

PB85217818



1. Report No. FHWA-RD-		2. Government Accession No.	
4. Title and Subtitle RELATIONSHIP BETWEEN ACCIDENT SEVERITY AND FULL-SCALE CRASH TEST Vol. II: Appendices		5. Report Date August 31, 1984	
		6. Performing Organization Code SwRI 06-7742	
7. Author(s) L. R. Calcote and R. L. Mason		8. Performing Organization Report No. 06-7742	
9. Performing Organization Name and Address Southwest Research Institute 6220 Culebra Road, P.O. Drawer 28510 San Antonio, Texas 78284		10. Work Unit No.	
		11. Contract or Grant No. DTFH61-83-C-00072	
12. Sponsoring Agency Name and Address Federal Highway Administration Office of Safety Traffic Operations Research and Dev. 6300 Georgetown Pike McLean, Virginia 22101		13. Type of Report and Period Covered Final Report Sept., 1983 - Aug., 1984	
		14. Sponsoring Agency Code	
15. Supplementary Notes FHWA Contract Manager: Mr. Lawrence McCarthy, HSR-20			
16. Abstract <p>Available accident files are used to generate a 412-accident data base of guardrail impacts. This base is analyzed to develop a statistical model for predicting accident severity index (ASI) as a function of vehicle type or weight, impact speed, and impact angle.</p> <p>Reported full-scale test results are used to generate a 91-test data base of guardrail full-scale crash tests. Mathematical severity index (MSI) is calculated for each test as the resultant of the reported maximum 50-ms vehicle lateral and longitudinal accelerations. The statistical model is applied to each test to predict the corresponding ASI. These pairs of MSI/ASI values are used to determine the relationship between the two indexes.</p> <p>It is shown that only a moderate MSI/ASI relationship appears to exist and that the MSI is probably not a severity-discerning characteristic of full-scale tests. Low, constant ASI values over the range of MSI values indicate that guardrails are performing their intended purposes.</p> <p>This volume contains related appendices. Technical documentation of work done in the study is contained in Volume I.</p>			
17. Key Words Guardrails, Full-Scale Crash Test Analysis, Highway Accident Analysis, Mathematical Severity Index, Accident Severity Index		18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia, 22161.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 48	22. Price \$ 8.50



TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
APPENDIX A	PROSPECTUS	1
APPENDIX B	FULL-SCALE TESTS	3
APPENDIX C	PREDICTION EQUATION COEFFICIENTS	34
APPENDIX D	SEVER PROGRAM LISTING AND INPUT	41



PROSPECTUS

"Relationship Between Highway Accident Severity
and Full-Scale Crash Test"

INTRODUCTION

The cost-effective deployment of roadside safety hardware is a function of the hardware's expected effectiveness in reducing accident severity. Full-scale crash testing for acceptance of roadside barriers provides information on structural adequacy (for containment and redirection) and impact severity in terms of the vehicle's lateral and longitudinal accelerations. Barrier acceptance requires that the barrier satisfy these test evaluation criteria, yet these test data results cannot accurately predict the barrier's in-service performance. This link between vehicle accelerations derived from crash tests (or computer simulations) and real world accident severity is needed as input into cost-effectiveness analysis for the warranting and evaluation of roadside safety appurtenances. Cost-effective decision making requires a procedure to estimate the yearly accident severity expected from the range of in-service hits prior to the barrier's actual deployment.

STATEMENT OF WORK

CONTRACT OBJECTIVES

The objective of this study is to develop and quantify a relationship between vehicle accelerations and real-world accident severity. The study will relate vehicle acceleration data from full-scale crash testing to the accident severity expected in the field based upon existing accident files. The study will establish a method that uses actual crash testing data input into field performance prediction.

SCOPE OF WORK

This study shall be limited to existing data bases. No new data will be collected.

DELINEATION OF CONTRACTOR TASKS

To achieve the contract objectives, the contractor shall, as a minimum, perform the following tasks:

Task A - Develop Appropriate Mathematical Severity Index (MSI)

1. Contractor shall define a mathematical severity index as a function of full-scale crash test data parameters, including:
 - a. G_{long} - defined as the maximum 50 ms longitudinal acceleration.
 - b. G_{lat} - defined as the maximum 50 ms latitudinal acceleration.
2. Contractor shall develop MSI data base from available crash test data.

Task B - Analytical Model Development

Contractor shall develop an analytical model that predicts accident severity (i.e., percentage of PDO, injury, and fatal accidents) as a function of:

1. Impact speed
2. Departure angle
3. Lateral offset distance
4. Vehicle type
5. Object struck

This model shall be developed from existing data bases, including the Calspan Data ¹ and the Interstate System Accident Research Data Base. ²

Task C - Develop Appropriate Accident Severity Index

Contractor shall convert accident severity percentage developed in Task B to a single accident severity index (ASI). The conversion of the percentages of PDO, injury, and fatal accidents to the ASI shall be guided by the AASHTO ³ severity indices.

Task D - Analysis of Relationship Between ASI and MSI

Contractor shall conduct statistical analyses to determine the relationship between ASI and MSI.

Task E - Prepare Report

Synthesize study results and prepare final report.

APPENDIX B
FULL-SCALE TESTS

CASE 1 SWRI TEST 101 4042 lb/55.2 mph/30.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES
PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 6.37
GUARDRAIL TYPE = G4W

CASE 2 SWRI TEST 103 4123 lb/60.1 mph/22.2 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES
PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 6.45
GUARDRAIL TYPE = G4W

CASE 3 SWRI TEST 105 4051 lb/60.1 mph/27.8 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES
PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 3.90

GUARDRAIL TYPE = G2

CASE 4 SWRI TEST 123 3883 lb/64.3 mph/27.1 deg

INDEX VALUES OF SPOD,SINJ,SFAT = 24 72 120

SEVERITIES
PDO = .388
INJJRY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 5.39
GUARDRAIL TYPE = G2/6.25

CASE 5 SWRI TEST 124 3904 lb/60.7 mph/26.4 deg

INDEX VALUES OF SPOD,SINJ,SFAT = 24 72 120

SEVERITIES
PDO = .388
INJJRY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 3.94
GUARDRAIL TYPE = G2/9.37

CASE 6 SWRI TEST 112 3761 lb/56.5 mph/26.9 deg

INDEX VALUES OF SPOD,SINJ,SFAT = 21 69 117

SEVERITIES
PDO = .472
INJJRY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 3.60

