TABLE OF CONTENTS

PREFACE xi

Chapter 1 THE INVESTIGATION OR COLLISION RECONSTRUCTION REPORT

1.1 Getting Started 1
1.2 Visualization 3
1.3 Basic Physic Concepts 5
1.4 Collision Reconstruction Methodologies 10
1.5 The Anatomy of a Collision 11
1.6 Evaluating the Investigation Report 15
1.7 Who is a Collision Reconstruction Expert? 22
1.8 Selecting a Collision Reconstructionist 24

Chapter 2 THE INVESTIGATION

2.1 Opinion(s) Depend on Investigation 29
2.2 Point of Impact (POI) 30
2.3 Tire Mark Evidence 33
2.4 Photographic Evidence 37
2.5 Case Studies 39
2.5.1 Tire Mark Evidence Misinterpreted 40
2.5.2 Lamp Evidence 42
2.5.3 Tire Mark Measurements 48
2.5.4 Incorrect Determination of Vehicle Acceleration Rate 50
2.5.5 Incorrect Acceleration 53
2.5.6 Incorrect POI in Crossing the Center Line Case 56
2.5.7 Accuracy of Measuring Instrument 62
2.5.8 Grade Measurement Using Carpenter Level 66
2.5.9 Reconstructing Weather Information 68
2.5.10 Using Photographs to Locate Evidence 71
2.5.11 Misinterpretation of Air Bag Non-Deployment 74
2.5.12 Potential Error in Computer Drawing 78
2.5.13 Measurement of Gap Skid 82
2.5.14 Measurement of Skip Skid 85
2.5.15 Incomplete Description of Reference Point 87

2.5.16 How to Photograph Skid Mark evidence 91
2.5.17 Who was driving? 96

Chapter 3 DRAG FACTOR

3.1 What is the Drag Factor of a Road? 101
3.2 Case Studies 107
3.3.1 Use of Average f Value 108
3.3.2 Errors in Skid Tests 110
3.3.3 Drag Factor Variation with Speed 113
3.3.4 Drag Factor Grade Correction 116
3.3.5 Drag Sleds are Not Acceptable 118
3.3.6 Sled Used on Grass, Soft Shoulder, or Wet Road 122
3.3.7 Drag Factor is Tire Specific 124
3.3.8 Drag Factor in Overlap Skid 126
3.3.9 Misuse of Accelerometer 128
3.3.10 Skid Tests Done at Low Speeds 131
3.3.11 Accelerometer is a "Black Box" 135
3.3.12 Drag Factor Charts 138
3.3.13 Published Charts of f Values 141
3.3.14 Accuracy of Drag Sled Scale 143
3.3.15 Drag Sled Scale Jumps 146
3.3.16 Adjustment to f Value for Trucks 147
3.3.17 Location of f Measurement 150
3.3.18 Post-impact Drag Factor 153

Chapter 4 SPEED FROM SKID MARK EVIDENCE

4.1 Methodology 161
4.2 Sample Calculations 164
4.3 Case Studies 166
4.3.1 Braking Efficiency 167
4.3.2 Post-impact Skids 168
4.3.3 Curved ABS Brake Marks 171
4.3.4 Single Curved ABS Mark 175
4.3.5 Propagation of Errors in Calculations 178
4.3.6 Evidence of Braking 180
4.3.7 Skid Length Measurement 183
4.3.8 Pre-skid Shadow 186

4.3.9 Weight Shift During Braking 189
4.3.10 Braking Efficiency in Motorcycle Skid 191
4.3.11 Speed Estimate for Tumbling, Rollover Motion 195
4.3.12 Speed Estimate in Pedestrian Collision 199

