersection to indicate where crash occurred.....	44
Figure 51. Image. Indicate where the bicyclist was initially positioned.....	45
Figure 52. Image. Indicate travel direction of the bicyclist.	45
Figure 53. Image. Indicate unusual/specific circumstances.....	46
Figure 54. Image. Indicate initial approach paths.....	46
Figure 55. Image. Indicate maneuvers made by the parties.....	47
Figure 56. Image. Indicate type of traffic control at the intersection.	47
Figure 57. Image. Describe the circumstances of a sign-controlled intersection crash.....	48
Figure 58. Image. Enter crash typing data into the entry form.	48
Figure 59. Image. Page 1 of North Carolina Crash Report for example 2.	50
Figure 60. Image. Page 2 of North Carolina Crash Report for example 2.	51
Figure 61. Image. Page 3 of North Carolina Crash Report for example 2.	52
Figure 62. Images. Pedestrian crash data entry forms.	53
Figure 63. Image. Indicate where the crash occurred.	53

Figure 64. Image. Indicate position of pedestrian when struck.	54
Figure 65. Image. Indicate initial direction of travel of the motorist.....	54
Figure 66. Image. Indicate the motorist maneuver.	55
Figure 67. Image. Indicate where the crash occurred at the intersection.....	55
Figure 68. Image. Select the scenario that illustrates the pedestrian's movement when struck.	56
Figure 69. Image. Indicate no unusual circumstances.	56
Figure 70. Image. Indicate no unusual vehicle types or vehicle actions.....	57
Figure 71. Image. Indicate no unusual pedestrian action.....	57
Figure 72. Image. Describe the typical pedestrian action in the crash.	58
Figure 73. Image. Describe the circumstances of the crash.....	58
Figure 74. Image. Describe the circumstances of the crash in more detail.	59
Figure 75. Image. Enter crash typing data into data entry form.	59
Figure 76. Image. Enable group typing for bicyclist crashes.	60
Figure 77. Image. Open a bicyclist crash data entry form then begin the crash typing process.	61
Figure 78. Image. Indicate initial approach paths for bicyclist and motorist.	61
Figure 79. Image. Describe the circumstances of the crash in this case.	62
Figure 80. Image. Enter crash typing data into form.	62
Figure 81. Image. Select analysis options.....	65
Figure 82. Image. Produce a list of crash types or crash groups in order of frequency.....	65
Figure 83. Image. Produce single-variable and multivariate tables.....	66
Figure 84. Image. Produce a single-variable table.....	68
Figure 85. Image. Produce a graph of a single-variable table.	68
Figure 86. Image. Export results to Excel.....	69
Figure 87. Image. Produce a multivariate table.	69
Figure 88. Image. Present results as percentages.....	70
Figure 89. Image. Import and export data.....	71
Figure 90. Image. Import a PBCAT Version 1.0 database.	71
Figure 91. Image. Select the database to be imported.	71
Figure 92. Image. Select database and fields to be exported and choose format.	72
Figure 93. Image. Access the PEDSAFE and BIKESAFE Web sites.	75
Figure 94. Image. Access the PEDSAFE and BIKESAFE Web sites.	76

Figure 95. Image. View countermeasures for 12 pedestrian crash groups.	77
Figure 96. Image. View countermeasures for 13 bicyclist crash groups.	79
Figure 97. Image. View countermeasure descriptions.	81
Figure 98. Step 1.	83
Figure 99. Step 1 completed.	83
Figure 100. Step 2.	83
Figure 101. Step 2—setup file.	83
Figure 102. Step 3.	84
Figure 103. Step 4.	84
Figure 104. Step 5.	84
Figure 105. Step 6.	85
Figure 106. Step 7.	85
Figure 107. Step 8.	85
Figure 108. Step 9.	86
Figure 109. Step 9—sample installation screen.	86
Figure 110. Step 10.	87
Figure 111. Step 11.	87
Figure 112. Step 11—setup file.	87
Figure 113. Step 12.	88
Figure 114. Step 13.	88
Figure 115. Step 14.	89
Figure 116. Step 15.	89
Figure 117. Step 16.	90
Figure 118. Motorist traveling straight through.	92
Figure 119. Motorist turning right.	93
Figure 120. Motorist turning left.	94
Figure 121. Ped_All_Data_Milepost Form.	124
Figure 122. Ped_All_Data_Refpost Form	125
Figure 123. Ped_All_Data_RouteName Form.	126
Figure 124. Ped_All_Data_LinkNode Form.	127
Figure 125. Ped_Crash_Type Form.	128
Figure 126. Bike_All_Data_Milepost Form	129
Figure 127. Bike_All_Data_Refpost Form.	130

Figure 128. Bike_All_Data_RouteName Form	131
Figure 129. Bike_All_Data_LinkNode Form	132
Figure 130. Bike_Crash_Type Form	133
Figure 131. Codes for North Carolina Commission Report Forms	156
Figure 132. North Carolina Crash Report—Number 1.....	157
Figure 133. North Carolina Crash Report—Number 2.....	159
Figure 134. North Carolina Crash Report—Number 3.....	161
Figure 135. North Carolina Crash Report—Number 4.....	163
Figure 136. North Carolina Crash Report—Number 5.....	165
Figure 137. North Carolina Crash Report—Number 6.....	167
Figure 138. North Carolina Crash Report—Number 7.....	169
Figure 139. North Carolina Crash Report—Number 8.....	171
Figure 140. North Carolina Crash Report—Number 9.....	173
Figure 141. North Carolina Crash Report—Number 10.....	175
Figure 142. Florida Crash Report—Report 1	183
Figure 143. Florida Crash Report—Report 2	186
Figure 144. Florida Crash Report—Report 3	189
Figure 145. Florida Crash Report—Report 4	191
Figure 146. Florida Crash Report—Report 5	194
Figure 147. Florida Crash Report—Report 6	197
Figure 148. Florida Crash Report—Report 7	200
Figure 149. Florida Crash Report—Report 8	203
Figure 150. Florida Crash Report—Report 9	206
Figure 151. Florida Crash Report—Report 10	209

LIST OF TABLES

Table 1. Values for Crash Typing Fields for Example 1	49
Table 2. Values for Crash Typing Fields for Example 2	60
Table 3. Values for Crash Typing Fields for Example 3	63
Table 4: Pedestrian Crash Types and Crash Groups.....	96
Table 5. Bicyclist Crash Types and Crash Groups	99
Table 6. Pedestrian Table Structure for PBCAT.MDB Database.....	104
Table 7. Bicyclist Table Structure for PBCAT.MDB Database	113
Table 8. Pedestrian Crash Location Definitions	136
Table 9. Bicyclist Crash Location Definitions.....	137
Table 10. Pedestrian Crash Type Definitions	139
Table 11. Pedestrian Crash Group Definitions	144
Table 12. Bicyclist Crash Type Definitions.....	146
Table 13. Bicyclist Crash Group Definitions.....	152
Table 14. Correct Responses to the Crash Typing Logic for the 10 Sample Pedestrian Crashes	177
Table 15. Correct Responses to the Crash Typing Logic for the 10 Sample Bicycle Crashes.....	213
Table 16. PEDSAFE—PBCAT Mapping.....	224
Table 17. BIKESAFE—PBCAT Mapping.....	227