GUARDRAIL TYPE = G3

CASE 7 SWRI TEST 114 4031 lb/57.7 mph/26 deg
INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129
SEVERITIES
PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 4.54
GUARDRAIL TYPE = G3

CASE 8 SWRI TEST 119 4069 lb/53.4 mph/30.2 deg
INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129
SEVERITIES
PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 5.39
GUARDRAIL TYPE = A/6.25

CASE 9 SWRI TEST 120 3813 lb/56.8 mph/28.4 deg
INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117
SEVERITIES
PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 7.58

GUARDRAIL TYPE = G4S

CASE 10 SWRI TEST 121

4478 lb/56.2 mph/27.4 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES

POD = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 6.74
GUARDRAIL TYPE = G4S

CASE 11 SWRI TEST 122

4570 lb/62.9 mph/25.3 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES

POD = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 8.34
GUARDRAIL TYPE = G4S

CASE 12 SWRI TEST ODH-2

4404 lb/62 mph/25.3 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES

POD = .455
INJJRY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 2.85

GUARDRAIL TYPE = A

CASE 13 SWRI TEST ODH-3

4445 lb/62.5 mph/28.7 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES

PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 5.90
GUARDRAIL TYPE = A

CASE 14 SWRI TEST ODH-4

4242 lb/63.1 mph/28.3 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES

PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 3.95
GUARDRAIL TYPE = A

CASE 15 SWRI TEST ODH-5

4407 lb/70.8 mph/26.7 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES

PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 4.60

GUARDRAIL TYPE = A

CASE 16 SWRI TEST ODH-7 4292 lb/58.2 mph/26.3 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES
PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 5.18
GUARDRAIL TYPE = A

CASE 17 SWRI TEST AS-1 4500 lb/66.1 mph/26.8 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES
PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 7.70
GUARDRAIL TYPE = THRIE/MB

CASE 18 SWRI TEST AS-2 4000 lb/67.1 mph/28.9 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES
PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 9.52

GUARDRAIL TYPE = THRIE/N8

CASE 19 SWRI TEST AS-3

2200 lb/54.1 mph/16.8 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 8 56 104

SEVERITIES

PDO = .400
INJURY = .552
FATAL = .048
COST = 15324.

ACCIDENT SEVERITY INDEX = 4.84
MATHEMATICAL SEVERITY INDEX = 5.46
GUARDRAIL TYPE = THRIE/NB

CASE 20 SWRI TEST AS-4

4500 lb/59.1 mph/15.9 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 32 80 128

SEVERITIES

PDO = .517
INJURY = .421
FATAL = .062
COST = 16989.

ACCIDENT SEVERITY INDEX = 5.02
MATHEMATICAL SEVERITY INDEX = 4.64
GUARDRAIL TYPE = THRIE/NB

CASE 21 SWRI TEST AS-5

4000 lb/56.4 mph/25.2 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 8.32

GUARDRAIL TYPE = THRIE/NB

CASE 22 SWRI TEST EAS-1 4000 lb/66.0 mph/25.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES
PDD = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 10.11
GUARDRAIL TYPE = THRIE/HYC.B

CASE 23 SWRI TEST NASS-2 4619 lb/62.0 mph/29.3 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES
PDD = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 6.93
GUARDRAIL TYPE = THRIE

CASE 24 SWRI TEST AS-6 4323 lb/61.3 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES
PDD = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 6.84

GUARDRAIL TYPE = THRIE/C-POST

CASE 25 SWRI TEST AS-7 4323 lb/62.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES
PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 6.31
GUARDRAIL TYPE = THRIE/C-POST

CASE 26 SWRI TEST AS-8 4323 lb/59.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES
PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 6.92
GUARDRAIL TYPE = THRIE/C-POST

CASE 27 SWRI TEST 137 BEAM 3900 lb/62.0 mph/27 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES
PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 9.13

GUARDRAIL TYPE = B

CASE 28 SWRI TEST 141 BEAM

3900 lb/61.9 mph/27.4 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES

PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 6.33
GUARDRAIL TYPE = B

CASE 29 SWRI TEST 148 TERMINAL

3900 lb/63.0 mph/27 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES

PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 8.17
GUARDRAIL TYPE = B/18'SHEET

CASE 30 SWRI TEST 154 TERMINAL

3800 lb/60.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES

PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 10.22

GUARDRAIL TYPE = G4S/30'SHEET

CASE 31 SWRI TEST 157 TERMINAL 3900 lb/58.0 mph/26 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES
PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 9.56
GUARDRAIL TYPE = G2/30" SHEET

CASE 32 SWRI TEST IHSC-1 2250 lb/62.4 mph/15.3 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 11 59 107

SEVERITIES
PDO = .333
INJURY = .533
FATAL = .133
COST = 32226.

ACCIDENT SEVERITY INDEX = 5.04
MATHEMATICAL SEVERITY INDEX = 6.76
GUARDRAIL TYPE = G45/12.5'

CASE 33 SWRI TEST IHSC-2 4500 lb/57.6 mph/24.4 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES
PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 7.09

GUARDRAIL TYPE = G45/12.5'

CASE 34 SWRI TEST IHSC-3

4500 lb/60.2 mph/24.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES

PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 11.80
GUARDRAIL TYPE = G4S/3.13'

CASE 35 SWRI TEST IHSC-4

2250 lb/58.7 mph/13.9 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 8 56 104

SEVERITIES

PDO = .400
INJURY = .552
FATAL = .048
COST = 15324.

ACCIDENT SEVERITY INDEX = 4.84
MATHEMATICAL SEVERITY INDEX = 8.11
GUARDRAIL TYPE = G4S/12.5'

CASE 36 SWRI TEST IHSC-6 TRANS.

4500 lb/58.7 mph/24 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES

PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 9.72

GUARDRAIL TYPE = G4S/AL.EX.

CASE 37 SWRI TEST IHSC-7 TRANS. 4500 lb/59.4 mph/24.2 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES

PDD = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 10.28
GUARDRAIL TYPE = G4S/AL.EX.

CASE 38 SWRI TEST SRB-1 2650 lb/58.6 mph/17.2 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 4 56 104

SEVERITIES

PDD = .400
INJURY = .552
FATAL = .048
COST = 15324.

