Case No. 78701

In the Supreme Court of Nevada

MOTOR COACH INDUSTRIES, INC.,

Appellant,

vs.

KEON KHIABANI; ARIA KHIABANI, MINORS, by and through their Guardian MARIE-CLAUDE RIGAUD; SIAMAK BARIN, as Executor of the Estate of KAYVAN KHIABANI, M.D.; the Estate of KAYVAN KHIABANI; SIAMAK BARIN, as Executor of the Estate of KATAYOUN BARIN, DDS; and the Estate of KATAYOUN BARIN, DDS,

Respondents.

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APPEAL
from the Eighth Judicial District Court, Clark County
The Honorable ADRIANA ESCOBAR, District Judge
District Court Case No. A-17-755977-C

APPELLANT'S APPENDIX
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PAGES 1251–1500

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	Defendants Filed Under Seal on March 26, 2019			
40	Notice of Entry of Findings of Fact Conclusions of Law and Order on Motion for Determination of Good Faith Settlement	01/08/18	11	2581–2590
137	Notice of Entry of Findings of Fact, Conclusions of Law and Order on Motion for Good Faith Settlement	02/01/19	50	12385–12395
111	Notice of Entry of Judgment	04/18/18	42	10365–10371
12	Notice of Entry of Order	07/11/17	1	158–165
16	Notice of Entry of Order	08/23/17	1	223–227
63	Notice of Entry of Order	02/09/18	15	3511–3536
97	Notice of Entry of Order	03/19/18	36	8839–8841
15	Notice of Entry of Order (CMO)	08/18/17	1	214–222
4	Notice of Entry of Order Denying Without Prejudice Plaintiffs' Ex Parte Motion for Order Requiring Bus Company and Bus Driver to Preserve an Immediately Turn Over Relevant Electronic Monitoring Information from Bus and Driver Cell Phone	06/22/17	1	77–80
13	Notice of Entry of Order Granting Plaintiffs' Motion for Preferential Trial Setting	07/20/17	1	166–171
133	Notice of Entry of Stipulation and Order Dismissing Plaintiffs' Claims Against Defendant SevenPlus Bicycles, Inc. Only	10/17/18	50	12361–12365
134	Notice of Entry of Stipulation and Order Dismissing Plaintiffs' Claims Against Bell Sports, Inc. Only	10/17/18	50	12366–12370
143	Objection to Special Master Order Staying Post-Trial Discovery Including May 2, 2018 Deposition of the Custodian of Records of the Board of Regents NSHE and, Alternatively, Motion for Limited Post-Trial	05/03/18	51	12495–12602

	Discovery on Order Shortening Time (FILED UNDER SEAL)			
39	Opposition to "Motion for Summary Judgment on Foreseeability of Bus Interaction with Pedestrians of Bicyclists (Including Sudden Bicycle Movement)"	12/27/17	11	2524–2580
123	Opposition to Defendant's Motion to Retax Costs	05/14/18	49	12039–12085
118	Opposition to Motion for Limited Post-Trial Discovery	05/03/18	48	11761–11769
151	Order (FILED UNDER SEAL)	03/26/19	52	12931–12937
135	Order Granting Motion to Dismiss Wrongful Death Claim	01/31/19	50	12371–12372
25	Order Regarding "Plaintiffs' Motion to Amend Complaint to Substitute Parties" and "Countermotion to Set a Reasonable Trial Date Upon Changed Circumstance that Nullifies the Reason for Preferential Trial Setting"	11/17/17	3	638–641
45	Plaintiffs' Addendum to Reply to Opposition to Motion for Summary Judgment on Forseeability of Bus Interaction with Pedestrians or Bicyclists (Including Sudden Bicycle Movement)"	01/17/18	11	2654–2663
49	Plaintiffs' Joinder to Defendant Bell Sports, Inc.'s Motion for Determination of Good Faith Settlement on Order Shortening Time	01/18/18	11	2735–2737
41	Plaintiffs' Joint Opposition to Defendant's Motion in Limine No. 3 to Preclude Plaintiffs from Making Reference to a "Bullet Train" and to Defendant's Motion in Limine No. 7 to Exclude Any Claims That the Motor Coach was Defective Based on Alleged Dangerous "Air Blasts"	01/08/18	11	2591–2611

37	Plaintiffs' Joint Opposition to MCI Motion for Summary Judgment on All Claims Alleging a Product Defect and to MCI Motion for Summary Judgment on Punitive Damages	12/21/17	9	2129–2175
50	Plaintiffs' Motion for Determination of Good Faith Settlement with Defendants Michelangelo Leasing Inc. d/b/a Ryan's Express and Edward Hubbard Only on Order Shortening Time	01/18/18	11	2738–2747
42	Plaintiffs' Opposition to Defendant's Motion in Limine No. 13 to Exclude Plaintiffs' Expert Witness Robert Cunitz, Ph.D. or in the Alternative to Limit His Testimony	01/08/18	11	2612–2629
43	Plaintiffs' Opposition to Defendant's Motion in Limine No. 17 to Exclude Claim of Lost Income, Including the August 28 Expert Report of Larry Stokes	01/08/18	11	2630–2637
126	Plaintiffs' Opposition to MCI's Motion to Alter or Amend Judgment to Offset Settlement Proceeds Paid by Other Defendants	06/06/18	49	12104–12112
130	Plaintiffs' Supplemental Opposition to MCI's Motion to Alter or Amend Judgment to Offset Settlement Proceeds Paid by Other Defendants	09/18/18	50	12310–12321
150	Plaintiffs' Supplemental Opposition to MCI's Motion to Alter or Amend Judgment to Offset Settlement Proceeds Paid by Other Defendants (FILED UNDER SEAL)	09/18/18	52	12917–12930
122	Plaintiffs' Supplemental Verified Memorandum of Costs and Disbursements Pursuant to NRS 18.005, 18.020, and 18.110	05/09/18	49	12019–12038

91	Plaintiffs' Trial Brief Regarding Admissibility of Taxation Issues and Gross Versus Net Loss Income	03/12/18	33	8018–8025
113	Plaintiffs' Verified Memorandum of Costs and Disbursements Pursuant to NRS 18.005, 18.020, and 18.110	04/24/18	42	10375–10381
105	Proposed Jury Instructions Not Given	03/23/18	41	10207–10235
109	Proposed Jury Verdict Form Not Used at Trial	03/26/18	42	10298–10302
57	Recorder's Transcript of Hearing on Defendant's Motion for Summary Judgment on All Claims Alleging a Product Defect	01/23/18	12	2818–2997
148	Reply in Support of Motion for a Limited New Trial (FILED UNDER SEAL)	07/02/18	52	12755–12864
128	Reply on Motion to Retax Costs	06/29/18	50	12269–12281
44	Reply to Opposition to Motion for Summary Judgment on Foreseeability of Bus Interaction with Pedestrians or Bicyclists (Including Sudden Bicycle Movement)"	01/16/18	11	2638–2653
46	Reply to Plaintiffs' Opposition to Motion for Summary Judgment on Punitive Damages	01/17/18	11	2664–2704
3	Reporter's Transcript of Motion for Temporary Restraining Order	06/15/17	1	34–76
144	Reporter's Transcript of Proceedings (FILED UNDER SEAL)	05/04/18	51	12603–12646
14	Reporter's Transcription of Motion for Preferential Trial Setting	07/20/17	1	172–213
18	Reporter's Transcription of Motion of Status Check and Motion for Reconsideration with Joinder	09/21/17	1 2	237–250 251–312
65	Reporter's Transcription of Proceedings	02/13/18	16 17	3818–4000 4001–4037
66	Reporter's Transcription of Proceedings	02/14/18	17 18	4038–4250 4251–4308

68	Reporter's Transcription of Proceedings	02/15/18	18	4315–4500
69	Reporter's Transcription of Proceedings	02/16/18	19	4501–4727
72	Reporter's Transcription of Proceedings	02/20/18	20 21	4809–5000 5001–5039
73	Reporter's Transcription of Proceedings	02/21/18	21	5040–5159
74	Reporter's Transcription of Proceedings	02/22/18	21 22	5160–5250 5251–5314
77	Reporter's Transcription of Proceedings	02/23/18	22 23	5328–5500 5501–5580
78	Reporter's Transcription of Proceedings	02/26/18	23 24	5581–5750 5751–5834
79	Reporter's Transcription of Proceedings	02/27/18	24 25	5835–6000 6001–6006
80	Reporter's Transcription of Proceedings	02/28/18	25	6007–6194
81	Reporter's Transcription of Proceedings	03/01/18	25 26	6195–6250 6251–6448
82	Reporter's Transcription of Proceedings	03/02/18	26 27	6449–6500 6501–6623
83	Reporter's Transcription of Proceedings	03/05/18	27 28	6624–6750 6751–6878
86	Reporter's Transcription of Proceedings	03/07/18	29 30	7045–7250 7251–7265
88	Reporter's Transcription of Proceedings	03/09/18	30 31	7424–7500 7501–7728
89	Reporter's Transcription of Proceedings	03/12/18	31 32	7729–7750 7751–7993
99	Reporter's Transcription of Proceedings	03/20/18	37 38	9076–9250 9251–9297
100	Reporter's Transcription of Proceedings	03/21/18	38 39	9298–9500 9501–9716
101	Reporter's Transcription of Proceedings	03/21/18	39 40	9717–9750 9751–9799

102	Reporter's Transcription of Proceedings	03/21/18	40	9800–9880
103	Reporter's Transcription of Proceedings	03/22/18	40 41	9881–10000 10001–10195
104	Reporter's Transcription of Proceedings	03/23/18	41	10196–10206
24	Second Amended Complaint and Demand for Jury Trial	11/17/17	3	619–637
107	Special Jury Verdict	03/23/18	41	10237–10241
112	Special Master Order Staying Post-Trial Discovery Including May 2, 2018 Deposition of the Custodian of Records of the Board of Regents NSHE	04/24/18	42	10372–10374
62	Status Check Transcript	02/09/18	14 15	3492–3500 3501–3510
17	Stipulated Protective Order	08/24/17	1	228–236
121	Supplement to Motor Coach Industries, Inc.'s Motion for a Limited New Trial	05/08/18	49	12013–12018
60	Supplemental Findings of Fact, Conclusions of Law, and Order	02/05/18	14	3470–3473
132	Transcript	09/25/18	50	12333–12360
23	Transcript of Proceedings	11/02/17	3	598–618
27	Volume 1: Appendix of Exhibits to Motion for Summary Judgment on Punitive Damages	12/01/17	3 4	665–750 751–989
28	Volume 2: Appendix of Exhibits to Motion for Summary Judgment on Punitive Damages	12/01/17	4 5	990–1000 1001–1225
29	Volume 3: Appendix of Exhibits to Motion for Summary Judgment on Punitive Damages	12/01/17	5 6	1226–1250 1251–1490

14:41 general idea that -- underlying the invention, that it is safer for a person under the bus to be impacted by the S-1 Gard and pushed out of the way rather than be run over by the rear wheels of the bus?

14:42 A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. At the top of the same page of Exhibit 1 under Column 4, it says, "As shown in Figure 2 and Figure 5, a

14:42 safety barrier is located such that it generally faces obliquely with respect to the transverse axis of the vehicle and is positioned to extend to a marginal distance above the surface over which the vehicle travels."

14:42 A. Yes.

Q. Does that mean it's essentially designed to close the gap --

A. Yes.

Q. Does that mean that it's generally designed to

14:42 close the gap between the bottom of the bus and the ground?

A. The rocker panel and the ground.

Q. And is there any space between the S-1 Gard and the ground?

14:43 A. Yes.

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14:43 **Q. Approximately how much?**

A. 3 inches.

Q. I'm going to hand you what's been marked as Exhibit 3.

14:43 (Whereupon the document referred to is marked by the reporter as EXHIBIT 3 for identification.)

MR. PEPPERMAN:

Q. Can you tell me what this document is.

A. It's a media brochure.

14:43 **Q. And what is a media brochure?**

A. It's for the industry to read, inform them of the product.

Q. Is this type of product literature made available to people in the bus manufacturing industry?

14:44 A. Yes.

Q. Again, I'm going to refer to the Bates numbers in the bottom right-hand corner, if you could turn to P01317.

A. Okay.

14:44 **Q. At the top under S-1 Gard Dangerzone Deflector, can you read that first paragraph to me.**

A. I don't have my glasses.

Q. Okay.

I'll read it: "The S-1 Gard Dangerzone Deflector,

14:45 **a securely mounted maintenance-free barrier installed in**

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front of the right rear wheels of a transit bus or motor coach, designed to deflect a person out of the path of the wheels, preventing catastrophic injury or death."

We see a lot of references to transit buses in the literature, but does the S-1 Gard work with motor coach buses, such as tour buses, as well?

A. Yes.

Q. Okay.

Are motor coach manufacturers prohibited, in any sense, from equipping their motor coaches with S-1 Gards?

A. No.

Q. Is there any difference in the benefits that the S-1 Gard would provide with respect to if it's on a transit bus or a motor coach?

A. Preventing injury and death or cost?

Q. The S-1 Gard would serve the same function --

A. Yes.

Q. -- on both?

A. Yes.

Q. So just so I'm clear with what you're saying, the S-1 Gard would serve the same function and provide the same benefits on a motor coach as it does on a transit bus?

A. Yes.

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14:47 **Q. Okay.**

If you flip to page P01318, under the section that says, "The S-1 Gard is Working," the last blurb says, "Capital Metro transit in Austin, Texas, installed the 14:47 **S-1 Gard in 2005. Prior to installation, Capital Metro had been averaging one severe accident or fatality every two years. Since installing the S-1 Gard, Capital Metro has reported zero right rear wheel incidents."**

Do you know how you received the information 14:47 **contained in the product literature?**

A. I believe from Austin.

Q. And is it your understanding that this statement in the product literature regarding reduction in right rear wheel incidents experienced by 14:48 **Capital Metro Transit in Austin is a true and correct statement?**

A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

14:48 **Q. Did you have any involvement in creating the document that we see in Exhibit 3?**

A. Yes.

Q. And is Exhibit 3 a true and correct copy of the product information related to the S-1 Gard?

14:49 A. Yes.

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14:49 **Q. I'm going to hand you what's been marked as Exhibit 4 to your deposition.**

(Whereupon the document referred to is marked by the reporter as EXHIBIT 4 for identification.)

14:49 MR. PEPPERMAN:

Q. Can you tell me what this document is.

A. I believe it's a report from Jim Green, James Green.

Q. Did you commission this report by Mr. Green?

14:49 A. Yes.

Q. And did you commission the report in the course of your regularly conducted business activities?

A. Yes.

Q. Is this a true and correct copy of the report

14:49 **furnished to you by Mr. Green?**

A. Yes.

But this is a paper form. It was in a book form. It's published in a book.

Q. Is this report on Public Transportation

14:50 **Safety's web site?**

A. Yes.

Q. Is Exhibit 4 a true and correct copy of the report published on Public Transportation Safety's web site?

14:50 A. Yes.

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14:50 **Q. If you look at page 2 of Exhibit 4, in the middle of the page, it says, "In order to eliminate these accidents, the results of the enclosed analysis were provided to the National Academy of Forensic**
14:51 **Engineers at their semi-annual seminar in Los Angeles in January 2001. This information allows the valuable design characteristics of the S-1 Gard to be available to the engineering design community. A peer-reviewed paper on the subject is expected in the NAFE Journal**
14:51 **later this year," NAFE referring to the National Academy of Forensic Engineers.**

Do you have any understanding whether a peer-reviewed paper on the subject was published in the NAFE journal?

14:52 A. Yes.

Q. Hand you what's been marked as Exhibit 5.

(Whereupon the document referred to is marked by the reporter as EXHIBIT 5 for identification.)

MR. PEPPERMAN:

14:52 **Q. Is this the peer-reviewed paper on the subject that was published in the NAFE journal?**

A. Yes.

Q. If you look through it, it's largely the same or similar to the report provided by Mr. Green that we
14:52 **see in Exhibit 4; right?**

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14:52 A. Yes.

Q. On page 2 of Exhibit 4, Mr. Green writes, "It is my professional engineering opinion that the installation of the S-1 Gard will eliminate the high

14:53 **rate of accidents at the wheel wells of transit authority buses and other heavy equipment."**

Did you know that that was Mr. Green's conclusion?

MR. TERRY: Objection. Form.

THE WITNESS: Yes.

14:53 MR. PEPPERMAN:

Q. And what did Mr. Green's conclusion indicate to you about the safety and effectiveness of the S-1 Gard?

A. I'm not really an engineer in this field. So I read it, and it sounds, you know, like he knew what he

14:53 was -- you know, he was the expert. I'm not an expert.

Q. When you invented the S-1 Gard, it was your intention to reduce the number of accidents at the wheel wells of transit buses and other vehicles; correct?

A. Yes.

14:54 MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. Did Mr. Green's report validate to you that your ideas were effective?

A. No.

14:54 **Q. Did you already have sufficient validation that**

14:54 **your invention of the S-1 Gard was an effective device?**

A. Yes.

Q. So is it fair to say Mr. Green's conclusion didn't tell you something you didn't already know?

14:55 MR. TERRY: Objection. Form.

THE WITNESS: No.

MR. PEPPERMAN:

Q. So yes, Mr. Green's conclusion did not tell you anything you already know; correct?

14:55 A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. Are you aware of the principle in which the rotation on the rear tires of a bus might cause people

14:55 **or objects to be sucked into the rear wheel well?**

A. No.

I'm aware of it happening?

Q. Yes.

A. Yes.

14:55 **Q. Okay.**

Are you able to explain how the S-1 Gard decreases this rear tire suction effect?

A. No.

Q. Is it your understanding that the S-1 Gard does

14:56 **reduce this rear tire suction effect?**

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14:56 A. No.

Q. You don't know one way or the other?

A. No.

MR. PEPPERMAN: Can we go off the record.

14:56 THE VIDEOGRAPHER: We are off the record at 2:56.

(A recess is taken.)

(Ms. Barry exits the deposition room.)

THE VIDEOGRAPHER: This commences Video File 2. We are on the record at 3:11.

15:11 MR. PEPPERMAN: Mr. Barron, I'm going to show you a video that will be attached to your deposition as Exhibit 6.

(Whereupon the document referred to is marked by the reporter as EXHIBIT 6 for identification.)

15:11 THE WITNESS: Okay.

MR. PEPPERMAN: If you don't mind reaching over and pressing play. Just click on the mouse pad. Yeah, right there. Okay.

Q. And can you tell me what we're looking at here?

15:11 A. It's a stuntman chasing an RTS bus, and it's a promotional video for the S-1 Gard.

Q. Okay.

Were you present when this video was made?