Chapter 5 SPEED FROM YAW MARKS

5.1 Yaw Marks or Critical Speed Scuff Marks 207
5.2 Caveats 218
5.3 Loss of Energy during Yaw 219
5.4 Case Studies 220
5.4.1 Yaw after Impact 221
5.4.2 Braking Action Causes Yaw 224
5.4.3 Yaw Mark or Curved ABS Scuff Mark 226
5.4.4 Yaw on Soft Shoulder 227
5.4.5 Speed Estimate at End of Yaw 229
5.4.6 Yaw Caused by Weight Shift or Irregular Road Surface 231
5.4.7 Yaw after Vault 233
5.4.8 Articulated Vehicle Yaw 235
5.4.9 Road Radius Measurement 236
5.4.10 Accuracy of Radius Determination 238
5.4.11 Direction of Drag Factor Measurement 242
5.4.12 Yaw Mark Radius not Constant 244
5.4.13 Lack of Yaw Marks as Evidence 247
5.4.14 Yaw Speed Does Not Match FRP 249
5.4.15 Yaw Speed Added to Subsequent Event 252

Chapter 6 SPEED FROM AN AIRBORNE MOTION

6.1 The Airborne Equations 255
6.2 Technical Basis for the Airborne Equations 256
6.3 Caveats 261
6.4 Case Studies. 263
6.4.1 Accuracy of Airborne Speed Estimate 264
6.4.2 Launch Angle in Motorcycle Collision 267
6.4.3 Airborne Motion Caused by Jumping a Curb 270
6.4.4 Slope Measurement Rounded 272
6.4.5 Where Did Vehicle Go Airborne? 276
6.4.6 Airborne Speed Added to Subsequent Event 279

6.4.7 Airborne Speed Added to Prior Event 281
6.4.8 Fall Height Determination 283
6.4.9 Unrestricted Parabolic Motion 286
6.4.10 Airborne Speed from Debris 288
6.4.11 Use of 45° Angle in Pedestrian Cases 290
6.4.12 Speed from Shoe Throw 292
6.4.13 FRP Used as Landing Point 294
6.4.14 Airborne Motion of Mailbox 296

Chapter 7 MOMENTUM AND OTHER TOPICS

7.1 Overview 299
7.2 Time-Distance Analysis 299
7.2.1 Definitions and Vocabulary 300
7.2.2 Motion at Constant Speed 302
7.2.3 Motions with Non-Constant Speed 305
7.2.4 Vehicle Acceleration Tests 310
7.2.5 Assumptions Based on Statistical Studies 311
7.2.6 Galileo's Laws of Motion 313
7.2.7 Perception-Reaction Time 316
7.3 Case Studies 318
7.3.1 Stopping Distance Charts 319
7.3.2 Assigning a PRT Value to an Operator 320
7.3.3 Identifying the Assumptions 323
7.3.4 PRT Used to Calculate Speed 325
7.4 Linear Momentum—An Overview 326
7.4.1 Definition of Momentum 327
7.4.2 Technical Background 328
7.4.3 Components of a Vector 331
7.4.4 Momentum Notation 333
7.4.5 Conservation of Momentum Theory 334
7.4.6 Attacks on Momentum Calculations 336
7.5 Case Studies 338
7.5.1 Approach Angle of Turning Vehicle 338
7.5.2 Speed of Turning Vehicle Exceeds Critical Speed 340
7.5.3 Sensitivity in Head-On collisions 341
7.5.4 Weight ratio of Vehicles—MC, TT, Pedestrian 344
7.5.5 Errors in Momentum Calculations 346
7.6 Miscellaneous Topics 348
7.6.1 Pedestrian Head Strike on Windshield 348
7.6.2 Car Breaks Apart in Utility Pole Impact 351

7.6.3 Driving Beyond the Headlights 353
7.6.4 Incorrect Interpretation of Damage 354
7.6.5 Misapplication of Computer Software 356
7.6.6 Accuracy of Video Animation 360
7.6.7 Notice of Video Animation 364

Chapter 8 EXPERT DISCOVERY

8.1 Discovery from an Expert's Perspective 369
8.2 The Credentials of the Other Expert 370
8.3 Taking an Effective Deposition 374
8.4 Deposition Checklist 376

APPENDICES

Resources 381
Sample Direct Examination Testimony 383
Attacks on the Expert Witness 389
Glossary 391
Helpful Web Sites 397