ACCIDENT SEVERITY INDEX = 4.84
MATHEMATICAL SEVERITY INDEX = 9.21
GUARDRAIL TYPE = TU.THRIE/4.17'

CASE 39 SWRI TEST SRB-2 4700 lb/60.6 mph/24.6 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES

PDD = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 11.36

GUARDRAIL TYPE = TU.THRIE/4.17'

CASE 40 SWRI TEST SR8-3

20,000 lb/56.9 mph/17.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 44 92 140

SEVERITIES

PDO = .368
INJURY = .526
FATAL = .105
COST = 26581.

ACCIDENT SEVERITY INDEX = 5.69
MATHEMATICAL SEVERITY INDEX = 5.26
GUARDRAIL TYPE = TU.THRIE/4.17'

CASE 41 SWRI TEST SR8-4

2083 lb/54.7 mph/17.1 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 8 56 104

SEVERITIES

PDO = .400
INJURY = .552
FATAL = .048
COST = 15324.

ACCIDENT SEVERITY INDEX = 4.84
MATHEMATICAL SEVERITY INDEX = 6.63
GUARDRAIL TYPE = TU.THRIE/4.17'

CASE 42 SWRI TEST SR8-6 TRANS.

4832 lb/56.2 mph/25.3 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES

PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 8.81

GUARDRAIL TYPE = THRIE

CASE 43 SWRI TEST RBCT-3

4692 lb/55.9 mph/24.9 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES

PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 8.89
GUARDRAIL TYPE = G4W

CASE 44 NEW YORK TEST-3

3300 lb/50.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 5.50
GUARDRAIL TYPE = G3

CASE 45 NEW YORK TEST-5

3385 lb/58.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 5.50

GUARDRAIL TYPE = G3/6X12BJX

CASE 46 NEW YORK TEST-7

2825 lb/60.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 5.20
GUARDRAIL TYPE = G3/6X88JX

CASE 47 NEW YORK TEST-8

3385 lb/55.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 4.70
GUARDRAIL TYPE = G3/3'

CASE 48 NEW YORK TEST-9

3300 lb/53.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 6.10

GUARDRAIL TYPE = G1

CASE 49 NEW YORK TEST-10

3300 lb/56.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 2.40
GUARDRAIL TYPE = G1/12'

CASE 50 NEW YORK TEST-11

3300 lb/58.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 3.90
GUARDRAIL TYPE = G1/8'

CASE 51 NEW YORK TEST-12

3000 lb/55.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJJRY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = .90

GUARDRAIL TYPE = G1/4'

CASE 52 NEW YORK TEST-18

2135 lb/61.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 12 60 108

SEVERITIES

PDO = .333
INJURY = .533
FATAL = .133
COST = 32226.

ACCIDENT SEVERITY INDEX = 6.04
MATHEMATICAL SEVERITY INDEX = 4.90
GUARDRAIL TYPE = G3/MB

CASE 53 NEW YORK TEST-19

1623 lb/60.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 9 57 105

SEVERITIES

PDO = .422
INJURY = .531
FATAL = .047
COST = 14988.

ACCIDENT SEVERITY INDEX = 4.80
MATHEMATICAL SEVERITY INDEX = 6.40
GUARDRAIL TYPE = G3

CASE 54 NEW YORK TEST-20

1975 lb/70 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 12 60 108

SEVERITIES

PDO = .333
INJURY = .533
FATAL = .133
COST = 32226.

ACCIDENT SEVERITY INDEX = 6.04
MATHEMATICAL SEVERITY INDEX = 6.30

GUARDRAIL TYPE = G2/MB

CASE 55 NEW YORK TEST-21

1623 lb/57.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 9 57 105

SEVERITIES

PDO = .422
INJJRY = .531
FATAL = .047
COST = 14988.

ACCIDENT SEVERITY INDEX = 4.80
MATHEMATICAL SEVERITY INDEX = 2.20
GUARDRAIL TYPE = G1

CASE 56 NEW YORK TEST-26

3680 lb/32.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 18 65 114

SEVERITIES

PDO = .583
INJJRY = .365
FATAL = .052
COST = 14500.

ACCIDENT SEVERITY INDEX = 4.74
MATHEMATICAL SEVERITY INDEX = 1.60
GUARDRAIL TYPE = G2

CASE 57 NEW YORK TEST-31

2660 lb/54.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 9 57 105

SEVERITIES

PDO = .422
INJJRY = .531
FATAL = .047
COST = 14988.

ACCIDENT SEVERITY INDEX = 4.80
MATHEMATICAL SEVERITY INDEX = 2.10

GUARDRAIL TYPE = G1-G3/TRANS.

CASE 58 NEW YORK TEST-32

3000 lb/40.0 mph/20 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 17 65 113

SEVERITIES

PDO = .560
INJURY = .389
FATAL = .051
COST = 14558.

ACCIDENT SEVERITY INDEX = 4.75
MATHEMATICAL SEVERITY INDEX = 3.00
GUARDRAIL TYPE = G1-G3/TRANS.

CASE 59 NEW YORK TEST-33

3985 lb/55.0 mph/22 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 1.60
GUARDRAIL TYPE = G1-G3/TRANS.

CASE 60 NEW YORK TEST-34

3105 lb/61 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES

PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 8.10

GUARDRAIL TYPE = G1-G3/TRANS.

CASE 61 NEW YORK TEST-37

3000 lb/62.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 .120

SEVERITIES

PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 6.13
MATHEMATICAL SEVERITY INDEX = 6.90
GUARDRAIL TYPE = G2-G3/TRANS.

CASE 62 NEW YORK TEST-38

3680 lb/60.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 3.40
GUARDRAIL TYPE = G2-G3/TRANS.

CASE 63 NEW YORK TEST-39

3680 lb/53.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJJRY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 4.70

GUARDRAIL TYPE = G2-G3/TRANS.

CASE 64 NEW YORK TEST-40

3680 lb/46.0 mph/32.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 3.30
GUARDRAIL TYPE = G2/M8

CASE 65 NEW YORK TEST-42

3680 lb/62.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 24 72 120

SEVERITIES

PDO = .388
INJURY = .459
FATAL = .153
COST = 35440.