A. Yes.

15:12 **Q. Can you tell me what we're seeing in this --**

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15:12 A. An illustration of someone getting their bag caught in the door and being shoved out of the way with the guard.

Q. Okay.

15:12 **It looked like the guard hit the person's head?**

A. Yes.

Q. What are we seeing here?

A. Someone getting struck by the front of the bus and going under the bus.

15:12 **Q. Would you tell me what we're seeing here.**

A. Someone, a rider that leaves their wallet or iPad or their cell phone on the bus, they ran back, and they fall down.

Q. Okay.

15:12 **Did it appear that the S-1 Gard impacted that stuntman's head?**

A. Yes.

Q. Okay.

Is it fair to say that we've seen a lot of

15:13 **different scenarios where different body parts have fallen underneath the bus?**

MR. TERRY: Objection. Form.

MR. PEPPERMAN: In these videos.

Q. Is that a fair statement, Mr. Barron?

15:13 A. Repeat, please.

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15:13 **Q. Is it fair to say that we've -- in this video, we've seen different scenarios where different body parts are under the bus and impacted by the S-1 Gard?**

A. Yes.

15:13 **Q. Including the head?**

A. Yes.

Q. And we just saw another event right there where the head was impacted; correct?

MR. TERRY: Objection. Form.

15:13 MR. PEPPERMAN:

Q. Is that a yes?

A. Yes.

Q. Okay.

Okay, we could close the -- you can just close the

15:13 **laptop.**

A. Okay.

Q. And you could take your regular seat.

A. Okay.

MR. TERRY: Is that 5 or 6?

15:14 MR. PEPPERMAN: 6.

MR. TERRY: What's 5? Okay.

MR. PEPPERMAN:

Q. You've stated that you were present for the filming of the video that we just watched; correct?

15:14 A. Yes.

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15:14 **Q. And the video that we just watched that will be attached as Exhibit 6 to your deposition, is that a true and correct depiction of the video that was shot in your presence?**

15:14 A. Yes.

Q. Do you know when the video was made?

A. 2002, I believe.

Q. And is the video on your web site?

A. Yes.

15:15 **Q. And the video that we just watched that's Exhibit 6 to your deposition, is that a true and correct copy of a video from the web site?**

A. Yes.

Q. If the S-1 Gard is on a motor coach and that

15:15 **motor coach impacted a cyclist, causing the cyclist's head to fall under the bus in front of the right hand -- or the right rear wheel, would the S-1 Gard protect the cyclist's head from being run over?**

A. By the right rear wheel?

15:15 **Q. Yes.**

A. Yes.

Q. And, in fact, we saw that exact scenario in a couple versions of the video we just watched; right?

A. Uh-huh.

15:16 MR. TERRY: Objection. Form.

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MR. PEPPERMAN:

Q. Is that correct? Yes?

A. Yes.

Q. Are you aware of any tests or studies done to determine the impact force of the S-1 Gard if the bus is moving faster than it is in the video that we just watched?

A. Yes.

Q. What kind of studies or tests have been done on that?

A. We've had forensic tests done on the durometer of the urethane, to cast the urethane a certain durometer. So we've done certain speeds and impact of objects to come up with a durometer to make and cast the S-1 Gard.

Q. What are you looking for -- strike that.

What is the purpose of those tests?

A. Well, if the urethane is produced too hard, it would break on a curb impact. It needs to be flexible, but firm enough to shove a body.

Q. And are you aware of the different impact forces associated with the S-1 Gard at varying speeds?

A. Not my professional opinion. It's not my profession.

Q. As part of these tests that you are aware of or

15:17 **that were performed, was one of the purposes of those tests is to determine what damage the S-1 Gard could do to a person who it impacts?**

A. Not my professional opinion.

15:18 **Q. Are you aware of any actual events in which the S-1 Gard pushed someone out from under a bus when the bus was moving faster than what we see in the video?**

A. No.

Q. Are you aware of any -- well, strike that.

15:18 A. To answer that, we had a scenario of a bus on PCH where a bicyclist woman was run over and dragged. The bus was moving over 25 miles per hour, and she was sucked in under and killed under the chassis and then her body ended up wrapped around the S-1 Gard.

15:18 So our company came up with a barrier management system that would go from the front wheel to the rear wheel.

Q. She was killed -- in this circumstance that you're describing, the woman was killed prior to coming

15:19 **into contact with the S-1 Gard?**

A. Yes.

Q. Are you aware of anyone falling under a bus that's equipped with the S-1 Gard who was impacted and killed by the S-1 Gard?

15:19 A. No.

15:19 **Q. Based on your experience as the inventor of the S-1 Gard, do you believe the S-1 Gard would still be effective if the bus was moving 20 miles per hour?**

A. It's not my professional opinion.

15:19 **Q. You leave that question up to a forensic engineer?**

A. Yes.

Q. Could you give me an estimate of the total number of buses to date with S-1 Gards?

15:20 A. In the country, U.S.?

Q. In the world.

A. In the world, over 50,000; 30 to 60, you know, it's hard to -- 40 to 60.

Q. If you could pull Exhibit 3 which is the

15:20 **product information.**

A. Uh-huh.

Product information? I said 30,000 --

Q. There it is. It's on the bottom.

A. Oh, okay.

15:21 **Q. If you could flip to page P01320 and the top of the page says "Major Transit Fleets Worldwide Retrofitting with the S-1 Gard."**

A. Yes.

Q. "Transit agencies and bus OEMs around the world

15:21 **have made the decision to install the S-1 Gard."**

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15:21 **What is OEM?**

A. Original manufacturer equipment.

An OEM would be like GM, Ford, and buses, we have New Flyer and Gillig.

15:22 **Q. Okay.**

So if a transit agency, for example, or a tour bus company, they operate the bus; correct? They don't manufacture the bus?

A. No.

15:22 They manage them.

Q. They purchase the bus from the manufacturer?

A. Yes.

Q. And the manufacturer is the original equipment manufacturer?

15:22 A. Right.

Q. So the S-1 Gard is made available to these operators of buses, like transit agencies and motor coach tour companies, and they can retrofit the buses that they purchase with this safety device; correct?

15:22 A. Yes.

Q. The S-1 Gard is also marketed and sold to original equipment manufacturers; correct?

A. Yes.

Q. And those manufacturers can install the

15:22 **S-1 Gard on their buses as original equipment and sell**

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15:23 **it with the S-1 Gard to the operators?**

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. Is that generally how it works?

15:23 A. Repeat that real quick, I'm sorry.

Q. So your company sells the S-1 Gard to the operators of buses?

A. Uh-huh.

Q. Right?

15:23 A. Right.

Q. In those instances?

A. The operator would retrofit the bus they purchased.

Q. They would add the S-1 Gard to it; correct?

15:23 A. Yeah, if they retrofit.

Q. Your company also sells the S-1 Gard to bus manufacturers?

A. Yes.

Q. And those bus manufacturers would install the

15:23 **S-1 Gard as original equipment and sell the bus with the S-1 Gard to the operator; right?**

MR. TERRY: Objection. Form.

THE WITNESS: If the operator specifies it, the OEM will install it, like a bike rack or a special mirror or

15:24 a video camera.

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MR. PEPPERMAN:

Q. And could be the bus manufacturers equip their buses with S-1 Gards as standard equipment?

MR. TERRY: Objection. Form.

THE WITNESS: No.

MR. PEPPERMAN:

Q. They -- why not?

A. It's federal-funded.

Q. What is federal-funded?

A. For transit.

Q. Well, okay.

I'm talking about the private bus manufacturers.

A. Oh, private bus manufacturers.

Q. Yeah.

They have the option to install the S-1 Gard as standard original equipment as part of the bus?

A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. And they could sell that to the operator?

A. The OEM?

Q. The bus.

A. The bus manufacturer won't put it on, the OEM.

Q. Why not?

A. Because they don't have to. They want to sell

15:25 the bus.

Q. But they could put the S-1 Gard as standard equipment?

A. If it's specified by the contractor, the

15:25 operator.

Q. And could they also put it on the bus as standard equipment --

A. Yes, they could.

Q. -- even if it's not specified by the operator?

15:25 A. Yeah.

But -- yeah, private contractors could. Yes, they could, but they don't.

Q. In your experience, why don't they include S-1 Gards as standard equipment on the buses they

15:25 **manufacture?**

A. Because they want to sell the bus at a low cost, and any extra features -- video cameras, bike racks, S-1 Gards -- are extra equipment that needs to be specified by the end user, the contractor or the bus

15:25 operator, the company that operates the buses, the private buses.

They would have to specify that special mirror. In Europe, they had mirrors that turned. They don't come standard on motor coaches.

15:26 **Q. So if I understand you correctly, you're saying**

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15:26 **that if a bus manufacturer wanted to equip their buses with an S-1 Gard as original equipment on the bus --**

A. They could.

Q. -- it would cost extra money to do that?

15:26 A. Yes.

It could.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. And you believe that they don't put the safety

15:26 **device of an S-1 Gard on their buses because then their buses would cost more?**

MR. TERRY: Objection. Form.

THE WITNESS: Well, I believe, being in the business for over 20 years, I believe the motor coach

15:26 companies, independent companies, do things in a certain manner where they buy the buses, and then in the environment where they're running, they will ask for the special mirror. In Europe where the streets are narrow, in Italy and France, they have the mirrors that are

15:27 special.

They won't put that special expensive mirror on in, let's say, Utah, where the streets are wider. They won't spend the extra money, you know, as a selling feature to that division, to that user. They won't

15:27 upsell it unless they know there's a need.

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MR. PEPPERMAN:

Q. Do you believe that there's a need for S-1 Gards to be standard equipment on buses?

A. Yes.

Q. How much would it cost to equip a bus with an S-1 Gard as standard equipment?

A. Between 1300 and 1700, depending on the make and the model of the bus, 1500.

Q. Is that the cost for one bus?

A. Yes.

Q. Is there a discounted cost if a larger manufacturer buys several S-1 Gards to put on several of its buses?

A. Only in the private market, not the private market?

Q. I'm only talking about the private buses.

A. Private, yes.

Q. And is it fair to call it some sort of a bulk purchase cost?

A. Quantity discount.

Q. What's the typical quantity discount, over a hundred?

A. Hundred parts, kits.

Q. So if a bus manufacturer were to purchase more than a hundred S-1 Gard kits, they would get a quantity

15:29 **discount?**

A. Right.

Q. And what would the range of that quantity discount be in terms of dollars?

15:29 A. 10 to 30 percent, depending how often they order.

Q. So if the S-1 Gard was made a standard feature by a bus manufacturer on all its buses that it manufactured, it's more likely than not they would get

15:29 **the 30 percent quantity discount?**

A. No.

Q. Why is that incorrect?

A. What was that, a hundred or more?

Depending if they're a new customer and we don't

15:29 know the quantity they're going to be purchasing, they get a lower discount. Once there's a relationship formed, then they would get a higher percentage.

Q. So if you had a bus manufacturer, for example, Motor Coach Industries, and they regularly purchased

15:30 **more than a hundred S-1 Gards for their fleets of buses that they manufactured year after year --**

A. Right.

Q. -- is it more likely than not they would get the 30 percent quantity discount?

15:30 A. Yes, they would.

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15:30 **Q. And we're looking at page 01320 of Exhibit 3.**
Is this -- I see two lists, transit agencies and bus OEMs.
Is it -- are these exhaustive lists of all your
15:30 **customers of S-1 Gards?**
A. No.
Q. Okay.
So these are just examples?
A. Yes.
15:31 **Q. Under OEMs Including, I see New Flyer Industries on there?**
A. Yes.
Q. So New Flyer has purchased S-1 Gards from your company in the past?
15:31 A. Yes.
Q. At the bottom, it says, "As well as major theme parks and international airport shuttles."
Is there a greater need for S-1 Gards on buses or vehicles that are around pedestrians and cyclists more?
15:31 A. Yeah.
Q. Okay.
So if -- you know, is that why there's such a large focus on transit agencies?
A. Yeah.
15:32 Because they move millions of people daily.

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15:32 **Q. Okay.**

So would the same principle that applies to the transit agencies apply to a bus company that is routinely used to shuttle people within city limits?

15:32 A. Yes, but not as -- the percentage is lower of incidents.

Q. Sure.

But ultimately, in your opinion, does the S-1 Gard provide a safety benefit with respect to any vehicle

15:32 **that's driven on city streets?**

A. No.

Q. Well, let me rephrase that.

In your opinion, does the S-1 Gard provide a safety benefit to any buses that are driven on city streets?

15:32 A. Oh, buses, yes.

Q. Okay.

And the more inner city driving that the bus does, the more likelihood that that benefit will actually come into play; correct?

15:33 A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. So when you have a transit bus that is repeatedly stopping and picking up pedestrians and

15:33 **driving near cyclists, it's the most likely scenario**

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15:33 **where the S-1 Gard's going to come into play; right?**

A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

15:33 **Q. And then maybe not as much, but still significant is the shuttle bus that shuttles people around the city?**

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

15:33 **Q. Correct?**

A. Yes.

Q. Okay.

You can flip back a page to P01319 of that same exhibit.

15:34 A. What page are you on, I'm sorry?

Q. P01319.

There's a blurb about S-1 Gard saves lives, and it references an incident from April 9th, 2003, on Wilshire Boulevard in West Los Angeles. It says, 15:34 **"Accident: Bicyclist caught under bus and saved by S-1 Gard. Result: Minor scrapes, abrasions, and bruises."**

Are you familiar with the incident described in the product information?

15:34 A. Yes.

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15:34 **Q. Can you tell me what you recall happened in this incident.**

A. I had a lady friend that lived on Wilshire, and she called me and said a rider got struck by a bus. So
15:34 I lived nearby and went by there and spoke to the gentleman.

He was riding his bike on Wilshire westbound to Santa Monica to work and he said he got swiped under the bus, and he wanted to thank God that the MTA had a guard
15:35 on the bus. So that's how.

Q. So you spoke to the gentleman that we see in the picture here?

A. Yes.

Q. And he told you he was swiped under the bus?

15:35 A. Yes.

Q. Did he tell you how?

A. His hip, whether the bus turned, was turning on Wilshire. It had a curve on the road. His body was swiped by the bus, the front side of the bus, and then
15:35 when he went down, he went under the bus.

Q. So he was riding his bicycle?

A. Yes.

Q. And the bus swiped his hip?

A. Yes.

15:35 **Q. And he fell off his bicycle underneath the bus?**

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15:35 A. Yes.

Q. And rather than getting run over by the rear wheels, the S-1 Gard pushed him out of the way?

A. Yes.

15:36 **Q. And are you aware of other stories similar to this where the S-1 Gard saved someone from catastrophic injury or fatality?**

A. No.

Q. This is the only one that you've personally

15:36 **experienced?**

A. Yes.

There's been others, but they don't -- you know, when someone's struck and they live or they die, they don't really actually mention the bumper or the

15:36 guard. So we only know by statistics of accidents stopped happening in cities that have the part on.

Q. So based on the statistics, are you able to estimate the number of serious injuries or deaths that were prevented to date by the S-1 Gard?

15:36 A. We have no database on that.

Q. But you are aware of statistics about a reduction in the number of serious accidents or fatalities from agencies that have started using the S-1 Gard?

15:37 A. Yes.

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15:37 MR. TERRY: Objection. Form.

MR. PEPPERMAN: I'm going to hand you what's been marked as Exhibit 7 to your deposition.

(Whereupon the document referred to is marked by

15:37 the reporter as EXHIBIT 7 for identification.)

MR. PEPPERMAN:

Q. Can you thumb through these documents and tell me what they are.

A. These are letters from agencies on mentioning

15:38 the reduction of accidents, and one here in Rochester City Lines where the ice doesn't stick to urethane.

Q. Are these testimonial letters on Public Transportation Safety's web site?

A. Yes.

15:38 **Q. And the letters we see in Exhibit 7, are they true and correct copies of letters from the web site?**

A. Yes.

Q. And did Public Transportation Safety request these letters from its customers actually using

15:38 **S-1 Gards?**

A. Yes.

Q. Did Public Transportation Safety request these letters as part of its regular course of business activities?

15:38 A. Yes.

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15:38 **Q. Did Public Transportation Safety ask for testimonials regarding customers' experience with the effectiveness of the S-1 Gard --**

A. Yes.

15:39 **Q. And these customers responding in the letters we see in Exhibit 7, they actually took the time to respond about the safety and/or effectiveness of the S-1 Gard?**

A. Yes.

15:39 MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. The first testimonial letter of Exhibit 7 is an email from Frederick Goodina.

A. Yes.

15:39 **Q. He writes, "Ms. McCombe" -- who is Ms. McCombe?**

A. I'm not sure.

Q. "I understand you are considering or proposing to adopt the referenced guard for your bus fleet. WMATA made the decision to go with this engineering control

15:39 **about seven years ago. At the time, were experiencing two fatalities involving the right rear tires."**

Reading down in the third paragraph, "I am pleased to report that since the complete installation of the product six years ago, we have not had a right rear tire

15:40 **fatality."**

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15:40 **Is this the type of statistical information that you've received regarding the reduction in accidents or serious or fatal accidents as a result of the S-1 Gard?**

A. Only MTA. These statistics only came from Washington.

15:40

Q. Correct.

This is just an example of the type of statistics?

A. No. No.

Q. Well, let me ask it this way.

15:40 **So WMATA stands for what?**

A. WMATA.

Q. Is it Washington Metro Area Transit Authority?

A. Yes.

Q. So prior to equipping their fleet of buses with

15:41 **the S-1 Gard, is it your understanding that the Washington Metro Area Transit Authority was experiencing two fatalities a year involving the right rear tires?**

A. Yes.

MR. TERRY: Objection. Form.

15:41

MR. PEPPERMAN:

Q. And is it your understanding that after equipping their buses with the S-1 Gard, those two fatalities per year were reduced to zero?

MR. TERRY: Objection. Form.

15:41 THE WITNESS: It's what's stated in the letter.

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15:41 MR. PEPPERMAN:

Q. The second testimonial letter in Exhibit 7 is from Brad Ellis with New Flyer.

Do you know Mr. Ellis?

15:42 A. Yes.

Q. How do you know him?

A. Trade shows, met him.

Q. Okay.

This letter's addressed to Ken Lutkus.

15:42 **Who is Ken Lutkus?**

A. An engineer, fits the parts; that goes on location to fit, to fit the S-1, take dimensions for the bracket train.

Q. And what is Mr. Ellis communicating in this

15:42 **letter?**

A. Basically saying it doesn't affect any other parts of the bus.

Q. In other words, there's no reason with respect to the chassis and suspension of why a bus cannot be

15:43 **fitted with the S-1 Gard?**

A. Right.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. Looking at the next letter in Exhibit 7 from

15:43 **Tom Barrio of Montebello Bus Lines, do you know**

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15:43 **Mr. Barrio?**

A. Yes.

Q. Did Montebello Bus Lines equip its buses with S-1 Gards?

15:44 A. Yes.

Q. And do you know if Montebello Bus Lines were happy with the results from the S-1 Gard?

A. Yes.

Q. Yes, they were happy?

15:44 A. Yes.

Q. Mr. Barrio states in his letter that, "Although all engineered safety devices cannot protect persons in every situation, it is MBL's belief that if the S-1 Gard saves one person, it has done what it's hoped it would

15:44 **and that is minimize the possibility for the rear tires of the bus from running over a person."**

Do you agree with that statement?

MR. TERRY: Objection. Form.

THE WITNESS: With the opinion, yes.

15:45 MR. PEPPERMAN:

Q. In your opinion, is there any better validation for the safety and effectiveness of the S-1 Gard than actual customers' verifying that the product is safe and effective?

15:45 A. Not sure.

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15:45 **Q. As the inventor of the S-1 Gard, is it good to know that the customers actually using it believe it's a safe and effective device that helps people?**

A. Yes.

15:46 MR. TERRY: Objection. Form.

MR. PEPPERMAN: I'm going to hand you what's been marked as Exhibit 8.

(Whereupon the document referred to is marked by the reporter as EXHIBIT 8 for identification.)

15:46 MR. PEPPERMAN:

Q. Can you tell me what this document is.

A. This is a test report in Albany, New York, on a right turn scenario.

Q. Okay.

15:46 **The front page says that this report is sponsored by the Federal Transit Administration?**

A. Yes.

Q. Is this testing report on Public Transportation Safety's web site?

15:47 A. Yes.

Q. And what we see in Exhibit 8, is it a true and correct copy of the report that is on Public Transportation Safety's web site?

A. Yes.

15:47 **Q. How did Public Transportation Safety come to be**

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15:47 **in possession of this report?**

A. We were asked by them to participate in the test.

Q. And did you participate in the test?

15:47 A. Yes.

Q. Okay.

The page numbers are in the top right- and left-hand corners.

A. Uh-huh.

15:48 **Q. Okay.**

And just so we're clear for the record, the title of this report is "Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions"; correct?

A. Yes.

15:48 **Q. If you turn to page 37 of the report.**

A. Uh-huh.

Q. Under Section 2.9.

A. Okay.

Q. It says, "Strategy 9: Bus Stop Location Planning and Bus Stop Design."

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Wait, I'm sorry, if you can flip back to page 34.

A. Okay.

Q. Under Section 2.8.

A. Okay.

15:49 **Q. Strategy 8: Bus Design/Modification.**

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15:49 A. Uh-huh.

Q. What is your understanding of this section of the report?

A. It's right turn scenario.

15:49 **Q. Let me ask it this way: Is it your understanding that Section 2.8, Bus Design/Modification strategy, is a strategy for bus designs and modifications to mitigate fixed-route bus-and-pedestrian collisions?**

15:49 A. Yes.

Q. Okay.

And if you could turn to page 38, Table 2-10.

A. Okay.

Q. It's titled "Applications of Bus

15:49 **Design/Modification."**

A. Uh-huh.

Q. Down at the bottom, it says, "Application: S-1 Gard."

A. Right.

15:50 **Q. "Purpose: To reduce the severity of injuries resulting from accidents involving pedestrians coming into contact with the rear right wheels of transit buses."**

A. Right.

15:50 **Q. So is it your understanding that, based on this**

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15:50 **report, that one of the strategies for reducing or for mitigating fixed-route bus-and-pedestrian collisions and injuries was to design or modify the bus to include an S-1 Gard?**

15:50 MR. TERRY: Objection. Form.

THE WITNESS: Not PTS. That's not my company. I believe they were investigating it.

MR. PEPPERMAN: Right.

Q. The Transit Cooperative Research Program --

15:50 A. Yes.

Q. -- they were doing this big investigation to try to reduce bus and collision -- bus-and-pedestrian collisions and injuries; correct?

A. Yes.

15:51 **Q. And this report was sponsored by the Federal Transit Administration?**

A. Yes.

Q. And they reached out to Public Transportation Safety and asked you to participate --

15:51 A. Yes.

Q. -- by providing the S-1 Gards?

A. Yes.

Q. Okay.

And one of the strategies for reducing

15:51 **bus-and-pedestrian collisions injuries was to design or**

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15:51 **modify the bus to include an S-1 Gard; correct?**

MR. TERRY: Objection. Form.

THE WITNESS: Yes.

MR. PEPPERMAN: Okay.

15:51 **Q. So was it your understanding that one of the Transit Cooperative Research Program -- as sponsored by the Federal Transit Administrations -- strategies for reducing fixed-route bus-and-pedestrian collisions was to design or modify buses to include an S-1 Gard?**

15:52 A. Yes.

Q. Do you know the approximate date that Public Transportation Safety's S-1 Gard web site was made available to the public?

A. In the beginning of the company. Since the

15:52 company started, but it's been changed over the years.

Q. Sure.

So when did Public Transportation Safety first start, you know, advertising or providing information regarding the S-1 Gard on its web site?

15:52 A. At the start of the company.

Q. Approximately what year?

A. '94, '95.

Q. I know the internet is relatively new, but when it became the norm for companies to have web sites --

15:53 A. Yes.

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15:53 **Q. -- Public Transportation Safety had a web site?**

A. Yes.

Q. And since its had a web site, it's published information, advertisements about the S-1 Gard?

15:53 A. Yes.

Q. Can you generally describe your company's sales and marketing efforts related to the S-1 Gard.

A. We have sales representatives, sales marketing agents, trade shows, meetings with the OEMs and bus

15:54 contractors.

Q. So you have a booth at trade shows with the S-1 Gard that people in the industry attend?

A. Yes.

MR. TERRY: Objection. Form.

15:54 MR. PEPPERMAN:

Q. Does that include OEMs, or original equipment manufacturers?

A. Yeah.

They attend.

15:54 **Q. Okay.**

So anyone who is attending a trade show can come to your booth and see information about the S-1 Gard?

A. Yes.

Q. You also mentioned that you have individual

15:54 **meetings with the original equipment manufacturers?**

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15:54 A. Yes.

Q. Did you ever have any meetings with Motor Coach Industries or a subsidiary of Motor Coach Industries?

A. Yes.

15:54 **Q. When did this meeting take place?**

A. I'm not sure, possibly in 15 years ago.

Q. Was the meeting with Motor Coach Industries or a subsidiary of Motor Coach Industries?

A. Don't recall.

15:55 **Q. Do you recall where the meeting took place?**

A. Don't recall.

Q. You don't recall meeting with -- whether the meeting was with Motor Coach Industries or a subsidiary of Motor Coach Industries; correct?

15:55 A. Don't recall.

Q. Do you recall that it was either Motor Coach Industries or a subsidiary of Motor Coach Industries?

A. Don't recall.

Q. So I asked if you ever had a meeting with

15:55 **Motor Coach Industries or a subsidiary of Motor Coach Industries, and you said yes?**

A. Yes.

Q. Is that -- is your answer still yes to that question?

15:56 A. Yes.

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15:56 **Q. Okay.**

Have you ever heard of a company called Universal Coach Parts?

A. Yes.

15:56 **Q. Are you aware if Universal Coach Parts is a subsidiary of Motor Coach Industries?**

A. Don't recall.

Q. Did you ever have a meeting with someone from Universal Coach Parts about the S-1 Gard?

15:56 A. Yes.

Q. Do you recall when that meeting took place?

A. Don't recall.

Q. Do you recall where it took place?

A. I believe Chicago, Illinois.

15:56 **Q. Do you recall who was present at the meeting?**

A. Myself and Chris Ferrone.

Q. And Chris Ferrone isn't with Universal Coach Parts; right?

A. Yeah.

15:57 **Q. Do you recall who was present from Universal Coach Parts?**

A. Don't recall.

Q. Does the name Pablo Fierros ring a bell?

A. Yes.

15:57 **Q. Do you recall if Pablo Fierros was present with**

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15:57 **you at this meeting on behalf of Universal Coach Parts?**

A. Yes.

Q. Yes, you recall, or yes, it was Pablo from Universal Coach Parts?

15:57 A. Yes.

Q. Yes, it was Pablo Fierros?

A. Yes.

Q. And Pablo Fierros was acting on behalf of Universal Coach Parts?

15:57 MR. TERRY: Objection. Form.

THE WITNESS: I don't know what. He could be a subsidiary. He could be -- I believe so. I can't say positively who was -- who he was representing.

MR. PEPPERMAN:

15:57 **Q. What was the purpose of the meeting?**

A. A presentation regarding the S-1 Gard.

Q. A sales presentation?

A. Yes.

Q. You were trying to sell the S-1 Gard to

15:58 **Universal Coach Parts?**

A. No.

Q. Who were you trying to sell the S-1 Gard to?

A. To them. They would be the distributor. Distributors wouldn't pay for the product.

15:58 **Q. Okay.**

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15:58 A. A new product, they would have to be, you know.

Q. Okay.

You were meeting with Pablo Fierros about having Universal Coach Parts distribute the S-1 Gard?

15:58 A. Yes.

Q. Okay.

And what was the result of that meeting?

A. Not their cup of tea, not their format. It's a difficult product to sell that's not a fan belt or a

15:58 radiator or something. It's a safety device.

So it wasn't, I believe at that -- I recall that it didn't fit into their format of marketing part, that their part catalog. They wouldn't have the wherewithal to sell it properly, I believe.

15:59 **Q. Do you recall a meeting with a Motor Coach Industries subsidiary known as Transportation Manufacturing Corporation?**

A. Don't recall.

Q. Have you ever attempted to sell the S-1 Gard to

15:59 **Motor Coach Industries or a Motor Coach Industries subsidiary for Motor Coach Industries to install the S-1 Gard on its buses?**

A. Other companies?

Q. Motor Coach Industries.

16:00 A. No.

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16:00 Q. You don't --
A. Don't recall.
Q. You don't recall.
In the meeting with Pablo Fierros and Universal
16:00 Coach Parts, did you discuss -- strike that.
Did you -- did you make the S-1 Gard available for
Motor Coach Industries to equip its buses with the
device?
A. Yes.
16:00 Q. Okay.
And did Motor Coach Industries equip its buses with
the S-1 Gard?
A. No.
Q. Do you know why Motor Coach Industries decided
16:01 not to equip its buses with the S-1 Gard?
A. No.
Q. Was it ever expressed to you that cost was a
reason for Motor Coach Industries not to use the S-1
device safety -- or the S-1 Gard safety device?
16:01 A. No.
Q. Are you familiar with the J4500 motor coach
manufactured by Motor Coach Industries?
A. Yes.
Q. Does Public Transportation Safety sell an
16:01 S-1 Gard that would fit on a Motor Coach Industries

16:02 **J4500 that was manufactured in 2008?**

A. Yes.

Q. If Motor Coach Industries were to have purchased S-1 Gards as standard equipment for all of --

16:02 **strike that.**

I think I might have asked this already, but I'll ask it again.

If Motor Coach Industries were to purchase S-1 Gard as standard equipment for all the buses it manufactured

16:02 **in 2008, including the J4500, can you tell me what the approximate purchase price would have been per bus?**

A. 1100, approximately 1100.

Q. And I believe, based on your earlier testimony, that if MCI had started equipping all of its buses with

16:03 **the S-1 Gard earlier and had a more established relationship, that price would go down?**

A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

16:03 **Q. Are you aware of anything that would have prohibited Motor Coach Industries with equipping its J4500s with S-1 Gards in 2008?**

A. Well, Motor Coach USA, they build buses; right?

Q. Motor Coach Industries.

16:03 A. Yes.

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16:03 **Q. Correct.**

A. Okay.

So it would have to be specified by the end user, let's say, Greyhound or the sheriff's department, or, 16:03 you know, New York Transit, they use them. They have to be specified.

Q. Well, it doesn't have to be specified; right?

A. No.

MR. TERRY: Objection. Form.

16:03 MR. PEPPERMAN:

Q. MCI, or Motor Coach Industries, could equip its buses with the S-1 Gard as original equipment; right?

A. Yeah, they could.

Q. Yeah.

16:04 **It would cost more; right?**

A. Uh-huh, yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. They would have to, you know, arguably sell 16:04 **their bus for a little more; right?**

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. But nothing that you're aware of prohibits them from making that decision to put the safety device on 16:04 **their bus?**

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A. No.

There's no law.

Q. Okay.

And is there anything about the bus itself

16:04 **structurally that would prohibit Motor Coach Industries from equipping its J4500 with S-1 Gards in 2008?**

A. No.

Q. What is your understanding, if any, as to why Motor Coach Industries did not equip its buses,

16:04 **including its 2008 J4500s, with S-1 Gards?**

A. I believe at the time, it didn't fit into their parts catalog. It was too difficult of a product to sell.

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Q. And I'm talking about the Motor Coach

16:05 **Industries manufacturer of the bus.**

What is your understanding, if any, as to why the manufacturer did not equip its buses --

A. It's extra equipment, adds extra cost. They want to sell buses.

16:05 **Q. Based on your experience as the inventor of the S-1 Gard and a seller of a safety device to bus companies and manufacturers for more than two decades, what is your opinion regarding Motor Coach Industries' attitude towards safety?**

16:05 A. I believe they leave it to the end user, they

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manage, the purchaser.

Q. So you believe Motor Coach Industries tries to pass on the safety of its buses to the companies that purchase its buses?

A. Yeah, uh-huh.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. And is the reason that you believe Motor Coach Industries passes the decision to equip its buses with the S-1 Gard is so it could sell its bus for a cheaper price?

MR. TERRY: Objection. Form.

THE WITNESS: Well, the OEM has to draw a line. There's all this extra equipment. Which ones do they choose to put on, and which ones do they not?

So special mirror, a special video, bike rack, et cetera, you know, extra equipment, which one would they choose, they leave it up to the end user.

MR. PEPPERMAN:

Q. And that's regardless if it's a safety device as opposed to a utility device?

A. Yes.

MR. PEPPERMAN: All right.

Thank you, Mr. Barron. I have nothing further. I believe Mr. Terry will have some questions for you.

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16:07 MR. TERRY: You want to rock and roll or take a break?

THE WITNESS: Yeah.

We can finish, yeah.

16:07

-EXAMINATION-

BY MR. TERRY: All right.

Q. Will you take a look at the TCRP Report 125

16:07 **that's in front of you and the table of contents.**

A. Okay.

Q. It's got Part 1, "How to Mitigate the Most Common Collision Types and Circumstances."

You see that?

16:07 A. Uh-huh.

Q. What does it identify as the most common collision types and circumstances?

A. Collision by vehicle.

Q. Yeah.

16:08 **Part 1, "How to Mitigate the Most Common Collision Types and Circumstances," what does this identify, this study identify, as the most common collision types and circumstances?**

A. Pedestrians.

16:08 **Q. Well --**

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16:08 A. Where are you?

Q. I'm at page 6, Part 1.

A. Oh, page 6?

Q. No, no.

16:08 **I'm sorry, it's the contents page.**

A. Is it this page here?

Q. No, this. I'm sorry, the contents page.

A. What page is that on?

Q. It's not numbered, but it's right before

16:08 **page 1.**

A. Okay.

Go ahead, tell me.

Q. Next one.

A. Here we go.

16:08 **Q. All right.**

Are you looking at the contents page?

A. Yes.

Q. All right.

So you see on the contents page, Mr. Barron,

16:08 **there's a page 6, Part 1, How to Mitigate the Most Common Collision Types and Circumstances?**

I'm sorry, let me get it for you, sir.

A. Okay.

Yeah, thank you.

16:09 **Q. That's all right.**

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16:09 A. Okay.

Q. I've handed you TCRP Report 125, Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions, and there in Part 1, it identifies the most common 16:09 **collision types; correct?**

A. Yeah.

Part 2 or Part 1?

Q. Part 1.

A. Okay.

16:09 Collision Type 1, bus turning right. Number 2 is Collision Type 2, buses turning left. Three is Collision Type 3, pulling into bus stops. Four, Collisions Type 4, pulling away from bus stops.

Q. All right.

16:09 **Now, what they're actually studying are fixed-route bus-and-pedestrian collisions.**

So that is transit buses; correct?

A. Uh-huh.

Q. Yes?

16:09 A. Yes.

Q. Like the city bus?

A. Yes.

Q. So the most common occurrences are when the bus turns right or left or pulls into or away from a bus 16:10 **stop?**

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16:10

A. Yes.

Q. And those are the circumstances where the bus is most likely to encounter pedestrians outside the bus?

MR. PEPPERMAN: Form. Foundation.

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MR. TERRY:

Q. Correct?

A. Yes.

Q. So what this study is looking for is how do we reduce those collision types where the bus is turning

16:10

right or left or pulling into or away from the bus stop; correct?

A. Yes.

Q. And that is a problem that is particular to transit buses; right?

16:10

A. Yes.

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

Q. When you use the term or you hear the term "transit bus," what do you have -- what is your

16:10

definition of a transit bus?

A. Numbers, that moves more than any vehicle probably daily.

Q. Okay.

And does it generally run on a fixed route?

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A. Yes.

16:10 **Q. Does it have a lot of stops?**

A. Yes.

Q. Lot of people getting on and getting off?

A. Yes.

16:10 **Q. Lot of people walking around the bus as they get on and off?**

A. Yes.

Q. So there are a number of instances where the bus intersects or comes in contact with people on foot,

16:11 **pedestrians?**

A. Yes.

Q. And does it have more than one door, usually?

A. Yes.

Q. So people can get on and off in the front or in

16:11 **the middle or even in the rear?**

A. Uh-huh.

Q. Yes?

A. Yes.

Q. In terms of the buses themselves, when they

16:11 **move, how fast do they go when they make a right turn or a left turn?**

A. 2 miles, 3 miles per hour, 4 miles.

Q. And when they pull into the bus stop?

A. 4 miles, depending as they --

16:11 **Q. And as they pull away, they go from 0 to 4 to 5**

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16:11 **miles per hour?**

A. Yes.

Q. So essentially, what you're talking about is a great big bus with a lot of people turning right, left,

16:11 **pulling in and out of bus stops at low rates of speed?**

A. Yes.

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

Q. From time to time, there are incidents or

16:11 **events where those people are at risk of being run over by the bus tires?**

A. Yes.

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

16:11 **Q. Now, in terms of your patent application, which is Exhibit 1, do you have the patent application before you, sir?**

A. Yes.

Q. In terms of your patent application, did you

16:12 **identify the reason why you wanted to come up with or submit this invention for a patent?**

A. Yes.

Q. What did you identify as the reasons?

A. The reasons, bus stopping, going, people, you

16:12 know, horsing around, a lot of foot traffic near a heavy

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16:12 vehicle.