ACCIDENT SEVERITY INDEX = 5.13
MATHEMATICAL SEVERITY INDEX = 4.50
GUARDRAIL TYPE = G3/6X8M8

CASE 66 NEW YORK TEST-43

3680 lb/55.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 3.80

GUARDRAIL TYPE = G3/6X8M3

CASE 67 NEW YORK TEST-44

3000 lb/44.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJJRY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 4.80
GUARDRAIL TYPE = G3/6X8MB

CASE 68 NEW YORK TEST-47

3000 lb/48.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJJRY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 1.50
GUARDRAIL TYPE = G2/24"HI

CASE 69 NEW YORK TEST-48

3000 lb/45 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDO = .472
INJJRY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 1.50

GUARDRAIL TYPE = G2/27"HI

CASE 70 NEW YORK TEST-49

3300 lb/58.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDD = .472
INJURY = .453
FATAL = .076
CJST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 2.70
GUARDRAIL TYPE = G2/30"HI

CASE 71 NEW YORK TEST-52

3985 lb/40.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 18 66 114

SEVERITIES

PDD = .583
INJURY = .365
FATAL = .052
CJST = 14500.

ACCIDENT SEVERITY INDEX = 4.74
MATHEMATICAL SEVERITY INDEX = 1.00
GUARDRAIL TYPE = G2/28"HI/WOOD

CASE 72 NEW YORK TEST-53

3985 lb/40.0 mph/25 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 18 66 114

SEVERITIES

PDD = .583
INJURY = .365
FATAL = .052
CJST = 14500.

ACCIDENT SEVERITY INDEX = 4.74
MATHEMATICAL SEVERITY INDEX = 1.00

GUARDRAIL TYPE = G2/28"HI/WOOD

CASE 73 CAL TEST 272

4960 lb/66.0 mph/26 deg

INDEX VALUES OF SPDD,SINJ,SFAT = 36 84 132

SEVERITIES

PDD = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 7.78
GUARDRAIL TYPE = G4#

CASE 74 CAL TEST 273

4960 lb/68.0 mph/24 deg

INDEX VALUES OF SPDD,SINJ,SFAT = 36 84 132

SEVERITIES

PDD = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 9.69
GUARDRAIL TYPE = D

CASE 75 CAL TEST 276

4960 lb/66.0 mph/25 deg

INDEX VALUES OF SPDD,SINJ,SFAT = 36 84 132

SEVERITIES

PDD = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 7.82

GUARDRAIL TYPE = G4S

CASE 76 TTI TEST 4098-1

20,020 lb/55.6 mph/13.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 44 92 140

SEVERITIES

PDD = .368
INJURY = .526
FATAL = .105
COST = 26581.

ACCIDENT SEVERITY INDEX = 5.69
MATHEMATICAL SEVERITY INDEX = 3.16
GUARDRAIL TYPE = THRIE

CASE 77 TTI TEST 4098-2

20,050 lb/59.6 mph/15 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 44 92 140

SEVERITIES

PDD = .368
INJURY = .526
FATAL = .105
COST = 26581.

ACCIDENT SEVERITY INDEX = 5.69
MATHEMATICAL SEVERITY INDEX = 3.06
GUARDRAIL TYPE = G4S

CASE 78 TTI TEST 4098-3

20,040 lb/55.8 mph/15 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 44 92 140

SEVERITIES

PDD = .368
INJURY = .526
FATAL = .105
COST = 26581.

ACCIDENT SEVERITY INDEX = 5.69
MATHEMATICAL SEVERITY INDEX = 2.73

GUARDRAIL TYPE = THRIE/MDD.8L.

CASE 79 TTI TEST 4098-4

2276 lb/60.1 mph/15 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 11 59 107

SEVERITIES

POJ = .333
INJURY = .533
FATAL = .133
COST = 32226.

ACCIDENT SEVERITY INDEX = 6.04
MATHEMATICAL SEVERITY INDEX = 7.76
GUARDRAIL TYPE = THRIE/MOJ.BL.

CASE 80 TTI TEST 4098-5

2108 lb 59.4 mph/20 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 11 59 107

SEVERITIES

POJ = .333
INJURY = .533
FATAL = .133
COST = 32226.

ACCIDENT SEVERITY INDEX = 6.04
MATHEMATICAL SEVERITY INDEX = 7.69
GUARDRAIL TYPE = THRIE/MOJ.B.

CASE 81 TTI TEST 4098-6

32,000 lb/59.4 mph/15 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 44 92 140

SEVERITIES

POJ = .368
INJURY = .526
FATAL = .105
COST = 26581.

ACCIDENT SEVERITY INDEX = 5.69
MATHEMATICAL SEVERITY INDEX = 2.53

GUARDRAIL TYPE = THRIE/MOJ.BL.

CASE 82 NEW YORK TEST-1

3105 lb 28.0 mph/90 deg

INDEX VALUES OF SPOD,SINJ,SFAT = 18 66 114

SEVERITIES
POJ = .583
INJURY = .365
FATAL = .052
COST = 14500.

ACCIDENT SEVERITY INDEX = 4.74
MATHEMATICAL SEVERITY INDEX = 3.70
GUARDRAIL TYPE = G1

CASE 83 NEW YORK TEST-2

3105 lb/29.0 mph/90 deg

INDEX VALUES OF SPOD,SINJ,SFAT = 18 66 114

SEVERITIES
POJ = .583
INJURY = .365
FATAL = .052
COST = 14500.

ACCIDENT SEVERITY INDEX = 4.74
MATHEMATICAL SEVERITY INDEX = 5.40
GUARDRAIL TYPE = G3

CASE 84 NEW YORK TEST-13

3105 lb/35.0 mph/90 deg

INDEX VALUES OF SPOD,SINJ,SFAT = 18 66 114

SEVERITIES
POJ = .583
INJURY = .365
FATAL = .052
COST = 14500.

ACCIDENT SEVERITY INDEX = 4.74
MATHEMATICAL SEVERITY INDEX = 2.00

GUARDRAIL TYPE = G1

CASE 85 SWRI TEST SA-1

1896 lb/59.8 mph/16.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 8 55 104

SEVERITIES
PDO = .400
INJURY = .552
FATAL = .048
COST = 15324.

ACCIDENT SEVERITY INDEX = 4.84
MATHEMATICAL SEVERITY INDEX = 5.03
GUARDRAIL TYPE = E

CASE 86 SWRI TEST SA-2

4747 lb/59.2 mph/25.6 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 31 129

SEVERITIES
PDO = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 7.57
GUARDRAIL TYPE = E

CASE 87 SWRI TEST SA-3

4747 lb/60.3 mph/23.8 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 36 84 132

SEVERITIES
PDO = .455
INJURY = .418
FATAL = .127
COST = 29960.