Q. The same thing we were talking about when we reviewed the study itself?

A. Right.

16:12 **Q. So this is a lot of people mingling with or around a large vehicle traveling at a slow rate of speed?**

A. Yes.

Q. And there is a tendency or there has been

16:12 **reports of accidents where the people fall down and somehow get under the bus?**

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

Q. Correct?

16:12 A. I would say slow and fast, but the majority, slow.

Q. And then somehow, they get under the bus and they're at risk of getting run over?

A. Yeah, two-thirds slow and one-third fast, I

16:13 say, over 20 years experience seeing these accident studies.

Q. So what's fast?

A. Fast, is, you know, Pacific Coast Highway where that lady was killed.

16:13 **Q. 70?**

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16:13 A. No, no.

Q. 60?

A. No, too fast.

Fast would be like 40.

16:13 **Q. Okay.**

The lady on Pacific Coast Highway, she was run over and killed by the chassis?

A. Yeah, under the bus, the floor joists. They get -- the body gets turned under the vehicle, and they

16:13 get killed before the guard.

Q. Was she found at or near the S-1 Gard?

A. Wrapped around the guard.

Q. So the guard didn't push her out from the bus?

A. It did. They removed her between the guard and

16:13 the road surface. She was dragged.

Q. She was dragged by the bus?

A. Yeah, till the bus pulled over. So she was expired under the bus.

Q. Even though she came into contact with the

16:14 **S-1 Gard?**

A. We believe she swiped by the bus, went under the bus, and was killed before she got to the S-1 Gard. So the body is limp, and the bus stopped.

I was disturbed on it, and that's when I came up

16:14 with a barrier system.

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16:14 **Q. Did her body impact the S-1 Gard at all?**

A. Yeah.

The photos show the body was on the -- you know, around the guard.

16:14 **Q. But it hadn't been pushed out from underneath the bus?**

A. Half the body was, the legs.

Q. Just the legs?

A. Yeah.

16:14 **Q. And the rest remained at the S-1 Gard?**

A. Yes.

Q. Do you think that the speed at which the bus encountered the woman was 40 miles an hour?

A. Yeah, 35 to 45.

16:14 **Q. In terms of the transit buses that operate within the city, however, most of their events, collisions with pedestrians, bikes, and the like, are at slow speeds?**

A. Yes.

16:14 MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

Q. Was the purpose of the S-1 Gard, then, to protect those people from getting run over by the bus?

A. The highest priority.

16:15 **Q. And when you state the purpose of the**

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16:15 **invention, what do you state is the purpose of the invention?**

A. A physical barrier pushing limbs and head, limb and torso from being crushed and run over by the rear

16:15 wheels.

Q. Okay.

In terms of the designing that you did when you made the application for the patent, I assume that you had the thing engineered?

16:15 A. Uh-huh.

Q. Yes?

A. Yes.

Q. Did you have the thing tested?

A. Yes.

16:15 **Q. How did you have the thing tested?**

A. By durometer that pushed back when it -- you know, it had to be flexible enough for curb and pothole impact and pop, be flexible to stay on the bus.

Q. Okay.

16:15 **Did you test in terms of the force that the object would apply to the body?**

A. Yes, the force.

Q. All right.

And how did you measure?

16:15 A. Well, they clamp it to a machine and they put a

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dead weight on a conveyor belt, and it's a press test and the computer gives it a durometer test on a urethane, how much can it push, how much weight could the S-1 Gard push without bending, like a mudflap, and flapping over.

Q. Now, is the S-1 Gard just the urethane, or is it metal somehow?

A. The steel receiver is metal, and the lower part's all urethane.

Q. Okay.

A. There's some encapsulated urethane parts inside the upper part of the guard.

Q. But the receiver itself is steel?

A. Yes, sir.

Q. And then the guard is urethane?

A. Yes.

Q. At some point, does the urethane give?

A. Yes.

Q. Do you know, is that measured in force, do you know?

A. Durometer force.

Q. Do you know what the numbers are?

A. No.

Q. Do you know any relationship between the speed of the bus and the point at which the urethane gives?

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16:16 A. No.

Q. In terms of the receiver, however, the receiver is metal and does not --

A. Yeah.

16:17 **Q. It does not give?**

A. Yeah.

It's like a trailer hitch.

Q. When an individual encounters the S-1 Gard, do they encounter the receiver at all or just the urethane?

16:17 A. Just the urethane.

Q. And if the urethane fails, then they go under the bus wheels?

A. Yeah.

If the durometer -- if the guard's not produced

16:17 with the right durometer and it's very flexible, body could go under.

Q. All right.

Were there any tests done to determine what force -- at what force the polyurethane fails, if you

16:17 **will, and allows the object to go to the rear wheels?**

A. Speed in correlation with flexibility, no.

Q. Okay.

So do you know at what force the polyurethane will fail, measured in terms of foot pounds or momentum, mass

16:18 **times velocity or anything like that?**

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16:18 A. Yes.

We've done durometer tests on a conveyor belt with a hard object pushing on the guard. So we know how much pressure the guard can take before it buckles under.

16:18 We have those studies, and that's how we come up with the 90 durometer BSF or whatever, you know, urethane we're using at the factory.

Q. Are those studies available?

A. Yes.

16:18 MR. TERRY: May we go off the record for just a moment.

THE VIDEOGRAPHER: We are off the record at 4:18.

(Interruption in proceedings.)

THE VIDEOGRAPHER: We are back on the record at

16:19 4:19.

MR. TERRY: Okay.

Q. Now, in terms of the S-1 Gard, does it only go on the right side of the bus?

A. No.

16:19 **Q. It can go on the left?**

A. It could.

Q. Do most transit authorities put them on the right side and the left side or just --

A. Majority, the right side.

16:19 **Q. Because that's where most of the people are?**

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16:19 A. Yes.

Q. Now, in terms of motor coach, like a Greyhound motor coach or one that was still around, Trailways, is their method of operation different?

16:20 **Do they go from point to point? Do they travel on the highway?**

A. They're different.

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

16:20 **Q. How is a motor coach operated as a coach different?**

A. They do less stops.

Q. Okay.

Do they have more than one door, just one door?

16:20 A. Usually one door.

Q. Do they stop at bus stops, or do they stop at the --

A. They have designated bus stops designed for motor coach.

16:20 **Q. So like the bus station, if you will?**

A. Well, in New York, let's say, has a large motor coach quantity, and they have -- they wouldn't stop where the transit buses stop. They stop -- they have their own bus stops.

16:20 In the city, let's say Manhattan, they take the

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riders out to the different Bronx in New York.

Q. Do the motor coaches generally operate at higher speeds than the transit buses?

A. Yes.

Q. Do they generally go longer distances between stops?

A. Yes.

Q. So they have fewer stops than a transit bus?

A. Yes.

Q. Do you know of any bus line like Greyhound that has put on the S-1 Gard?

MR. PEPPERMAN: Form. Foundation.

THE WITNESS: Yes.

MR. TERRY:

Q. Who?

A. I'm going to have to get that for you.

Motor coach? I believe World Disney has some. I can't disclose the name yet. They have some over-the-road ones that have them. There's a few areas, airports, you know.

Q. Okay.

A. That take people out to the tarmac.

Q. So the ones at the airport, for example, they deal with a lot of people --

A. Uh-huh.

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16:21 **Q. -- getting on and getting off; correct?**

A. Right.

Q. And then the tour buses, the buses that go to Disney World and that kind of thing, same thing, they

16:22 **operate with a lot of people around?**

A. Yeah, parking lots.

Q. Okay.

But in terms of coaches that go over the road from city to city, few stops, high speeds, their method of

16:22 **operation is different than the transit bus?**

MR. PEPPERMAN: Form. Foundation.

THE WITNESS: Yes.

MR. TERRY:

Q. And they don't encounter as many people as

16:22 **often mingling with the bus?**

MR. PEPPERMAN: Form. Foundation.

THE WITNESS: Less riders.

MR. TERRY: Okay.

Q. Are you aware of any studies similar to the

16:22 **ones that were performed for the transit authority, like Report 125, that deal with motor coaches that operate as motor coaches?**

A. Well, the Fox News clip on the S-1 Gard where there was an actor that was killed by a motor coach in

16:22 New York -- you want to know whether accidents near it?

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Q. No, sir.

I'm talking about actual research programs --

A. Oh.

Q. -- where they look at fixed or motor coach bus-and-pedestrian collisions, where they look at the most common collisions.

A. Oh, like the other report?

Q. This report.

A. No.

Q. Is it Dr. Green or Mr. Green?

A. Barron.

Q. No, the --

A. His name is Green.

Q. Does he go by doctor?

A. What's his first name?

Q. James.

A. James Green, yeah.

Q. So James Green in Exhibit 4, for example, talks about the fact there are a lot of statistics about transit bus events and occurrences?

A. Yes.

Q. And there is no similar report dealing with coaches, motor coaches and the like, Greyhound buses and that sort of thing?

A. No.

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16:23 Q. Okay.

In terms of the marketing that you do, I note that in the product information that is Exhibit Number 3, on page 1320 -- I think you have it -- you list major

16:24 transit fleets worldwide retrofitting with the S-1 Gard?

A. Right.

Q. So what we're talking about here are those companies that run city buses -- San Francisco or Austin, Texas -- or make city buses, like New Flyer

16:24 Industries, retrofitting with the S-1 Gard; correct?

A. Correct.

Q. Now, this tells me that you, as a company, market to the actual transit agencies?

A. Yes.

16:24 Q. Do you?

Do you meet them at the shows that you talk about?

A. Yes.

Q. Do you and your sales force make calls on these people?

16:24 A. Yes.

Q. Do you attempt to sell the transit agencies the S-1 Gard?

A. Yes.

Q. Do you have product literature that you give

16:24 them, brochures that you give them?

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16:24 A. Yes.

Q. Do you show them the videos that you were shown this afternoon?

A. Yes.

16:24 **Q. Which demonstrates at low rates of speed how the gentleman who falls under the bus is pushed out --**

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

Q. Correct?

16:25 A. We have media material we show the transit property, yes.

Q. And you show the video we looked at this afternoon?

A. Well, it's on the web site. We have a thumb

16:25 drive we give them.

Q. And it's got those videos in there?

A. Yes.

Q. And those are the kind of things that occur with transit buses when people are getting in, getting

16:25 **off, getting caught on the door, forgetting their personal effects, that sort of thing?**

A. Yes.

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

16:25 **Q. Now, the transit authorities can obtain the**

16:25 **S-1 Gard from you?**

A. Yes.

Q. Do you assist them in actually making the installation?

16:25 A. Yes.

Q. Now, the transit authorities would know where their buses operate, how their buses operate, and whether or not they come into contact with a lot of people?

16:25 MR. PEPPERMAN: Form. Foundation.

THE WITNESS: They should.

MR. TERRY:

Q. When you deal with the transit agencies or your sales force deals with the transit agencies, do they

16:26 **appear, the agencies appear, to know what kind of injuries are occurring in their operation?**

MR. PEPPERMAN: Form. Foundation.

THE WITNESS: More than likely.

MR. TERRY:

16:26 **Q. And you tell them that you can deal with -- your guard can deal with a particular kind of bus-pedestrian event. The S-1 Gard can protect their passengers?**

A. It can minimize.

16:26 **Q. Yes.**

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16:26 **And do you find or does your sales force find the agencies are receptive when they realize that the S-1 Gard can protect or minimize injuries to their riding public?**

16:26 A. Yes.

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

Q. Apparently, a number of them have accepted and retrofitted in their buses?

16:26 **Yes?**

A. Yes.

Q. Do you know anything about Michelangelo's, the tour bus company?

A. Heard of them.

16:26 **Q. Have you ever dealt with them?**

A. They're located, I believe, in Arizona.

Q. Maybe Nevada?

A. Yeah, Nevada.

I've heard of them. You see them at the trade

16:27 shows. You see them in the industry. They're a coach company.

Q. Have you personally ever dealt with Michelangelo's at the trade shows?

A. Don't recall.

16:27 **Q. But when you are aware of them, they are at the**

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16:27 **trade shows where you are; right?**

A. Yes.

Q. And I suppose you have your booth?

A. Sure.

16:27 **Q. Your literature and your marketing, your material?**

A. Sure.

Q. Do you know whether or not you actually marketed to Michelangelo's?

16:27 A. Don't recall.

Q. If Michelangelo's wanted to acquire the S-1 Gard, would you sell it to them?

A. Yes.

Q. Michelangelo's, presumably, knows where it

16:27 **operates its coaches and how many people it comes into contact with, all that sort of thing?**

MR. PEPPERMAN: Form. Foundation.

MR. TERRY:

Q. Yes?

16:27 A. Yes.

Q. If you dealt with them and you were trying to market the S-1 Gard to them, would you stress that the S-1 Gard can protect when their coaches come into the stop, leave the stop, make a right turn, make a left

16:28 **turn?**

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16:28 A. Yes, mostly on turns with motor coaches.

Q. Okay.

A. Or most of -- 80 percent of their accidents are turns.

16:28 **Q. And these are turns generally made at --**

A. Two-thirds.

Q. At a low speed?

A. Majority of them are happening with the buses turning in heavily populated cities.

16:28 **Q. And that's when they run the risk of encountering pedestrians?**

A. The accidents that I've seen over the years.

Q. Okay.

Now, in terms of the marketing that you do, do you

16:28 **find that the agencies that run buses that encounter people on a regular basis have an interest in protecting their riding public?**

A. Transit?

Q. Yes.

16:29 A. 50 percent.

Q. And those are the ones that actually buy the S-1 Gard?

A. Yeah.

Q. And the others do not?

16:29 A. They're proactive.

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16:29 **Q. And the others are not?**

A. Yeah.

It's extra paperwork they have to do to get the funding. It's called procurement. You can't just write 16:29 a check. They have to get the money from the feds. So there's a procurement.

Q. So does the federal government, then, assist the agencies in acquiring the S-1 --

A. Yes.

16:29 **Q. How do they assist?**

A. Well, transit properties nationwide lose money every year, and the only profit they make is from fare box and advertising. That money goes into a special account for injury claims.

16:29 So they lose money every year. So the federal government pays, because they want people to go to work, to get tax revenue. So they're big, the federal government's big, on city transportation for riders for job operation.

16:30 **Q. Okay.**

So the federal government will actually pay transit authorities to buy the S-1; is that right?

A. Yes.

Q. So it's no cost to the transit agencies, just 16:30 **the paperwork?**

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16:30 A. Yes.

Q. And even then, some transit agencies don't do it?

A. Difficult, yes.

16:30 **Q. Okay.**

Do you market your product to actual governmental agencies?

A. Yes.

Q. Whom do you market to? Can you describe?

16:30 A. Government agencies?

Q. Yes.

A. Well, it would be the transit properties are government agencies.

Q. You sell to the FBI?

16:30 A. I see, like military and --

Q. That's right.

A. No, no.

Q. Okay.

But you do sell to those that can go to the federal

16:30 **government to get funding for the equipment that you sell?**

A. Yes.

Q. If someone wanted to buy one of your equipment, an S-1 Gard, how do they go about doing that?

16:31 A. Well, they would contact our company, and then

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16:31 we would send out somebody to do a fitting to see if their bus will accommodate the product.

Q. What if they just want to see the S-1 Gard?

A. We bring it out. We ship it. We ship it out

16:31 ahead of time, and then we send a representative.

Q. How long would it take to get an S-1 Gard?

A. Five days.

Q. Now, when the S-1 Gard is actually installed on the bus, does the guard go all the way out to the edge

16:31 **of the tire?**

A. Yeah.

We try to design it to go even with the tire and tread and hold it in as much as possible, because we don't want it rubbing on the curb.

16:31 **Q. Yeah.**

I've got to get it marked, if you would hand it to the court reporter.

(Whereupon the document referred to is marked by the reporter as EXHIBIT 9 for identification.)

16:32 THE WITNESS: Great.

MR. TERRY:

Q. What number does it have, Mr. Barron?

A. Number --

THE REPORTER: 9.

16:32 THE WITNESS: 9.

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16:32 MR. TERRY: Okay.

Q. I'm going to show you what the court reporter has marked as Number 9.

A. Yes.

16:32 **Q. Is it your literature?**

A. Yes.

Q. Does it show the S-1 Gard relative to the bus wheel?

A. Yes.

16:32 **Q. Does it show how much distance from the edge of the tire to the guard?**

A. Yes.

Q. What is the distance?

A. The tire has a radius to it. So we try to keep 16:32 the side of the guard even with the tire tread, not the sidewall of the tire, because the sidewall of the tire's not going to catch the pedestrian and pull them under.

The side of the tire has about an inch, inch-and-a-half radius. You put a straight edge on the 16:32 side of a tire and measure into the edge of the tire treads, it's about an inch and a quarter.

Q. Okay.

Does that document from your literature indicate that the guard is 1 to 2 inches from --

16:33 A. Yes, yes, right on the tire tread.

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16:33 **Q. Okay.**

So it's right on the tire tread, which can be 1 to 2 inches --

A. 1 1/2, 1 1/4, from the sidewall of the tire.

16:33 **Q. Okay.**

In terms of the testing that you have done, besides the simulations that we see in the video, have you done any actual testing to determine whether or not an individual struck by the S-1 Gard by a bus traveling 25 to 35 miles per hour would sustain injury?

A. No.

Q. Do you know whether or not they would sustain an injury?

A. Minimize.

16:33 **Q. Minimize, what do you mean minimize?**

A. Well, the side of their temple gets hit by the guard, they can die on impact.

Q. Okay.

A. Expire on impact.

16:33 You know, depending on if their legs go under and the bus is going 25, it would do major minimization, would minimize it majorly.

But the side of your head or your face or your temple getting struck by a bus, you know, a solid

16:34 impact --

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16:34 **Q. You'd be dead on impact?**

MR. PEPPERMAN: Form. Foundation.

THE WITNESS: Could. I don't know for sure, but it would be, you know, bus is going 25 miles an hour and

16:34 someone's head gets hit without a helmet, in a crystal ball --

MR. TERRY:

Q. What about with a helmet?

A. With a helmet?

16:34 **Q. With a bike helmet, do you know whether or not --**

A. It would help.

Q. The bike helmet would?

A. Yeah, the bike helmet, sure.

16:34 **Q. Do you know whether or not an individual would survive --**

A. Don't know. It's not my professional opinion. I couldn't give that opinion.

Q. Do you have any data within your company,

16:34 **either in terms of polyurethane testing or actual field testing, that can tell us whether that's a survivable event --**

MR. PEPPERMAN: Form --

MR. TERRY: -- if someone gets their head struck by

16:35 your guard when the bus is driving 25 to 35 miles an

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hour?