ACCIDENT SEVERITY INDEX = 5.93
MATHEMATICAL SEVERITY INDEX = 7.82

GUARDRAIL TYPE = E

CASE 33 TTI TEST 4798-8

4179 lb/56.9 mph/23.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 31 129

SEVERITIES

PDD = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 7.05
GUARDRAIL TYPE = G4S

CASE 39 TTI TEST 4798-6

3260 lb/60.0 mph/22 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 21 69 117

SEVERITIES

PDD = .472
INJURY = .453
FATAL = .076
COST = 19958.

ACCIDENT SEVERITY INDEX = 5.23
MATHEMATICAL SEVERITY INDEX = 8.77
GUARDRAIL TYPE = G4S

CASE 90 TTI TEST 4798-7

4324 lb/59.2 mph/24 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 33 81 129

SEVERITIES

PDD = .544
INJURY = .392
FATAL = .064
COST = 17101.

ACCIDENT SEVERITY INDEX = 5.03
MATHEMATICAL SEVERITY INDEX = 6.86

GUARDRAIL TYPE = G4S

CASE 91 TTI TEST 4798-4

2192 lb/59.9 mph/21.5 deg

INDEX VALUES OF SPDO,SINJ,SFAT = 9 57 105

SEVERITIES

PDJ = .422
INJURY = .531
FATAL = .047
COST = 14938.

ACCIDENT SEVERITY INDEX = 4.80
MATHEMATICAL SEVERITY INDEX = 9.56
GUARDRAIL TYPE = G4S

JOB FINISHED

APPENDIX C
 PREDICTION EQUATION COEFFICIENTS

ASYMPTOTIC STANDARD ERRORS OF THE PARAMETER ESTIMATES ARE COMPUTED BY INVERTING THE INFORMATION MATRIX.

ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE
 THETA(MEAN) .6614

ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))
 EXP(THETA) 1.9376

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

ANGLE		
SMALL	MED	LARGE
.319	-.141	-.177

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

ANGLE		
SMALL	MED	LARGE
3.215	-1.278	-1.575

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

ANGLE		
SMALL	MED	LARGE
1.375	.868	.837

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

SPEED			
S1	S2	S3	S4
-.319	.380	.346	-.406

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

SPEED			
S1	S2	S3	S4
-2.222	3.121	2.921	-2.817

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

SPEED			
	S1	S2	S3 S4
	.727	1.462	1.413 .666

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

SPEED	ANGLE		
	SMALL	MED	LARGE
S1	-.240	-.079	.319
S2	-.226	.186	.040
S3	.142	.084	-.225
S4	.325	-.192	-.134

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

SPEED	ANGLE		
	SMALL	MED	LARGE
S1	-1.553	-.450	1.880
S2	-1.959	1.516	.313
S3	1.245	.652	-1.622
S4	2.128	-1.018	-.684

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

SPEED	ANGLE		
	SMALL	MED	LARGE
S1	.786	.924	1.375
S2	.797	1.205	1.041
S3	1.152	1.087	.798
S4	1.384	.826	.875

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

VEH			
	SUB	MED	FULL TRUCK
	-.022	.046	.326 .350

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

VEH	VEH		
	SUB	MED	FULL TRUCK
	-.154	.357	2.765 -2.492

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

VEH	VEH		
	SUB	MED	FULL TRUCK

 .979 1.047 1.385 .705

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

VEH	ANGLE		
	SMALL	MED	LARGE
SUR	.132	-.085	-.047
MED	-.217	-.154	.371
FULL	-.010	-.114	.125
TRUCK	.096	.354	-.449

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

VEH	ANGLE		
	SMALL	MED	LARGE
SUR	.969	-.526	-.286
MED	-1.649	-.970	2.666
FULL	-.088	-.840	.946
TRUCK	.626	2.166	-2.296

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

VEH	ANGLE		
	SMALL	MED	LARGE
SUR	1.141	.918	.954
MED	.805	.857	1.450
FULL	.990	.892	1.133
TRUCK	1.100	1.424	.638

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

VEH	SPEED			
	S1	S2	S3	S4
SUR	.324	.288	-.031	-.581
MED	-.194	-.205	-.188	.586
FULL	.040	-.046	.139	-.133
TRUCK	-.170	-.037	.080	.128

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

VEH	SPEED			
	S1	S2	S3	S4
SUR	1.756	1.995	-.198	-2.279
MED	-.906	-1.367	-1.228	3.197
FULL	.235	-.355	1.044	-.687
TRUCK	-.705	-.214	.445	.529

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

VEH	SPEED			
	S1	S2	S3	S4
SUB	1.383	1.334	.970	.559
MED	.824	.815	.829	1.797
FULL	1.041	.955	1.149	.876
TRUCK	.844	.964	1.083	1.136

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

VEH	SPEED	ANGLF		
		SMALL	MED	LARGE
SUB	S1	-.776	.400	.376
	S2	.402	-.313	-.089
	S3	.065	.047	-.111
	S4	.310	-.134	-.176
MED	S1	.720	-.776	.056
	S2	-.422	.595	-.173
	S3	-.223	.092	.130
	S4	-.075	.088	-.013
FULL	S1	.039	.052	-.091
	S2	.031	-.011	-.020
	S3	.161	-.059	-.102
	S4	-.231	.018	.213
TRUCK	S1	.017	.324	-.342
	S2	-.010	-.272	.282
	S3	-.003	-.080	.083
	S4	-.004	.028	-.023

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

VEH	SPEED	ANGLE		
		SMALL	MED	LARGE
SUB	S1	-3.020	1.516	1.477
	S2	2.211	-1.477	-.415
	S3	.337	.209	-.461
	S4	1.062	-.347	-.452
MED	S1	2.728	-2.170	.206
	S2	-1.980	2.798	-.836
	S3	-1.107	.406	.603
	S4	-.331	.317	-.051
FULL	S1	.177	.205	-.388
	S2	.179	-.057	-.108
	S3	.969	-.305	-.513
	S4	-.972	.062	.763
TRUCK	S1	.055	1.028	-.894
	S2	-.044	-1.164	1.047