THE WITNESS: No.

MR. PEPPERMAN: Form. Foundation.

THE WITNESS: No.

MR. TERRY: Okay.

That's all I have. Thank you.

-EXAMINATION-

BY MR. PEPPERMAN: I just have a few follow-up questions.

Q. Counsel directed your attention to Exhibit 8 and the types of collisions that are at issue in that exhibit.

In terms of whether or not the S-1 Gard is a safe and effective device for preventing people from getting run over by the rear wheels of a bus, does it matter how the person gets under the bus?

A. No.

Q. So I'm looking at the collision types at issue in Exhibit 8.

If the person falls under the bus in front of the rear wheels and the bus is turning right, the S-1 Gard is going to prevent that person from getting run over by the rear wheels?

16:36 MR. TERRY: Objection to form.

MR. PEPPERMAN:

Q. Correct?

A. Minimize.

16:36 **Q. Yeah --**

A. It would help more than likely minimize the --

Q. Let me rephrase it; okay?

The S-1 Gard is designed to minimize the injuries sustained by people who fall underneath the bus in front

16:36 **of the rear wheels?**

A. Yes.

MR. TERRY: Objection. Form.

MR. PEPPERMAN: Okay.

Q. And for the purposes of the design, does it

16:36 **matter -- does it make a difference if the person falls under the rear wheels when the bus is turning right or turning left?**

A. No -- no professional opinion on that.

Q. Does it make a difference in terms of

16:37 **effectiveness of the S-1 Gard if the person falls under the bus when the bus is pulling into a bus stop or pulling away from the bus stop?**

A. Helps greatly minimize.

Q. It performs the same function in either

16:37 **circumstance; right?**

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16:37 A. Yes.

Q. Okay.

And if someone is hit -- if the bus hits a bicyclist and the cyclist falls under the bus in front

16:37 **of the rear wheels --**

A. Right.

Q. -- does it make any difference on whether or not the S-1 Gard is going to minimize the injuries of that person?

16:37 A. I believe it would more than likely minimize it.

If I had a child, you know, if I had a kid and he fell off a bike, I'd want the S-1. You know, minimize. I can't say exactly per scenario.

16:37 **Q. In other words, under the design, it's designed to minimize injuries of people who fall under the bus, regardless of how they get under there?**

MR. TERRY: Objection. Form.

THE WITNESS: You know, from one to a ten, you

16:38 know, from one to ten; in other words, an easy scenario would be a ten, and a hard scenario would be a one. I don't know. I'm not an expert, but it would definitely help minimize all ten examples.

MR. PEPPERMAN:

16:38 **Q. Earlier, I asked you, when we were looking at**

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16:38 the patent, Exhibit 1, whether you were -- one of the hazards you were considering when you invented the S-1 Gard was a bicyclist getting hit by the bus and falling underneath the bus.

16:38 You recall that?

A. Yes.

Q. And you said at the time, you had not considered the benefits that it would provide to a bicyclist who is hit by the bus and falls underneath the

16:38 bus; correct?

A. Yes.

Q. But subsequent to the patent, you realized that the S-1 Gard is an effective safety device to minimize injury in that circumstance when a cyclist is hit by the

16:39 bus and falls underneath the bus in front of the rear tires; right?

A. Yes.

It was one of the scenarios.

Q. And, in fact, when we looked at the stuntman

16:39 video in Exhibit 6, one of your scenarios that you contemplate is the bus hitting the bicyclist and the bicyclist falling off his bike underneath the bus; correct?

A. Yes, yes.

16:39 Q. There was a lot of discussion about the

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16:39 **application in the transit bus setting.**

A. Uh-huh.

Q. Does the S-1 Gard apply in a nontransit bus setting?

16:40 A. Yes.

Q. There was discussion about transit buses and the speeds at which they travel; right?

Do you recall that?

A. Yes.

16:40 **Q. Okay.**

Do transit buses travel at higher rates of speed?

A. Than other buses?

Q. Just in general.

A. Well, where there's scenarios of injuries and

16:40 fatalities, city buses are not -- mostly, I would say the accidents and injuries happen at low speed, not low, but I mean, they're not on the highway, you know, going 40 miles an hour.

Q. All right.

16:40 **But even city roads, speed limits get up to 40 or 50 miles per hour --**

A. Oh, yeah.

Q. So transit buses travel at speeds of 25 miles per hour?

16:41 A. Right.

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16:41 **Q. 30 miles per hour?**

A. There was one here on Sixth Street where a bicyclist courier was coming down the hill, and the bus, they travel fast. It's Sixth Street, one way. So I put 16:41 that fatality into this over here.

I'd say a third, a third of the reports I read, you know. I have Nexis Lexis that alarms our company when they happen. So I would say an estimate, in my experience in the business, a third of the -- 20 to 16:41 40 -- I can't say exactly -- 20 to 40 percent of injuries and deaths occur by buses that are in the city stopping and going.

The other 20 to 40 percent are like Sixth Street and Pacific Coast Highway incidents. That's the other 16:41 20 to 40 percent that I see, you know, over 20 years in this business.

MR. TERRY: Objection. Not responsive.

MR. PEPPERMAN: Sure.

Q. And do you believe that the S-1 Gard is 16:42 **potentially effective in the 20 to 30 percent of accidents you see which are not in city transit scenarios?**

A. Minimizing, yes.

Q. You were asked about whether you market to the 16:42 **actual transit agencies, and you said yes.**

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16:42 **Do you recall that?**

A. Yes.

Q. Do you also market to manufacturers of motor coaches, such as MCI, Motor Coach Industries?

16:42 A. Yes.

Q. Okay.

And are manufacturers of motor coaches, such as Motor Coach Industries, at the trade shows you attend?

A. Yes.

16:42 **Q. And is the S-1 Gard at these trade shows equally marketed to manufacturers such as motor coaches, such as MCI?**

A. I mean, I'm there. It's up to them. I can't -- you know.

16:43 **Q. Sure.**

A. Yeah.

Q. It's made available --

A. Yeah.

It's available to them.

16:43 **Q. Okay.**

And if they came up to you and inquired about your safety device, you wouldn't tell them to go away, you don't sell to motor coach manufacturers, would you?

A. No.

16:43 **Q. In fact, I think you mentioned that you have**

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16:43 **sold S-1 Gards to motor coach companies; right?**

A. Yes.

Q. And you mentioned specifically motor coach companies that shuttle people from the airport?

16:43 A. Right.

Santa Monica Big Blue, it's a big one here in Los Angeles. It's running about 500 buses. They have MCIs.

Q. You were also asked a lot of questions about

16:44 **whether the transit companies know the type of customers that they serve and what they need to serve their customers.**

Do you recall that?

A. Yes.

16:44 **Q. Okay.**

Does it make a difference when we're talking about a safety device, something that keeps people safe, whether it's put in by the product manufacturer, the bus manufacturer, such as Motor Coach Industries, or the

16:44 **transit company?**

A. Different, totally different.

Q. But for the effectiveness of the safety device --

A. No.

16:44 **Q. -- does it make a difference who puts it in?**

16:44 A. No.

Q. Okay.

So if someone, a pedestrian on a bicycle, is struck by a bus and they fall under the bus in front of the

16:45 **rear tires, the S-1 Gard is designed to minimize that injury in that scenario?**

A. Yeah.

MR. TERRY: Objection. Form.

MR. PEPPERMAN:

16:45 **Q. Right?**

Is the S-1 Gard --

A. More than likely, it will minimize. I can't say hundred percent.

Q. Sure.

16:45 A. I don't know the exact incident. The person could be under the influence of alcohol, or it could be -- but I would say, overall, it would greatly minimize.

Q. Yeah.

16:45 **And is the S-1 Gard generally designed to minimize the injuries a person sustains in that scenario I just described?**

MR. TERRY: Objection. Form.

THE WITNESS: By being swiped by a bus?

16:45 MR. PEPPERMAN: A bicyclist hit by the bus, falls

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underneath the bus in front of the rear tires.

THE WITNESS: Yes.

MR. PEPPERMAN:

Q. The S-1 Gard is designed to minimize the injuries that person would suffer in that type of incident?

A. Yes.

Q. Okay.

Does it matter, for the purpose of whether the S-1 Gard minimizes the injuries, if the S-1 Gard was put there by the bus manufacturer or the bus operator?

A. Wouldn't matter.

Q. Okay.

If you had a different safety device, for example, a seat belt, would you expect the bus manufacturer to install the seat belt or the bus operator to install the seat belt after purchasing the bus from the manufacturer?

A. Depending on if it's mandated, depends on whether other OEMs -- it's called industry mandation. Seat belts were industry-mandated. They were never mandated by an OEM put a safety device on, unless other OEMs know it's available. It's called industry mandation.

Q. Okay.

16:47 **But just generally speaking, if a bus has a seat belt on it, if bus has seat belts, would you expect those seat belts to have been installed by the manufacturer of the bus or would you expect those seat**
16:47 **belts to be retrofitted by the operator of the bus after the operator purchased the bus?**

A. I think they both should be wanting to put it on, both parties, the OEM and the user.

You're talking not federal. You're talking
16:47 private?

Q. Yes.

A. The private?

Yeah, the private people should be, you know, proactive, and so should the OEM.

16:47 **Q. Is that because we're talking about a safety device?**

MR. TERRY: Objection. Form. Argumentative.

THE WITNESS: Because there's lot of reasons. I mean, there's number -- cost, do they have the team
16:48 of -- you know, do they have a management team that can make that decision at the time?

There's too many different scenarios to answer that.

MR. PEPPERMAN: Okay.

16:48 THE WITNESS: It's too murky.

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16:48 MR. PEPPERMAN:

Q. I was a little confused when you said that 50 percent of transit authorities have an interest in protecting its riding public.

16:48 **What do you mean by that?**

A. Well, their incentive, they don't have the incentive and they don't have -- the incentive to do it, and you know, they know their family member's not going to be run over. So there's no urgency, and they have

16:48 other things on their agenda. So it's kind of like in low priority in this.

The risk manager's job at transit authorities are to put glass guards on buses for graffiti, preventing graffiti, and they're paid by the taxpayers, and one

16:49 accident pays for all the guards and they're just not doing their job.

Q. Do you believe that the S-1 Gard should be standard equipment on all buses?

A. In the U.S. or --

16:49 **Q. Yes.**

A. The U.S., yes.

Q. Okay.

Based on your experience in the industry, do you believe that the safety benefits of an S-1 Gard outweigh

16:49 **the cost to equip the buses --**

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16:49 A. Absolutely, absolutely.

Q. And when you say "absolutely," does that -- does it make a difference if it's a transit bus manufacturer or a motor coach manufacturer?

16:50 A. Depending on how many buses they have. If it's less buses, then less parts. I'd say it's the same.

Q. And, in fact, you have offered the S-1 Gard for sale to Motor Coach Industries; true?

A. If that's the name of the company. It's a 16:50 little murky. Could be -- sounds like the company. Pablo sounds -- Pablo, which is Ferrone. It sounds like, yes.

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Q. Do you believe that you have offered -- that you met with representatives or subsidiaries of 16:50 Motor Coach Industries and offered to sell the S-1 Gard to the manufacturer?

A. Not sell. At that time, I believe I was going to do -- because safety, it's hard to sell.

I wanted to let them -- give them parts at no cost 16:51 to get them on the buses, so it would become industry-mandated for the motor coach industry, because nobody puts money out. The companies aren't going to just write you a check.

So the plan was with Chris Ferrone and I was to 16:51 offer them the parts at no cost, my red -- and that once

16:51 their user started using it, you know, they'd put it on and get it jump-started, then they would be the main distributor. We would give them the rights to that, I believe.

16:51 It was something like that, but we didn't go to there to sell, like, "Here, I'm going to sell you a hundred S-1 Gards."

Q. So you offered the S-1 Gard to Motor Coach Industries or a subsidiary for free?

16:51 A. Well, not free. There was some type of --

MR. TERRY: Objection. Form.

THE WITNESS: -- strategy, marketing strategy that I always come up with.

MR. PEPPERMAN:

16:52 **Q. Is the strategy to provide them with the parts, let them try out --**

A. Yes.

Q. -- get them to like to use the product and then want to purchase more?

16:52 A. Right, to get them --

MR. TERRY: Objection. Form.

THE WITNESS: -- some type of marketing strategy.

MR. PEPPERMAN:

Q. And MCI or its subsidiary rejected that offer?

16:52 A. Yes.

16:52 **Q. They didn't even want to try them out for free?**

MR. TERRY: Objection. Form.

THE WITNESS: I gave them evaluation parts. Yeah, I'd say no.

16:52 MR. PEPPERMAN: Okay.

I have nothing further.

-EXAMINATION-

16:52 BY MR. TERRY:

Q. The meeting that you had with Pablo --

A. Oh, I'm sorry.

Q. That's all right.

The meeting you had with Pablo, he was Universal Coach Parts; correct?

16:52

A. I believe so.

Q. And that's a company that sells bus parts?

A. Yes.

Q. And you wanted him to become a distributor of the S-1 Gard?

16:52

A. Yes.

Q. So that he would include it in the inventory of things that he sells; right?

A. Uh-huh.

16:52 **Q. Yes?**

16:52 A. Be a distributor, yes.

Q. He would be your distributor?

A. Yes.

Q. And he told you that it didn't fit with the

16:53 **kind of equipment that he was selling?**

A. I believe so.

Q. What was he selling?

A. Bus parts.

Q. Do you know what kind of bus parts?

16:53 A. Radiators and fuel pumps and alternators and fan belts.

Q. So he -- he, Pablo -- did not pass judgment on whether or not the S-1 was a useful device.

He simply said, "It's not part of what we sell";

16:53 **correct?**

MR. PEPPERMAN: Form. Foundation.

THE WITNESS: I believe so. That was his --

MR. TERRY: Okay.

Q. You mentioned Santa Monica Big Blue and that

16:53 **they have S-1 Gards?**

A. Yes.

Q. Do they run coaches?

A. Yes.

Q. Do they run MCI coaches?

16:53 A. Yes.

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16:53 **Q. And why have they made the decision, do you know --**

A. Well, they have them on all their other buses.

Q. Why do they put the S-1 Gard on their coaches, do you know?

A. All their buses?

Q. Yes.

A. Well, they're in -- they're in the tourists, and people come from all over the world. They got bike paths, and they're proactive. They're safety-conscious.

Some people aren't. Some agencies, 50 percent, are wanting to do it, and other half, roughly, don't.

Q. Now, does Santa Monica run coaches like fixed stops, like a transit bus?

A. No.

Q. But they do run coaches where there's a lot of people?

A. Yeah.

Santa Monica, yeah, there's a lot of foot action. They collect them on Ocean Avenue, the tourists, and they take them out. They have about, I believe, 10 percent of their fleet is from MCI.

Q. So they made the decision they needed the S-1 Gard for their application?

A. Well, they have them on the rest of their

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buses. At that time, they didn't have them on their MCI buses. They had them on the New Flyers or Gillig or other makeup of their buses.

So when they started ordering MCI, I sent Mr. Lutkus, the engineer, to do the MCI buses.

Q. So they wanted those devices on their MCI buses?

A. Yes.

Q. And it was easy enough to do?

A. Oh, yeah.

Q. So if you're dealing with a carrier that operates buses where he recognizes or the company recognizes there are people at risk because of what they do, where they do, and the people they come into contact with, you're there to help them?

A. Right.

Q. All they have to do is call, and you'll be there?

A. Well, yes.

Q. Okay.

In terms of this study that we were looking at, the TCRP study, we looked at Table 2-10, which is at page 38, I think.

A. Yes.

Q. Okay.

16:55 **And this is -- have you got it there?**

A. Uh-huh.

Q. And it's got a number of applications and bus design and modifications, and at the bottom, it has the

16:55 **S-1 Gard; right?**

A. Yes.

Q. All right.

Do you know how many applications were studied by this group?

16:55 A. Different equipment groups?

Q. Yeah.

A. I believe maybe five.

Q. Okay.

They talk about, for example, video or bus curb

16:55 **lights?**

A. Uh-huh.

Q. And it says to increase operator's view of pedestrians running alongside the buses?

A. Right.

16:56 Those are the little round lights by the rear door.

Q. And they said that was rated a five in reducing collisions involving pedestrians; correct?

A. Yeah.

Q. So they rated just bus curb lights five, very

16:56 **effective, for reducing collision involving pedestrians;**

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16:56 **right?**

A. Yes.

Q. The S-1 Gard, did they rate your effectiveness or the effectiveness of your equipment?

16:56 A. Well, they did in the -- in the video, and they wrote a report.

Q. But here on the table --

A. Oh, on the table?

No. It says here unknown.

16:56 **Q. So the group that studied the S-1 Gard, as well as others, for the purposes of coming up with a Guidebook for Mitigated Fixed-Route Bus-and-Pedestrian Collision, talked about driver training, additional equipment on the bus, bus stops, routing, signage, and**

16:57 **all that sort of thing?**

A. Uh-huh.

Q. And among those, they included the S-1 Gard, but they had no opinion about whether or not it was effective?

16:57 A. Here, no. It says unknown.

MR. TERRY: Okay.

Thank you, sir. That's all I have.

(Continued on following page.)

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-EXAMINATION-

BY MR. PEPPERMAN: Sorry, just a few more.

Q. You were asked a couple questions that if a carrier, a motor coach carrier, determines that the S-1 Gard would be an effective safety device to add to its fleet, all they have to do is call you; right?

A. Yes.

Q. And you'll provide them with the S-1 Gards to equip on the buses; right?

A. Yes.

Q. Okay.

Same questions with respect to the manufacturer, if a bus manufacturer determines that an S-1 Gard would be an effective safety device to add to its bus, all they'd have to do is call you; correct?

A. Yes.

Q. And you'd be there to help them --

A. Right.

Q. Okay.

And I just want to, lastly, just clarify this situation with your meeting with Pablo Fierros and Universal Coach Parts.

So regardless of whether Universal Coach Parts wanted to distribute the S-1 Gard or not, as part of

16:58 **your marketing strategy with Universal Coach Parts, you offered to provide the S-1 Gards to be equipped on MCI buses to test it out, so it can make a determination regarding the safety and effectiveness of the device?**

16:58 MR. TERRY: Objection. Form.

MR. PEPPERMAN:

Q. Is that correct?

A. I believe it was in the scenario of trying to get them to be the distributor, too, yeah.

16:58 **Q. And that offer was rejected; right?**

A. Right, yeah.

MR. PEPPERMAN: Nothing further.

-EXAMINATION-

16:58

BY MR. TERRY:

Q. Well, when you talked to Pablo, did you say, "You can put them on the MCI buses," or did you say, "We'd like you to distribute the S-1 Gard"?

16:58 A. Don't recall.

Q. Do you know if Pablo Fierros had anything to do with manufacturing MCI buses?

A. I believe Chris introduced me to him, saying that he was the president of the company.

16:59 **Q. Which company?**

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16:59 A. Of MC -- of Universal Coach Parts.

Q. Okay.

Do you know if he, as the president of Universal Coach Parts, had anything to do with making the buses,

16:59 **or did he simply carry parts for sale?**

A. I believe that at that time, he was a parts distributor. Universal Coach Parts sold parts.

Q. To everyone?

A. Yeah, the largest in the company.

16:59 **Q. And they sold to anyone?**

A. Yes.

Q. So you wanted him to distribute through his marketing chain, through his distribution, your S-1 Gard?

16:59 A. Yes.

Q. And he declined?

A. Yeah.

MR. TERRY: Okay.

That's all I got.

16:59 MR. PEPPERMAN: Nothing. I'll end it.

MR. TERRY: Okay, good.

THE WITNESS: Done, okay. Did good.

THE VIDEOGRAPHER: This concludes the deposition of Mr. Mark Barron on September 26th, 2017, which consists

17:00 of two media files. The original media files will be

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17:00 retained by Litigation Services. We are off the record at 5:00 p.m.

THE REPORTER: Did you want a copy?

MR. TERRY: Yes.

17:00 But I think that we deal with -- I deal with Lee Roberts' office in Vegas. I'm not sure who it is that actually handles ordering and paying. Your firm does this case a lot, I guess. Why don't you check with them. We will want a copy, but I'm not one that does

17:00 it.

(The proceedings concluded at 5:00 p.m.)

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STATE OF CALIFORNIA) ss

I, Jana Ruiz, CSR 12837, do hereby declare:

That, prior to being examined, the witness named in the foregoing deposition was by me duly sworn pursuant to Section 2093(b) and 2094 of the Code of Civil Procedure;

That said deposition was taken down by me in shorthand at the time and place therein named and thereafter reduced to text under my direction.

I further declare that I have no interest in the event of the action.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

WITNESS my hand this 6th day of October, 2017.

Jana Ruiz, CSR 12837

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I declare under penalty of perjury that I have read the foregoing _____ pages of my testimony, taken on _____ (date) at _____(city), _____(state), and that the same is a true record of the testimony given by me at the time and place herein above set forth, with the following exceptions:

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EXHIBIT 6

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EXHIBIT 6

TCRP REPORT 125

TRANSIT COOPERATIVE RESEARCH PROGRAM

Sponsored by the Federal Transit Administration

Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

EXHIBIT 8
REPORTER JANA RUIZ
DEPONENT MARK BARRON
DATE 9-26-17

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*Membership as of October 2007.

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TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP REPORT 125

Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions

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Subject Areas
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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), Transportation 2000, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, the National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

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The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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FOREWORD

By Dianne S. Schwager
Staff Officer
Transportation Research Board

TCRP Report 125: Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions will be of interest to public transportation systems that provide fixed-route bus services (Guidebook) and their communities. This Guidebook will assist small, medium, and large transit agencies and their community members in better understanding bus-and-pedestrian collisions and in determining preventative or remedial strategies for reducing the frequency and severity of these types of collisions.

The research involved obtaining information, data, and relevant input from a sample of small, medium, and large transit systems that are geographically diverse, as well as from a large array of stakeholders—including 22 pedestrians, 26 bus operators, and 60 agencies and organizations concerned with transit and pedestrian safety. The Guidebook is divided into four parts.

- Part I of the Guidebook discusses how to mitigate the four most common collision types and circumstances.
- Part II presents a variety of strategies, including operator training and outreach, safety checks, defensive driving techniques and policies, public outreach and education, traffic engineering and roadway design, bus mirror configuration and placement, bus design/modification, bus stop location planning and bus stop design, and bus stop lighting and illumination. Detailed information for over 80 applications of the strategies is presented, as well as information on many more suggested applications of the strategies.
- Part III contains 14 case studies, which provide in-depth examples for the best documented applications. The case studies include detailed information about what is known about the bus-and-pedestrian collision problem, the implementation of one or more mitigating strategies, the goals and costs of implementation, and the successful and problematic elements of strategy implementation.
- Finally, Part IV presents a discussion of important considerations for improving pedestrian safety around transit buses. This section includes a description of contributing factors that are not necessarily directly linked to one of the four primary types of bus-and-pedestrian collisions described in the Guidebook, but that were identified by transit agencies and other stakeholders as playing an important role in the occurrence of these collisions. This section also discusses how to approach strategy implementation and specifically how to combine two or more strategies to add to the potential for success in reducing bus-and-pedestrian collisions and improving overall safety.

The Guidebook provides transit agencies and stakeholders with an array of strategies from which to choose for mitigating the frequency and severity of bus-and-pedestrian collisions, as well as approaches for doing so.

CONTENTS

SUMMARY

Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions

This Guidebook is the product of TCRP Project A-28, "Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions." The goal of the project was to gather quantitative and qualitative data to determine the frequency of bus-and-pedestrian collisions, to understand factors that contribute to their occurrence, and to identify implemented and potential strategies to mitigate their occurrence and severity. This Guidebook will assist transit agencies and community members in understanding the problem of bus-and-pedestrian collisions and in determining preventative or remedial strategies for reducing the frequency and severity of these types of collisions.

During the 18-month investigation, a team composed of transportation researchers gathered information using a variety of sources, including literature and previous research, incident reports, focus group meetings, and one-on-one interviews. The research team focused on obtaining information and data from a sample that is geographically diverse; one that includes the needs and perspectives of small, medium, and large transit agencies; and one that includes input from a large array of stakeholders. In addition to 22 pedestrians and 26 bus operators, 60 agencies and organizations provided input that went into the development of this Guidebook.

This Guidebook is organized into four parts and presents a number of strategies to meet the needs of different users. Part 1 discusses how to mitigate the four most common collision types and circumstances as identified during the investigation, each of which is described and illustrated. Part 2 presents a variety of strategies, including operator training and outreach, safety checks, defensive driving techniques and policies, public outreach and education, traffic engineering and roadway design, bus mirror configuration and placement, bus design/modification, bus stop location planning and bus stop design, and bus stop lighting and illumination. Detailed information for more than 80 applications of the strategies is presented, as well as information on many more suggested applications of the strategies.

Part 3 contains 14 case studies, which provide in-depth examples for the best documented applications of the strategies. The case studies include single-agency case studies, which detail how individual agencies have addressed pedestrian safety issues, and multi-agency case studies, which compare the same applications implemented across multiple agencies. The case studies include detailed information about what is known about the bus-and-pedestrian collision problem, the implementation of one or more mitigating strategies, the goals and costs of implementation, and the successful and problematic elements of strategy implementation.

Finally, Part 4 presents a discussion of important considerations for improving pedestrian safety around transit buses. This section includes a description of contributing factors that

are not necessarily directly linked to one of the four primary types of bus-and-pedestrian collisions described in the Guidebook, but that were identified by transit agencies and other stakeholders as playing an important role in the occurrence of these collisions. This section also discusses how to approach strategy implementation and specifically how to combine two or more strategies to add to the potential for success in reducing bus-and-pedestrian collisions and improving overall safety.

This guidebook provides transit agencies and stakeholders with an array of strategies from which to choose for mitigating the frequency and severity of bus-and-pedestrian collisions, as well as approaches for doing so.

Introduction

This Guidebook has been developed to assist transit agencies and community members in understanding the problem of bus-and-pedestrian collisions and determining preventative or remedial strategies for reducing the frequency and severity of these types of collisions. A bus-and-pedestrian collision, for the purpose of this project and Guidebook, was defined as a collision between a fixed-route transit bus and a pedestrian. This Guidebook does not address collisions between pedestrians and other types of vehicles in the vicinity of transit stops, nor does it address accidents that involve pedestrians being injured when boarding or alighting buses.

Guidebook Development

The Guidebook is the product of an investigation for TCRP Project A-28, "Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions." The goal of the project was to gather data (both quantitative and qualitative) to determine how often bus-and-pedestrian collisions occur, to understand factors that contribute to their occurrence, and to identify implemented and potential strategies to mitigate their occurrence. During this 18-month investigation, a team composed of transportation researchers gathered quantitative and qualitative information using a variety of sources, including literature and previous research, incident reports, focus group meetings, and one-on-one interviews. In all cases, the research team focused on obtaining information and data from a sample that is geographically diverse; one that includes the needs and perspectives of small, medium, and large transit agencies; and one that includes input from a large array of potential stakeholders.

Literature and Previous Research

The main literature sources for the research team were reports from FHWA, NCHRP, TCRP, NTSB, and federally funded university research, as well as state and local publications and newspaper articles.

Incident Reports

The research team obtained and reviewed 169 incident reports from 8 transit agencies across the country. The majority of the incident reports were from 2005 and 2006; however, a few of the reports went back as far as 2003. The detail in these reports ranged from brief incident synopses to detailed site illustrations, interviews, and police reports. The team developed a database cataloging the circumstances of the collisions as well as any reported contributing factors. Analysis was then performed to understand the most common and/or most important collision types

and associated factors. Due to inconsistent reporting across agencies and lack of detail in many of the reports, this data analysis revealed very little in terms of contributing factors.

Focus Group Meetings

Eight focus group meetings were conducted at several locations throughout the United States and one location in Canada with individuals who have a vested interest in mitigating bus-and-pedestrian collisions. The goal of these focus groups was to understand the different perspectives of stakeholders with regard to collision circumstances, contributing factors, and mitigation strategies. In total, approximately 80 stakeholders participated in these meetings including 21 transit agency representatives, 24 bus operators, 6 departments of transportation (DOT) representatives, 3 pedestrian advocate representatives, and 24 pedestrians and bus riders.

One-On-One Interviews

A total of 30 interviews were conducted. Twenty-two telephone interviews were conducted with transit agency staff holding positions such as safety manager, risk manager, or operator training supervisor. Additional interviews were conducted with four representatives from pedestrian advocacy groups, a city government pedestrian safety engineer, a state government bicycle and pedestrian program manager, a bus operators' union representative, and the deputy director of a transit insurance corporation who was interviewed via e-mail.

Following data collection, the research team synthesized all of the information collected to create categories of collision types and to identify the common mitigation strategies. These collision types and strategies are used to organize this Guidebook, and contributing factors are discussed throughout.

Guidebook Organization

For this purpose of this Guidebook, a "strategy" refers to a high-level approach to mitigation, such as operator training or public outreach. For each strategy, the Guidebook presents specific examples of "applications" of each strategy that were identified during the research process. An example of an application of an operator training strategy would be an instructional turning video.

The Guidebook, then, emphasizes applications of strategies for mitigating bus-and-pedestrian collisions, all of which were identified during the research process. The Guidebook is organized to present the applications in a variety of ways. Thus, any particular application may be described in multiple places throughout. This repetition is purposeful and is designed to help the reader find the appropriate information and level of detail suited to his or her needs.

Parts 1 and 2 complement one another and enable the reader to search for applications either by collision type or by strategy. Parts 3 and 4 provide more detail regarding well-documented applications of strategies and present an overall approach to implementing strategies for mitigating bus-and-pedestrian collisions. This organization enables easy reference of strategies and applications of the strategies in a variety of ways, depending on the needs of the reader. The four parts are as follows:

- **PART 1: How to Mitigate the Most Common Collision Types and Circumstances**
  This section guides readers to strategies and applications based on common problems. The section begins with a list of the most common collision types and circumstances between buses and pedestrians. From here the reader is directed to a more detailed description and a diagram of each collision type, as well as a discussion of the most likely contributing factors,

as reported by transit agencies and stakeholders. Finally, actual applications of strategies for mitigating each particular type of collision are listed.

- **PART 2: Applications of Strategies for Mitigating Bus-and-Pedestrian Collisions**
  This section guides readers to specific applications of strategies based on the type of strategy. The section begins with a list of 10 strategies as defined for this Guidebook. From here the reader is directed to a more detailed presentation of specific applications of each strategy as reported by agencies and stakeholders. The information on each application includes the purpose or goal of the application, a brief description of the application, and the reported effectiveness or success of the application (if available).
- **PART 3: Case Studies**
  This section presents in-depth examples, in the form of case studies, for the best documented application of strategies for mitigating bus-and-pedestrian collisions. The case studies include single-agency case studies, which detail how individual agencies have addressed their pedestrian collision issues, and multi-agency case studies, which present examples of similar applications across multiple agencies. The case studies include detailed information about what is known about the bus-and-pedestrian collision problem, the implementation of one or more mitigation strategies, the goals and costs of implementation, and the successful and problematic elements of strategy implementation.
- **PART 4: Important Considerations for Improving Pedestrian Safety Around Transit Buses**
  This section presents a discussion of other important considerations when implementing pedestrian-and-bus safety strategies. This section includes a description of other contributing factors, not necessarily directly linked to one of the four primary types of bus-and-pedestrian collisions. This section also discusses how to approach strategy implementation and, specifically, how to combine two or more strategies to add to the potential for success in reducing bus-and-pedestrian collisions and improving overall safety.

Important Note Regarding the Strategies and Applications Presented in This Guidebook

The strategies and applications presented in this Guidebook are not recommendations; rather, they are examples and, in some cases, suggestions given by transit agencies and community stakeholders who participated in focus groups or interviews during the research. As there is not a one-size-fits-all approach to mitigating bus-and-pedestrian collisions, each agency should examine the applicability and merit of the strategies and applications presented herein for their community or jurisdiction and then customize them accordingly. State and local laws, design regulations, and motor-vehicle codes should be consulted prior to any modifications, alterations, or additions being made.

PART 1

How to Mitigate the Most Common Collision Types and Circumstances

The purpose of this section of the Guidebook is to guide users to strategies and specific applications of the strategies based on the particular problems, collision types, or collision circumstances they are experiencing. Data regarding bus-and-pedestrian collisions were gathered from collision databases, from selected incident reports between 2003 and 2006, and from transit agencies and other stakeholders. Analysis of the collision data resulted in a number of collision circumstances that appear to account for the majority of all bus-and-pedestrian collisions.

The primary collision types and circumstances are shown in Table 1-1. The primary collision types are numbered (in no particular order) in the far left column. This numbering for collision type is important: it is used as a reference throughout this Guidebook. Then, for each collision type, the table shows the circumstances of the collision in terms of "bus action" and "pedestrian action." These actions depict what is happening just prior to the occurrence of each type of collision. Also noted in the table are the most likely points on the bus in which contact is made with the pedestrian for each collision type.

Throughout this Guidebook, the four primary types of collisions are defined in terms of the bus action, as shown in Table 1-1. These four collision types are (1) the bus turning right, (2) the bus turning left, (3) the bus pulling into a stop, and (4) the bus pulling away from a stop. Collision Types 1 and 4 have one or more variations of circumstances in terms of the pedestrian action. The collision circumstances, contributing factors, and associated mitigation strategies are discussed in more detail in this section of the Guidebook, as noted by the section number in the far right column of Table 1-1.

Of all the collision types, turns at intersections was the problem most frequently reported by transit agencies and other stakeholders, with left turns reported to be a problem more frequently than rights turns. Although turns were a common circumstance in the data, the data do not necessarily support the observation that turns are the most common problem. Of the incident reports reviewed, only 57 of these reports (34%) indicated that the bus was turning. However, amongst the 92 bus-and-pedestrian collisions that occurred at intersections, the data do show that 55 (60%) occurred when the bus was turning. The data also support the observation that, amongst the bus-and-pedestrian collisions that occurred while the bus was turning, left-turn collisions were more common than right-turn collisions: 69% involved a left turn, while 31% involved a right turn.

The other two collision circumstances most commonly cited by transit agencies and stakeholders were those occurring when the bus is either pulling into a stop or pulling away from a stop. Analysis of the incident data showed that 42 incidents (25%) occurred when the bus was at or near a bus stop. Of the 42 incidents that are known to have occurred at or near a bus stop, 23 (55%) involved a bus pulling into a stop, and 13 (31%) involved a vehicle pulling away from a stop.

Table 1-1. Most common collision types/circumstances (index table for Chapter 1).

Collision Type	Collision Circumstances		Point of Contact on Bus	Section
	Bus Action	Pedestrian Action		
1	Turning right at a green light	Crossing in parallel crosswalk	Front/front-right	1.1
		Waiting on curb or stepping into crosswalk	Rear-right	
	at a red light	Crossing in opposing crosswalk	Front	
2	Turning left	Crossing in parallel crosswalk	Front/front-right/ front-left	1.2
3	Pulling into a stop	Waiting at stop, crowding, or pushing	Front/front-right/mirror/door	1.3
4	Pulling away from a stop	Running next to bus	Right/rear-right/ rear duals	1.4
		Crossing in front of bus	Front/front-right/ front-left	

Another collision type that showed up in the collision data was when a bus was going straight and a pedestrian was struck. This collision circumstance is somewhat of an anomaly. Sixty-five (39%) of the bus-and-pedestrian incident records indicated that the bus was traveling straight when the collision occurred; however, this collision type was not frequently reported as a problem by transit agencies and stakeholders. Only a few agencies and stakeholders reported that they had experienced bus-and-pedestrian collisions when the bus was going straight, and the circumstances of these collisions varied. In some cases, pedestrians were hit mid-block, usually as a result of the pedestrian darting out from between parked cars. In other cases, pedestrians were hit crossing at intersections. Due to the differences across agencies in what and how much information was reported about the collisions, it was often times difficult to ascertain exactly what happened during the collisions. It is believed that at least some of the collisions in which the bus was reportedly going straight fall into one of the primary four collision types as just defined. For example, a bus pulling away from a stop that hits a pedestrian crossing in front of a bus could have been reported as going straight. Also, there were few strategies reported for specifically mitigating collisions in which the bus was going straight.

1.1 Collision Type 1: Bus Turning Right

Collision Type 1 occurs when a pedestrian is struck when a bus is turning right. Of the incident reports reviewed, 16 (10%) occurred when the bus was turning right. By far, the most frequently reported version of the right-turning collision is when the pedestrian is crossing in the parallel crosswalk and is struck by the front/front-right of the bus, as illustrated in Figure 1-1.

One variation of this collision type occurs when the bus, turning right, strikes a pedestrian who is waiting on the curb or who has just stepped from the curb into the roadway to begin crossing. In this case, the pedestrian is hit by the side of the bus near the rear. It should be noted that this particular variation was only reported as common by one transit agency and one stakeholder group.

Another variation of this collision type occurs when the bus is making a right-turn-on-red. In this case, the pedestrian is struck in the opposing crosswalk (the one perpendicular to the bus) with the front of the bus before the bus begins the turn.