S3 -.013 -.338 .285
 S4 -.016 .084 -.059

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

VEH	SPEED	ANGLE	SMALL	MED	LARGE
SUB	S1	.460	1.492	1.457	
	S2	1.494	.731	.915	
	S3	1.067	1.048	.895	
	S4	1.364	.874	.838	
MED	S1	2.054	.460	1.058	
	S2	.655	1.813	.841	
	S3	.800	1.097	1.139	
	S4	.928	1.092	.987	
FULL	S1	1.040	1.053	.913	
	S2	1.031	.989	.980	
	S3	1.175	.943	.903	
	S4	.794	1.018	1.237	
TRUCK	S1	1.017	1.383	.711	
	S2	.990	.762	1.325	
	S3	.997	.923	1.087	
	S4	.996	1.028	.977	

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

INJURY	PDO	INJ	FATAL
	.601	.538	-1.139

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

INJURY	PDO	INJ	FATAL
	7.136	6.353	-9.211

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

INJURY	PDO	INJ	FATAL
	1.824	1.713	.320

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

INJURY	ANGLE	SMALL	MED	LARGE

PDO -.077 .013 .064
 INJ .173 -.053 -.120
 FATAL -.096 .040 .056

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

INJURY ANGLE

 SMALL MED LARGE

 PDO -.731 .115 .556
 INJ 1.645 -.456 -1.011
 FATAL -.582 .224 .311

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

INJURY ANGLE

 SMALL MED LARGE

 PDO .925 1.013 1.066
 INJ 1.189 .948 .887
 FATAL .908 1.041 1.058

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

INJURY SPEED

 S1 S2 S3 S4

 PDO .240 .259 -.061 -.438
 INJ -.369 .105 .215 .049
 FATAL .129 -.364 -.154 .388

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

INJURY SPEED

 S1 S2 S3 S4

 PDO 1.612 1.985 -.473 -2.756
 INJ -2.298 .789 1.689 .326
 FATAL .570 -1.722 -.775 1.810

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

INJURY SPEED

 S1 S2 S3 S4

 PDO 1.271 1.296 .941 .646
 INJ .692 1.110 1.240 1.050
 FATAL 1.138 .695 .857 1.474

***** ESTIMATES OF THE LOG-LINEAR PARAMETERS (LAMBDA) IN THE MODEL ABOVE

INJURY VEH

 SUB MED FULL TRUCK

PDO .012 .038 .214 -.264
 INJ .199 -.038 -.126 -.035
 FATAL -.211 -.000 -.088 .300

***** RATIO OF THE LOG-LINEAR PARAMETER ESTIMATES (LAMBDA) TO ITS STANDARD ERROR

	VEH			TRUCK		
	SUB	MED	FULL	SUB	MED	FULL
PDO	.085	.277	1.713	-1.720		
INJ	1.444	-.274	-.987	-.239		
FATAL	-.947	-.002	-.447	1.373		

***** ESTIMATES OF THE MULTIPLICATIVE PARAMETERS (BETA = EXP(LAMBDA))

	VEH			TRUCK		
	SUB	MED	FULL	SUB	MED	FULL
PDO	1.012	1.039	1.239	.768		
INJ	1.220	.963	.882	.965		
FATAL	.810	1.000	.915	1.350		

NUMBER OF INTEGER WORDS OF STORAGE USED IN PRECEDING PROBLEM 1354
 CPU TIME USED 20.444 SECONDS
 1PAGE 3
 0ENDP4F

TWO-WAY FREQUENCY TABLES --- MEASURES OF ASSOCIATION
 MULTIWAY FREQUENCY TABLES -- LOGLINEAR MODELS (INCLUDING STRUCTURAL ZEROS)

EXECUTED ON 84/01/16.AT 14.32.04.

PROGRAM CONTROL INFORMATION

0NO MORE CONTROL LANGUAGE.

PROGRAM TERMINATED
 EOI ENCOUNTERED.

APPENDIX D
SEVER PROGRAM LISTING AND INPUT

84/05/22. 16.45.24.
PROGRAM LSEVER

LISTING

```

PROGRAM SEVER (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE4)
DIMENSION TITLE(5),ICODE(2),GT(2)
COMMON IVT,VP,VI,VF,S,A
WRITE(6,200)
200 FORMAT(1H1,20X,16H*PROGRAM OUTPUT*)
10 READ(5,100)TITLE,IVT,GT,S,A,AMSI
100 FORMAT(1X,5A8,11,1X,2A8,3F6.2)
IF(IVT.EQ.9) GO TO 204
IF(S.LE.20.0)IS=1
IF(S.GT.20.0.AND.S.LE.40.0)IS=2
IF(S.GT.40.0.AND.S.LE.60.0)IS=3
IF(S.GT.60.0)IS=4
IF(A.LE.10.0)IA=1
IF(A.GT.10.0.AND.A.LE.20.0)IA=2
IF(A.GT.20.0)IA=3
KP=(IVT-1)*12+(IS-1)*3+IA
KI=KP+48
KF=KP+96
WRITE(6,95)
95 FORMAT(1H0,80(1H*))
CALCULATE ACCIDENT SEVERITY
WRITE(6,97)TITLE
97 FORMAT(///10X,5A8)
WRITE(6,99)KP,KI,KF
99 FORMAT(//5X,*INDEX VALUES OF SPDO,SINJ,SFAT =*,3I10)
CALL FACTOR(KP,SPDO)
CALL FACTOR(KI,SINJ)
CALL FACTOR(KF,SFAT)
SPDO=SPDO/100.0
SINJ=SINJ/100.0
SFAT=SFAT/100.0
COST=SPDO*700.0+SINJ*10000.0+SFAT*200000.0
CALL POLYF(COST,ASI)
CALL OUTPUT
WRITE(6,201)SPDO,SINJ,SFAT,COST
201 FORMAT(//5X,*SEVERITIES*,/10X,*PDD =*,F10.3,/7X,*INJURY =*,F10.3,
1/8X,*FATAL =*,F10.3,/9X,*COST =*,F10.0)
WRITE(6,202)ASI,AMSI,GT
202 FORMAT(//10X,*ACCIDENT SEVERITY INDEX =*,F5.2,/6X,
1*MATHEMATICAL SEVERITY INDEX =*,F5.2,/19X,
2*GUARDRAIL TYPE =*,1X,10A8,///)
WRITE(4,301)ASI,AMSI,S,A
301 FORMAT(5X,4F6.2)
GO TO 10
204 PRINT 205
205 FORMAT(//10X,*JOB FINISHED*)
STOP
END
SUBROUTINE POLYF(C,S)
DIMENSION X(11),Y(11)
DATA X /0.0,1.0,2.0,3.0,4.0,5.0,6.0,7.0,8.0,9.0,10.0 /
DATA Y /700.0,2095.0,3490.0,4885.0,8180.0,16710.0,30940.0,
1 66070.0,124000.0,160100.0,190500.0 /
DO 1 I=1,11