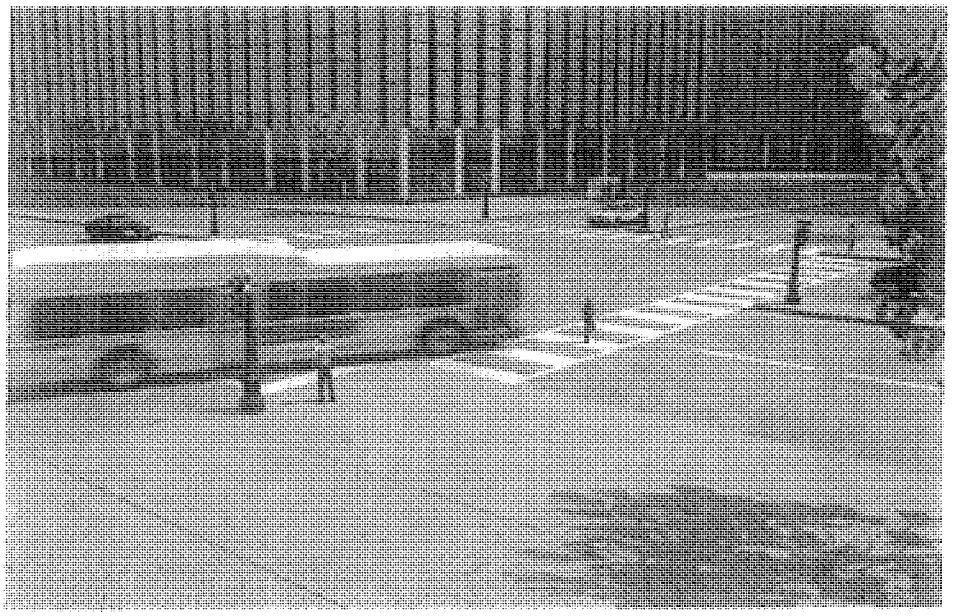


Figure 1-1. Illustration of Collision Type 1—collision between pedestrian and right-turning bus.

While the location of the pedestrian varies, the circumstances of this collision type, its contributing factors, and mitigating strategies are quite similar regardless of the pedestrian position. These are discussed below.

1.1.1 Contributing Factors to Right-Turn Collisions with Pedestrians

This section presents and discusses a variety of factors that may contribute to right-turn collisions with pedestrians. The list is by no means exhaustive, and is presented here simply as a discussion of what appear to be the most probable contributing factors, based on the experience and expert opinions of the transit agencies and stakeholders who provided input to the development of this Guidebook.

1.1.1.1 Characteristics of Bus Turns

A key factor influencing the occurrence of right-turn collisions with pedestrians might be that pedestrians have difficulty recognizing that buses are about to turn. When buses turn, they pivot on the rear axle, moving forward and then sweeping an arc as the bus follows through the turn. At first glance, it may appear to a pedestrian that the bus is moving straight forward through the intersection when in fact the operator is initiating a right turn. Believing the bus is going straight, the pedestrian makes the decision to enter the crosswalk. Then, when the bus begins to move laterally into the right turn, the pedestrian is already in the roadway, setting up a situation in which a collision could occur.

1.1.1.2 Reduced Visibility of Pedestrians

There are a variety of reasons why pedestrians crossing in a crosswalk or standing at the curb may not be visible to a bus operator:

- Bus components—including the A-pillar, the farebox, and the side mirrors—might create blind spots, which obstruct the operator's view of a pedestrian.
- Visual obstructions outside of the bus such as posts, vendors, and signage may also block an operator's view of pedestrians.
- Various characteristics of pedestrians and the environment might make people more or less visible to a driver:
  - Someone who is small or slow-moving,
  - Someone who is wearing dark clothing, or
  - The absence or lack of adequate street or crosswalk lighting.

Often times when asked what happened following a bus-and-pedestrian collision, operators reported that they just did not see the pedestrian. The pedestrians seem to have come from "out of nowhere." This phenomenon is consistent with the visual cognition concept of "inattentional blindness" in which a person looks but does not see (*1*).

1.1.1.3 Failure to Scan

Failure of the operator to scan the crosswalk before initiating the turn can contribute to this type of collision. Even if the operator scans the crosswalk initially, failure to re-scan the crosswalks after initiating the right turn could lead to collisions with pedestrians in the crosswalk.

1.1.2 Strategies for Mitigating Right-Turn Collisions with Pedestrians

Table 1-2 presents strategies and specific applications of the strategies that have been implemented by one or more transit agencies or stakeholders. These applications could help mitigate

Table 1-2. Strategies for mitigating right-turn collisions with pedestrians.

Strategy	Application
Operator training	Instructional turning video
	Mirror adjustment training station
Operator outreach	"No trash on the dash" campaign
	"Watch for pedestrians" sticker on farebox
	Themed safety outreach slogans
Defensive driving techniques and policies	Operator moves in seat to see around obstructions
	Mandatory turning procedure
	Operator keeps eyes moving
	Slow down at intersections
	No right turn on red
Public outreach and education	Public outreach to schools
	Public outreach videos
Traffic engineering	Pedestrian scramble
	Pedestrian channelization
Bus mirror configuration and placement	Dual right-side mirrors
	Dual mirrors in single housing
	Smaller mirrors
Bus design/modification	Increased number of side marker lamps
	Blinking chevrons on right-side mirrors
	Audible turn signals
	Side strobe lights

right-turn collisions with pedestrians. For more detail on each application, refer to the corresponding section in Part 2.

In addition to the applications listed in Table 1-2, transit agencies and stakeholders provided suggestions that, in their opinions, might be ways to mitigate right-turn collisions with pedestrians. These suggestions included the following:

- Keep intersections and sidewalks clear of obstructions (such as heavy posts, signage, vendors, etc.) to improve the line of sight from the bus operator to pedestrians.
- Make crosswalks more noticeable through crosswalk enhancements (e.g., delineation, lighting) to enhance bus operators' expectations about the presence of pedestrians.
- Use split mirrors (with the convex mirror on top), larger convex mirrors, and mirrors in which the height could be adjusted (either manually or electronically).
- Install tactile strips on the edges of sidewalks to keep pedestrians away from the edge of the roadway after consulting ADA standards and guidelines.
- Implement public education and outreach campaigns to educate pedestrians about important issues such as watching for turning buses while crossing, keeping back from the edge of the roadway when waiting to cross, and the mechanics of a turning bus.

1.2 Collision Type 2: Bus Turning Left

Collision Type 2 occurs when a pedestrian is crossing the street in the crosswalk and a bus operator is making a permitted left turn onto the street that the pedestrian is crossing, as illustrated in Figure 1-2. Of the incident reports reviewed, 36 (22%) occurred when the bus was turning left.

This potential conflict between a pedestrian and a left-turning vehicle is intrinsic to many signalized intersections with pedestrian signals. This is because the pedestrian WALK phase occurs simultaneously with the permitted left turn phase for traffic (i.e., green ball). When there is a

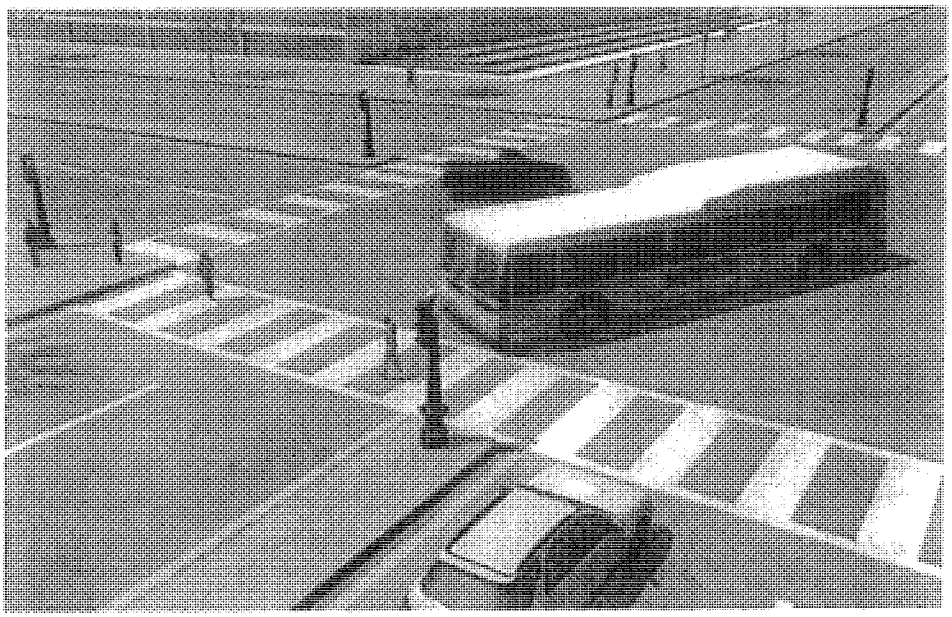


Figure 1-2. Illustration of Collision Type 2—collision between pedestrian and left-turning bus.

protected left-turn phase for traffic (i.e., green arrow), the corresponding pedestrian signal will read DON'T WALK or will show a solid orange hand, thereby separating the movements and eliminating potential conflicts between left-turning vehicles and pedestrians by prohibiting pedestrians from crossing. In many locations, however, even when there is a protected left-turn phase, it is followed by a time when vehicles are allowed to make permitted left turns. Here, the left-turning vehicles must yield to oncoming traffic, as well as to pedestrians in the crosswalk.

1.2.1 Contributing Factors to Left-Turn Collisions with Pedestrians

This section presents and discusses a variety of factors that may contribute to left-turn collisions with pedestrians. The list is by no means exhaustive and is presented here simply as a discussion of what appear to be the most probable contributing factors, based on the experience and expert opinions of the transit agencies and stakeholders who provided input to the development of this Guidebook.

1.2.1.1 Characteristics of Bus Turns

A key factor influencing the occurrence of left-turn collisions with pedestrians might be that pedestrians have difficulty recognizing that buses are about to turn. When buses turn, they pivot on the rear axle, moving forward and then sweeping an arc as the bus follows through the turn. At first glance, it may appear to a pedestrian that the bus is moving straight forward through the intersection when in fact the operator is initiating a left turn. Believing the bus is going straight, the pedestrian makes the decision to enter the crosswalk. Then, when the bus begins to move laterally into the left turn, the pedestrian is already in the roadway, setting up a situation in which a collision could occur.

1.2.1.2 Reduced Visibility of Pedestrians

There are a variety of reasons why pedestrians crossing in a crosswalk or standing at the curb may not be visible to a bus operator:

- Bus components—such as the A-pillar and the side mirrors—might create blind spots, which obstruct the operator's view of a pedestrian.
- Visual obstructions outside of the bus such as posts, vendors, and signage may also block an operator's view of pedestrians.
- Various characteristics of pedestrians and the environment might make people more or less visible to a driver:
  - Someone who is small or slow-moving,
  - Someone who is wearing dark clothing, or
  - The absence or lack of adequate street or crosswalk lighting

Often times when asked what happened following a bus-and-pedestrian collision, operators reported that they just did not see the pedestrian. The pedestrians seem to have come from "out of nowhere." This phenomenon is consistent with the visual cognition concept of "inattentional blindness" in which a person looks but does not see (*1*).

1.2.1.3 Failure to Scan

Failure of the operator to scan the crosswalk before initiating the left turn can contribute to this type of collision. Even if the operator scans the crosswalk initially, failure to re-scan the crosswalks after initiating the left turn could lead to collisions with pedestrians in the crosswalk.

1.2.1.4 Attention to Opposing Vehicular Traffic

A unique characteristic of this collision type is that bus operators not only have to scan for pedestrians in the crosswalk before turning, but they also must watch for a gap in oncoming traffic before

turning. It was suggested that in some cases, the operator focuses so heavily on the oncoming traffic that not enough attention is paid to pedestrians. One stakeholder specifically reported that the combination of operators hurrying to keep schedule and waiting for a gap in both vehicle and pedestrian traffic causes them to lose sight of pedestrians.

1.2.2 Strategies for Mitigating Left-Turn Collisions with Pedestrians

Table 1-3 presents strategies and specific applications of the strategies that have been implemented by one or more transit agencies or stakeholders. These applications could help mitigate left-turn collisions with pedestrians. For more detail on each application, refer to the corresponding section in Part 2.

In addition to the applications listed in Table 1-3, transit agencies and stakeholders provided suggestions that, in their opinions, might be ways to mitigate left-turn collisions with pedestrians. These suggestions included

- Keep intersections and sidewalks clear of obstructions to improve the line of sight from the bus operator to pedestrians.
- Make crosswalks more noticeable to enhance bus operators' expectations about the presence of pedestrians.
- Reduce in-bus obstructions related to mirrors and the A-pillar.

1.3 Collision Type 3: Bus Pulling into Bus Stops

Collision Type 3 occurs when a bus is pulling into a bus stop and a pedestrian is struck. Of the incident reports reviewed, 25 (15%) occurred when the bus was pulling into a bus stop. When

Table 1-3. Strategies for mitigating left-turn collisions with pedestrians.

Strategy	Application
Operator training	Instructional turning video
	Mirror adjustment training station
Operator outreach	"No trash on the dash" campaign
	"Watch for pedestrians" decals on telephone/radio handsets
	Themed safety outreach slogans
Defensive driving techniques and policies	Operator moves in seat to see around obstructions
	Mandatory turning procedure
	Square left turns
	Operator keeps eyes moving
	Slow down at intersections
Public outreach and education	Public outreach to schools
Traffic engineering	Protected left-turn signal
	Pedestrian scramble
Bus mirror configuration and placement	Dual left-side mirrors placed lower on bus
	Dual mirrors in single housing
	Standardized left-side mirror height
	Smaller mirrors
Bus design/modification	Increased number of side marker lamps
	Blinking chevrons on left-side mirrors
	Audible turn signals
	Side strobe lights

the bus is pulling into a bus stop, the pedestrian's location and behavior varies: he or she might be waiting at the stop, crossing the road and arriving at the stop, or walking along the road or sidewalk near the stop. Figure 1-3 illustrates an example of this collision type.

1.3.1 Contributing Factors to Collisions with Pedestrians When Pulling into Bus Stops

This section presents and discusses a variety of factors that may contribute to collisions with pedestrians when buses are pulling into bus stops. The list is by no means exhaustive and is presented here simply as a discussion of what appear to be the most probable contributing factors, based on the experience and expert opinions of the transit agencies and stakeholders who provided input to the development of this Guidebook.

1.3.1.1 Crowded Bus Stop Locations

The primary contributing factor reported for collisions with pedestrians when pulling into bus stops was crowded bus stops due to

- A large demand for the bus,
- Limited sidewalk space, and
- Sidewalk obstacles.

Crowded bus stop locations can lead to various problems, including

- Pedestrians standing too close to the roadway as the bus arrives at the stop,
- Pedestrians pushing as the bus arrives at the stop, or
- Conflicts between intending passengers and passing pedestrians.

All of these situations can result in a pedestrian accidentally making contact with a bus in or near the roadway as the bus is pulling into the stop.

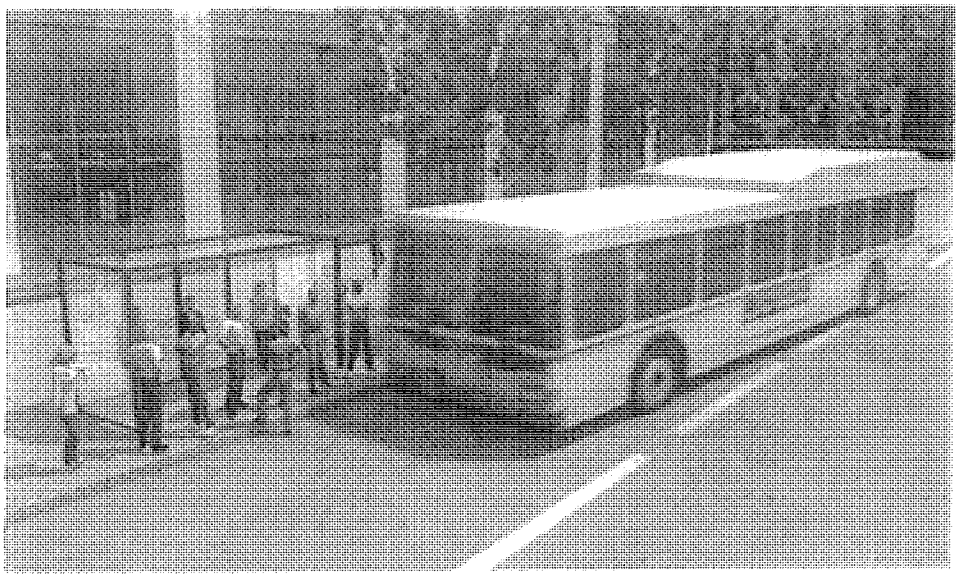


Figure 1-3. Illustration of Collision Type 3—collision between pedestrian and bus pulling into bus stop.

1.3.1.2 Lack of Visibility of Pedestrians at Bus Stops

Lack of visibility of pedestrians at bus stops is a problem that can be caused by a number of issues including

- Limited or no lighting, and
- Obstructions (e.g., wide columns, traffic signals, and signs) limiting an operator's view of pedestrians.

1.3.1.3 Bus Stop Placement

The location of a bus stop relative to the roadway may play a role in some collisions when buses are pulling into a bus stop:

- A bus stop that is located too close to the roadway provides no positive separation between pedestrians and passing vehicles.
- A bus stop that is set back too far from the roadway for the pedestrian to be seen by an approaching bus operator may lead the pedestrian to encroach into the roadway to be more visible.

1.3.2 Strategies for Mitigating Collision with Pedestrians When Pulling into Bus Stops

Table 1-4 presents strategies and specific applications of the strategies that have been implemented by one or more transit agencies or stakeholders. These applications could help mitigate collisions with pedestrians when buses are pulling into bus stops. For more detail on each application, refer to the corresponding section in Part 2.

In addition to the strategies listed in Table 1-4, transit agencies and stakeholders provided suggestions that, in their opinions, might be ways to mitigate collisions with pedestrians when buses are pulling into bus stops. Most of these strategies included creating "safe zones" for pedestrians. These suggestions included the following:

Table 1-4. Strategies for mitigating collisions with pedestrians when pulling into bus stops.