```

```

      IF(C.GT.Y(I).AND.C.LE.Y(I+1))GO TO 2
1  CONTINUE
2  S=X(I)+(C-Y(I))/(Y(I+1)-Y(I))
   RETURN
   END
   SUBROUTINE FACTOR(I,FAC)
   DIMENSION A(144)
   DATA (A(I),I=1,12)/51.11,58.82,60.80,
+ 43.10 , 50.40 , 53.33 ,
+ 32.79 , 40.00 , 42.19 ,
+ 27.06 , 33.33 , 33.33 /
   DATA (A(I),I=13,24)/ 57.14 , 64.29 , 64.71 ,
+ 49.23 , 56.00 , 58.26 ,
+ 38.10 , 44.71 , 47.17 ,
+ 31.20 , 36.36 , 38.82 /
   DATA (A(I),I=25,36)/ 63.16 , 69.23 , 70.48 ,
+ 55.34 , 62.42 , 64.57 ,
+ 44.51 , 51.72 , 54.40 ,
+ 37.65 , 42.86 , 45.45 /
   DATA (A(I),I=37,48)/ 47.22 , 53.33 , 57.14 ,
+ 41.05 , 47.06 , 49.09 ,
+ 30.34 , 36.84 , 38.89 ,
+ 24.00 , 28.57 , 33.33 /
   DATA (A(I),I=49,60)/ 42.22 , 34.12 , 31.20 ,
+ 53.80 , 45.60 , 42.96 ,
+ 63.11 , 55.24 , 53.13 ,
+ 64.71 , 53.33 , 53.33 /
   DATA (A(I),I=61,72)/ 34.52 , 28.57 , 25.88 ,
+ 46.15 , 38.86 , 36.52 ,
+ 56.19 , 48.24 , 45.28 ,
+ 56.80 , 49.09 , 45.88 /
   DATA (A(I),I=73,84)/ 29.47 , 23.08 , 20.95 ,
+ 40.78 , 33.33 , 30.86 ,
+ 50.42 , 42.07 , 39.20 ,
+ 51.76 , 42.86 , 41.82 /
   DATA (A(I),I=85,96)/ 38.89 , 31.11 , 28.57 ,
+ 52.63 , 44.71 , 41.82 ,
+ 61.38 , 52.63 , 50.00 ,
+ 60.00 , 51.43 , 46.67 /
   DATA (A(I),I=97,108)/ 6.67 , 7.06 , 8.00 ,
+ 3.10 , 4.00 , 3.70 ,
+ 4.10 , 4.76 , 4.69 ,
+ 8.24 , 13.33 , 13.33 /
   DATA (A(I),I=109,120)/ 8.33 , 7.14 , 9.41 ,
+ 4.62 , 5.14 , 5.22 ,
+ 5.71 , 7.06 , 7.55 ,
+ 12.00 , 14.55 , 15.29 /
   DATA (A(I),I=121,132)/ 7.37 , 7.69 , 8.57 ,
+ 3.88 , 4.24 , 4.57 ,
+ 5.07 , 6.21 , 6.40 ,
+ 10.59 , 14.29 , 12.73 /
   DATA (A(I),I=133,144)/ 13.89 , 15.56 , 14.29 ,
+ 6.32 , 8.24 , 9.09 ,
+ 8.28 , 10.53 , 11.11 ,
+ 16.00 , 20.00 , 20.00 /
   FAC=A(I)
   RETURN
   END

```

INPUT DATA

OLD,RDAT1

READY.
LIST

84/05/22. 16.50.03.
PROGRAM RDAT1

CASE 1	SWRI TEST 101	3 G4W	55.20	30.50	6.37
CASE 2	SWRI TEST 103	3 G4W	60.10	22.20	6.45
CASE 3	SWRI TEST 105	3 G2	60.10	27.80	3.90
CASE 4	SWRI TEST 123	2 G2/6.25	64.30	27.10	6.39
CASE 5	SWRI TEST 124	2 G2/9.37	60.70	26.40	3.94
CASE 6	SWRI TEST 112	2 G3	56.50	26.90	3.60
CASE 7	SWRI TEST 114	3 G3	57.70	26.00	4.54
CASE 8	SWRI TEST 119	3 A/6.25	53.40	30.20	5.39
CASE 9	SWRI TEST 120	2 G4S	56.80	28.40	7.58
CASE 10	SWRI TEST 121	3 G4S	56.20	27.40	6.74
CASE 11	SWRI TEST 122	3 G4S	62.90	25.30	8.34
CASE 12	SWRI TEST ODH-2	3 A	62.00	25.30	2.85
CASE 13	SWRI TEST ODH-3	3 A	62.50	28.70	5.90
CASE 14	SWRI TEST ODH-4	3 A	61.30	28.30	3.95
CASE 15	SWRI TEST ODH-5	3 A	70.80	26.70	4.60
CASE 16	SWRI TEST ODH-7	3 A	58.20	26.30	5.18
CASE 17	SWRI TEST AS-1	3 THRIE/MB	66.10	26.80	7.70
CASE 18	SWRI TEST AS-2	2 THRIE/NB	67.10	28.90	9.52
CASE 19	SWRI TEST AS-3	1 THRIE/MB	54.10	16.80	5.46
CASE 20	SWRI TEST AS-4	3 THRIE/NB	59.10	15.90	4.64
CASE 21	SWRI TEST AS-5	2 THRIE/NB	56.40	25.20	8.32
CASE 22	SWRI TEST EAS-1	2 THRIE/HYC.B	66.00	25.50	10.11
CASE 23	SWRI TEST NASS-2	3 THRIE	62.00	29.30	6.93
CASE 24	SWRI TEST AS-6	3 THRIE/C-POST	61.30	25.00	6.84
CASE 25	SWRI TEST AS-7	3 THRIE/C-POST	62.00	25.00	6.31
CASE 26	SWRI TEST AS-8	3 THRIE/C-POST	59.00	25.00	6.92
CASE 27	SWRI TEST 137 BEAM	2 B	62.00	27.00	9.13
CASE 28	SWRI TEST 141 BEAM	2 B	61.90	27.40	6.33
CASE 29	SWRI TEST 148 TERMINAL	2 B/18'SHEET	63.00	27.00	8.17
CASE 30	SWRI TEST 154 TERMINAL	2 G4S/30"SHEET	61.00	26.00	10.22
CASE 31	SWRI TEST 157 TERMINAL	2 G2/30"SHEET	58.00	25.00	9.56
CASE 32	SWRI TEST IHSC-1	1 G4S/12.5'	62.40	15.30	6.76
CASE 33	SWRI TEST IHSC-2	3 G4S/12.5'	57.60	24.40	7.09
CASE 34	SWRI TEST IHSC-3	3 G4S/3.13'	60.20	24.50	11.80
CASE 35	SWRI TEST IHSC-4	1 G4S/12.5'	58.70	13.90	8.11
CASE 36	SWRI TEST IHSC-6 TRANS.	3 G4S/AL.EX.	58.70	24.00	9.72
CASE 37	SWRI TEST IHSC-7 TRANS.	3 G4S/AL.EX.	59.20	24.20	10.28
CASE 38	SWRI TEST SRB-1	1 TU.THRIE/4.17'	58.60	17.20	09.21
CASE 39	SWRI TEST SRB-2	3 TU.THRIE/4.17'	60.60	24.60	11.36
CASE 40	SWRI TEST SRB-3	4 TU.THRIE/4.17'	56.90	17.50	5.26
CASE 41	SWRI TEST SRB-4	1 TU.THRIE/4.17'	54.70	17.10	6.63
CASE 42	SWRI TEST SRB-6 TRANS.	3 THRIE	56.20	25.30	8.81
CASE 43	SWRI TEST RBCT-3	3 G4W	55.90	24.90	8.89
CASE 44	NEW YORK TEST-3	2 G3	50.00	25.00	5.50
CASE 45	NEW YORK TEST-5	2 G3/6X12BOX	58.00	25.00	5.50
CASE 46	NEW YORK TEST-7	2 G3/6X8BOX	60.00	25.00	5.20

CASE 47	NEW YORK TEST-8	2 G3/3'	55.00	25.00	4.70
CASE 48	NEW YORK TEST-9	2 G1	53.00	25.00	6.10
CASE 49	NEW YORK TEST-10	2 G1/12'	56.00	25.00	2.40
CASE 50	NEW YORK TEST-11	2 G1/8'	58.00	25.00	3.90
CASE 51	NEW YORK TEST-12	2 G1/4'	55.00	25.00	0.90
CASE 52	NEW YORK TEST-18	1 G3/MB	61.00	25.00	4.90
CASE 53	NEW YORK TEST-19	1 G3	60.00	25.00	6.40
CASE 54	NEW YORK TEST-20	1 G2/MB	70.00	25.00	6.30
CASE 55	NEW YORK TEST-21	1 G1	57.00	25.00	2.20
CASE 56	NEW YORK TEST-26	2 G2	32.00	25.00	1.60
CASE 57	NEW YORK TEST-31	1 G1-G3/TRANS.	54.00	25.00	2.10
CASE 58	NEW YORK TEST-32	2 G1-G3/TRANS.	40.00	20.00	3.00
CASE 59	NEW YORK TEST-33	2 G1-G3/TRANS.	55.00	22.00	1.60
CASE 60	NEW YORK TEST-34	2 G1-G3/TRANS.	61.00	25.00	8.10
CASE 61	NEW YORK TEST-37	2 G2-G3/TRANS.	62.00	25.00	6.90
CASE 62	NEW YORK TEST-38	2 G2-G3/TRANS.	60.00	25.00	3.40
CASE 63	NEW YORK TEST-39	2 G2-G3/TRANS.	53.00	25.00	4.70
CASE 64	NEW YORK TEST-40	2 G2/MB	46.00	32.50	3.30
CASE 65	NEW YORK TEST-42	2 G3/6X8MB	62.00	25.00	4.50
CASE 66	NEW YORK TEST-43	2 G3/6X8MB	55.00	25.00	3.80
CASE 67	NEW YORK TEST-44	2 G3/6X8MB	44.00	25.00	4.80
CASE 68	NEW YORK TEST-47	2 G2/24"HI	48.00	25.00	1.50
CASE 69	NEW YORK TEST-48	2 G2/27"HI	45.00	25.00	1.50
CASE 70	NEW YORK TEST-49	2 G2/30"HI	58.00	25.00	2.70
CASE 71	NEW YORK TEST-52	2 G2/28"HI/WOOD	40.00	25.00	1.00
CASE 72	NEW YORK TEST-53	2 G2/28"HI/WOOD	40.00	25.00	1.00
CASE 73	CAL TEST 272	3 G4W	66.00	26.00	7.78
CASE 74	CAL TEST 273	3 D	68.00	24.00	9.69
CASE 75	CAL TEST 276	3 G4S	66.00	25.00	7.82
CASE 76	TTI TEST 4098-1	4 THRIE	55.50	13.50	3.16
CASE 77	TTI TEST 4098-2	4 G4S	59.50	15.00	3.06
CASE 78	TTI TEST 4098-3	4 THRIE/MOD.BL.	55.70	15.00	2.73
CASE 79	TTI TEST 4098-4	1 THRIE/MOD.BL.	62.40	15.00	7.76
CASE 80	TTI TEST 4098-5	1 THRIE/MOD.B.	61.40	18.00	7.69
CASE 81	TTI TEST 4098-6	4 THRIE/MOD.BL.	59.50	14.00	2.53
CASE 82	NEW YORK TEST-1	2 G1	28.00	90.00	3.70
CASE 83	NEW YORK TEST-2	2 G3	29.00	90.00	5.40
CASE 84	NEW YORK TEST-13	2 G1	35.00	90.00	2.00
CASE 85	SWRI TEST SA-1	1 E	59.80	16.50	5.03
CASE 86	SWRI TEST SA-2	3 E	59.20	25.60	7.57
CASE 87	SWRI TEST SA-3	3 E	60.30	23.80	7.82
CASE 88	TTI TEST 4798-8	3 G4S	56.90	23.50	7.05
CASE 89	TTI TEST 4798-6	2 G4S	60.00	22.00	8.77
CASE 90	TTI TEST 4798-7	3 G4S	59.20	24.00	6.86
CASE 91	TTI TEST 4798-4	1 G4S	59.90	21.50	9.66
END OF CASES		9 99	999999999999999999		

READY.
BYE

06P0301 LOG OFF 16.54.16.
06P0301 SRU 1.000 UNTS.

IAF CONNECT TIME 00.09.17.
LOGGED OUT.