Strategy	Application
Operator outreach	"No trash on the dash" campaign
Defensive driving techniques and policies	Operator moves in seat to see around obstructions
	Operator keeps eyes moving
Public outreach and education	Stay alert around buses and trains campaign
Roadway design	Bulb-outs
Bus mirror configuration and placement	Dual mirrors in single housing
	Smaller mirrors
Bus design/modification	Side strobe lights
Bus stop location planning and bus stop design	Monitoring, relocation, and removal of bus stops
	Bollards, barriers, and striping
	Standee lines at bus stops
Bus stop lighting and illumination	Retro-reflective paddles
	Flashing beacons
	Retro-reflective bus stop signs
	Solar-powered shelter lights
	Pocket and pen lights

- Install pedestrian channelization to funnel pedestrians to safe and visible locations in which to wait for the bus.
- Install pedestrian channelization at crowded stops to prevent pedestrians from falling or being pushed into the roadway when a bus is pulling into the stop.
- Install bus nubs to give pedestrians a place to wait for the bus and to make them more visible to operators.
- After consulting ADA standards and guidelines, install tactile strips at curbs to keep pedestrians from standing too close to the roadway.
- Install painted bus "pads" to delineate where a bus will stop and where passengers should wait.
- Use video supervision at bus stops where pedestrians crowding, pushing, or roughhousing is known to be a problem.
- Keep sidewalks and bus stops free from obstructions to improve an operator's line of sight to pedestrians and to reduce objects that pedestrians can run into or trip over.

1.4 Collision Type 4: Bus Pulling Away from Bus Stops

Collision Type 4 occurs when a bus is pulling away from a bus stop and a pedestrian is struck. Of the incident reports reviewed, 16 (10%) occurred when the bus was pulling away from a stop.

By far the most common circumstance of this collision is when a pedestrian is running after the bus after it has already pulled away from the curb and the pedestrian, who is running alongside the bus, trips and falls under the bus (Figure 1-4). However, a few stakeholders reported a variation of this collision type, which involves a pedestrian crossing the roadway in front of the bus as the bus is pulling away from the curb (Figure 1-5).

1.4.1 Contributing Factors to Collisions with Pedestrians When Pulling Away from Bus Stops

This section presents and discusses a variety of factors that may contribute to collisions with pedestrians when buses are pulling away from bus stops. The list is by no means exhaustive and is presented here simply as a discussion of what appear to be the most probable contributing factors, based on the experience and expert opinions of the transit agencies and stakeholders who provided input to the development of this Guidebook.

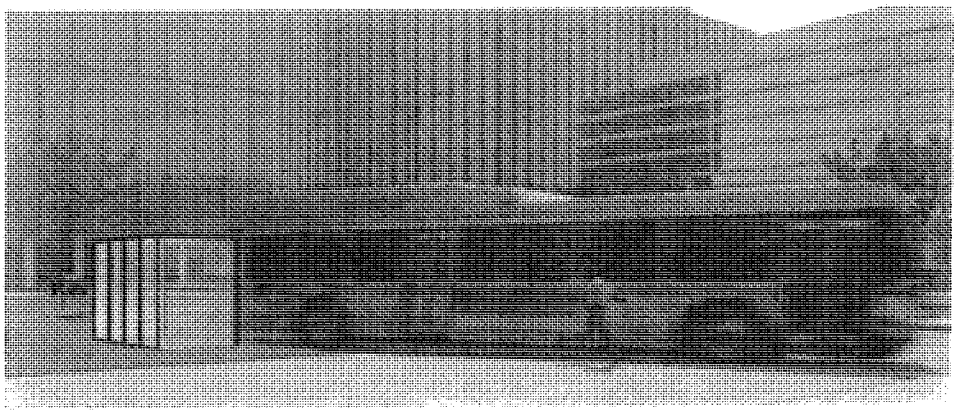


Figure 1-4. Illustration of Collision Type 4—collision with pedestrian running alongside bus when pulling away from a bus stop.

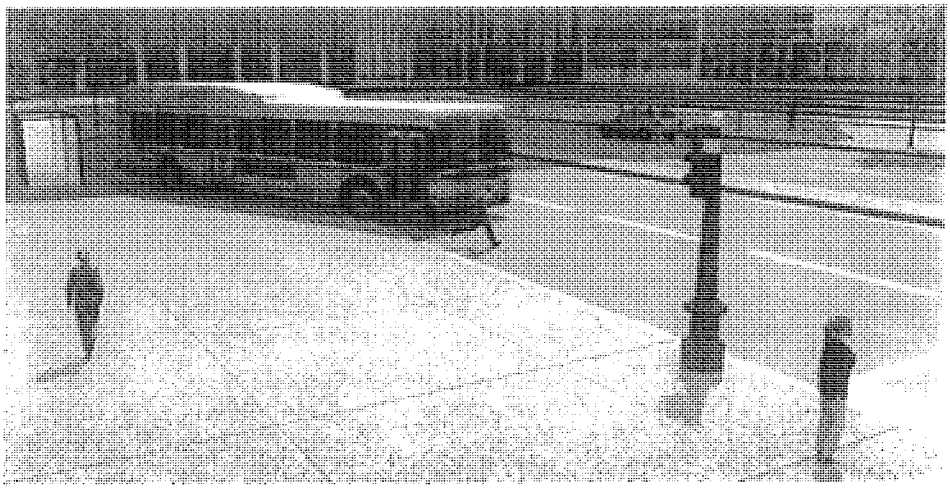


Figure 1-5. Illustration of Collision Type 4—collision with pedestrian crossing in front of bus when pulling away from a bus stop.

1.4.1.1 Pedestrians Chasing Buses

One causative factor for this collision type is pedestrians chasing buses after they have left the bus stop. Pedestrians are often times running late, rushing, and unwilling to wait for the next bus. When pedestrians chase after buses, they are usually trying to get the bus operator's attention and will sometimes even tap on the side of the bus.

1.4.1.2 Lack of Information about Bus Arrivals

In some cases, pedestrians may choose to run after a bus because they are unaware of when the next bus will arrive (they may not be familiar with the schedule, they may think the next bus will be running behind schedule, etc.).

1.4.1.3 Visibility of Pedestrians at Bus Stop

Sometimes, this collision type is influenced by the difficulty of seeing pedestrians along the side of the road, especially at night. This could be because of the poor design of the bus stop or roadway influencing overall visibility of pedestrians, including poor bus stop location relative to the edge of the roadway and overall visibility of pedestrians.

1.4.1.4 Attention to Vehicular Traffic

At some bus stop locations, bus operators must merge into the traffic when departing a stop. In the case of some collisions, it is possible that the operator focuses on finding a gap in traffic, and not enough attention is paid to pedestrians who are approaching the bus along the right side.

1.4.1.5 Sidewalk Obstacles and Maintenance

When pedestrians are running for the bus, objects in the bus stop area (such as trash dispensers and signs) become obstacles that when hit, can "push" pedestrians into the roadway. Likewise, poorly maintained sidewalks (e.g., uneven sidewalks, cracks) can cause pedestrians to trip and fall, especially when pedestrians are chasing a bus.

Table 1-5. Strategies for mitigating collisions with pedestrians when pulling away from bus stops

Strategy	Application
Operator training	Service stop exit procedure No stopping after closing door
Public outreach and education	Bus safety campaign Pamphlets about not running after the bus
Bus mirror configuration and placement	Right convex mirror(s) Larger, wider mirrors mounted higher
Bus design/modification	Bus curb light SI-GARD
Bus stop location planning and bus stop design	Far-side bus stops Bollards, barriers, and striping

1.4.2 Strategies for Mitigating Collisions with Pedestrians When Pulling Away from Bus Stops

Table 1-5 presents strategies and applications of the strategies that have been implemented by one or more transit agencies or stakeholders. These applications could help mitigate collisions with pedestrians when pulling away from bus stops. For more detail on each application, refer to the corresponding section in Part 2.

In addition to the strategies listed in Table 1-5, transit agencies and stakeholders provided suggestions that, in their opinions, might be ways to mitigate collisions with pedestrians when pulling away from bus stops. These suggestions included the following:

- Through public outreach campaigns, educate pedestrians about the specific dangers of running after buses.
- Install tactile strips on the sidewalk to keep pedestrians from running too close to the roadway.
- Maintain sidewalks and keep them free of obstructions.
- Install route number displays on the back of buses to provide information to riders that might stop them from running after a bus. An intending passenger may run after a bus thinking it is theirs, when it actually is not. Route number displays on the back of buses could help in this situation.
- Install route number displays and countdown timers on the back of buses to provide information to riders that might stop them from running after a bus. An intending passenger may run after a bus not knowing when the next bus will arrive, when in fact, the next bus may be only a few minutes away. Countdown times, displaying real-time bus arrival information could help in this situation. (It should be noted that real-time bus arrival information in some cases might also encourage pedestrians to run after the bus if they realize the next bus isn't for some time.)

PART 2

Applications of Strategies for Mitigating Bus-and-Pedestrian Collisions

The purpose of this section of the Guidebook is to guide the reader to specific applications of strategies. Eleven strategies were identified for the purposes of this Guidebook and are shown in the index table (Table 2-1).

For detailed information about applications of each strategy, refer to the section numbers listed in the table. Details of the applications were reported by transit agencies and stakeholders and include the following information:

- **Purpose**—The reason or objective for implementing the strategy/application.
- **Description**—A brief description of the application.
- **Effectiveness**—Reported effectiveness of the application. Reported in terms of a subjective rating or other comment regarding the effectiveness of success of an application. As the strategies are rarely evaluated empirically and in the absence of quantitative measures of effectiveness such as collision rates, these subjective ratings and comments could be thought of as surrogate measures of effectiveness. Agencies and stakeholders were asked to report the "effectiveness" or "success" of their applications in terms of
  - Reducing the frequency of bus-and-pedestrian collisions,
  - Reducing the severity of bus-and-pedestrian collisions,
  - Reducing claims,
  - Gaining bus operator acceptance, and
  - Gaining public acceptance.

Ratings were reported on a scale of 1 to 5 (with 1 being "very unsuccessful" and 5 being "very successful") or on a scale of 1 to 5 (with 1 being "very ineffective" and 5 being "very effective").

2.1 Strategy 1: Operator Training

Properly trained and qualified transit bus operators are vital to providing safe transit bus services. Training is the only means of ensuring that bus operators obtain safe driving skills. Training provides an opportunity to convey to the operator the characteristics of bus-and-pedestrian collisions as well as the knowledge to identify and to avoid, through defensive-driving techniques, bus-and-pedestrian conflicts that may result in a collision. As such, training is a critical component to mitigating bus-and-pedestrian collisions.

To be most effective, operator training must be closely coordinated with bus operations, risk/claims management, and safety staff. Risk management provides the accident statistics and claims costs associated with bus-and-pedestrian collisions. Safety provides information regarding the causal factors of bus-and-pedestrian collisions and the defensive-driving techniques to avoid collisions. The operations department provides input into the nature of the bus-and-pedestrian problem and the availability of operators for training.

Table 2-1. Strategies (index table for Part 2).

Strategy Number	Strategy	Section
1	Operator Training	2.1
2	Operator Outreach	2.2
3	Safety Checks	2.3
4	Defensive-Driving Techniques and Policies	2.4
5	Public Outreach and Education	2.5
6	Traffic Engineering and Roadway Design	2.6
7	Bus Mirror Configuration and Placement	2.7
8	Bus Design/Modification	2.8
9	Bus Stop Location Planning and Bus Stop Design	2.9
10	Bus Stop Lighting and Illumination	2.10
11	Other	2.11

The cost of new-hire training is largely dependent on the number of training sessions conducted annually and the number of students per session. The cost is relatively moderate as wages for new hires during the training period are less than that while working as a permanent employee. For many transit agencies, refresher training in a classroom setting is considered to be high cost—usually in excess of $150,000 annually—due to the need to compensate operators for their time in the classroom and the cost of replacing the operator on their scheduled work or for conducting the training on overtime.

The use of specialized training aids permit training on specific areas of concern, including pedestrian safety. While the addition of a pedestrian training module into current curricula contributes little additional expense to the overall training session, training aids such as driver simulators may contribute significant additional costs (e.g., $200,000 for a simulator and $180,000 for six operator assessment seats).

2.1.1 Applications of Operator Training

In discussing applications of operator training to mitigate bus-and-pedestrian collisions, transit agencies reported a variety of applications. While all transit agencies conduct some sort of new-hire and refresher training, the range of instruction specific to bus-and-pedestrian collisions varies. Some of the training applications reported were somewhat general in that they were implemented to improve overall safety, including pedestrian safety. Some agencies reported new-hire or refresher training programs, which incorporate a pedestrian safety module. There were some operator training applications that were implemented specifically in response to bus-and-pedestrian collisions that had occurred. Most agencies that had specific programs with regard to bus-and-pedestrian collisions reported operator training to be highly effective in reducing the occurrence, severity, and costs of these collisions.

Specific applications of operator training, as reported by agencies, are shown in Table 2-2.

2.1.2 Suggested Applications of Operator Training

Beyond the specific applications of operator training shown in Table 2-2, one transit agency suggested another application of operator training that may mitigate bus-and-pedestrian collisions:

- Better familiarize bus operators with the routes they drive. This familiarization can be accomplished during different types of training. In the classroom, the operators can be

Table 2-2. Applications of operator training.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
Instructional turning video	To reduce turning collisions with pedestrians	A turning procedure training video developed following a series of pedestrian collisions involving turns. Video illustrates a newly developed turning procedure. All operators were shown the video. Video was subsequently incorporated into the overall training program. See further details in Section 3.1.1.	• Very successful • ~85% drop in bus-and-pedestrian collisions • Ratings: – 4.5 to 5 for reducing collisions – 4.5 for reducing claims
	To show operators how to properly make a left turn and to recognize how busy the intersection is	A left-turn training video developed in response to a spike in left-turn pedestrian collisions at an intersection. Is an over-the-shoulder view of an operator making proper left-hand turns (pedestrians were not involved in the videos). There is also a diagram showing the movement of a vehicle making a left turn. See further details in Section 3.2.1.	• Rated a 4 for reducing collisions • While there have been no statistical analyses, agency has seen a reduction of collisions at that right
	To focus on blind spots encountered during turns	A 6-minute instructional turning video produced to show operators the importance of bobbing and weaving and to be aware of pedestrians. Has been shown over a 3-day period in the operators' room four times since 2009. An instructor is also present to answer questions. See further details in Section 3.2.1.	Ratings: – 4 for initial success – 2 (6 years later) as it has lost operators' attention
	To communicate to bus operators the need for extra caution during right and left turns	An operator safety training video produced in response to a finding that left turns were the primary type of bus-and-pedestrian collisions in the state. Right turns were later included in the video because a neighboring state found that right turns were more problematic. See further details in Section 3.2.1.	• Decline in bus-and-pedestrian collisions, but may not be linked to video • Very positive feedback from member agencies • Operators have reported finding the tips on the video helpful
Pedestrian safety elements of new-hire and refresher training	To emphasize elements of pedestrian safety	Examples include: • Driving with instructor through worst pedestrian areas and put in difficult conditions (e.g., sun glare). • Director of Risk Management spends 3 hours discussing collisions, including a review of all bus-and-pedestrian collisions within the last few years. • Emphasizing monetary cost of bus-and-pedestrian collisions to the agency in terms of claims. • Reminding operators that a collision victim could be a family member. See further details in Section 3.1.4.	• Successful, since high pedestrian exposure but low rate of collisions • Operators take safety message more seriously when they understand the huge costs associated with settlements
Pedestrian safety training module	To improve defensive driving around pedestrians, help operators overcome blind spots, and safely exit from service stops	2.5-hour defensive-driving module focused on pedestrian safety. Includes blind spot demonstration training and a service stop exit procedure. See further details in Section 3.1.2.	Operators find it eye-opening and fun
Pedestrian-focused refresher training	• To improve the overall safety of bus operations • To raise the awareness of operators when it comes to addressing traffic safety, pedestrians and operator alertness • To reinforces standard operating procedures	A full-day training course developed with input from bus operators, superintendents, street supervisors, transit police, safety department staff, and the local DOT. The course combines classroom training with a field trip to a top pedestrian accident location to raise awareness and give operators a pedestrian's perspective. Allows operators to observe the behavior of pedestrians, bicyclists, and motorists. A worksheet is used to tally certain behaviors such as jaywalking, pedestrians standing on the curb, reckless drivers, etc. See further details in Section 3.1.3.3.	This is a new program
Pedestrian collision training	To educate operators about bus-and-pedestrian collisions and how to avoid them	1.5 hours during training, which focus on bus-and-pedestrian collisions. Covers the details of pedestrian collisions at terminals and intersections and how to overcome blind spots. Training gets into graphic details of previous bus-and-pedestrian collisions.	• Believes successful; no bus-and-pedestrian collision in 3.5 years • Some operators get upset by graphic nature of training
Mirror adjustment training station	To help operators determine whether mirrors are properly set and to teach them to adjust mirrors in order to see cones	Established a mirror station in the agency's transit center. When bus is parked in a certain location, the operator should be able to see all the traffic cones. This was incorporated into new hire training. Takes 1 day for mirror adjusting.	Ratings: – 5 for successfulness – 5 for operator acceptance. Experienced operators appreciate learning that they may not have their mirrors properly adjusted
Simulator training	To put operators in a more realistic setting and to measure operator feedback	• The package that comes with the simulator contains about 12 different scenarios involving pedestrians. Custom scenarios can be built to match actual collisions. Driver assessment seats are used to measure driver reaction time before hiring.	• Too early to rate effectiveness • Rated a 5 on operator acceptance

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

shown photos or videos of the routes that identify points of confusion, hazards, or safety concerns. During on-the-road training, trainers can also point out these locations to operators. Then, operators can be told how to approach these situations in a defensive manner. The advantage of this type of training and familiarization is that operators are made aware of potential problem areas before they start driving a route rather than having to discover them during one of their runs. It will train them to be more defensive in situations that are already known to be potentially hazardous.

2.2 Strategy 2: Operator Outreach

Communicating safety messages to operators in an ongoing manner is an important component of an effective pedestrian safety program. One source reported that at their agency, pedestrian fatalities tend to occur in cycles. Immediately following a pedestrian fatality, everyone at the agency is extremely sensitive to the issue of pedestrian safety; however, over time they tend to relax. Therefore, it is important for agencies to search for ideas and ways to always keep the impacts of a pedestrian collision in the forefront of their minds and in the minds of operators.

Operator outreach is typically coupled with other strategies, such as training. Operator outreach techniques are used as a means to maintain operator awareness; however, their effectiveness, as a strategy in and of themselves, is not well known. To increase the potential for success, agencies recommend that messages be succinct, engaging, and something that will get operators talking about pedestrian safety. They suggest communicating the messages to operators through outreach campaigns; decals; flyers, signs, and bulletins; radio broadcasts; and safety meetings. Agencies recommend posting messages where operators are likely to see them—in the operators' room, restroom, on-board the bus, or broadcasting messages over the radio or by text message.

Transit agencies reported relatively low costs (less than $2,000) for decals, bulletins, posters, and other printed materials. However, the costs begin to rise significantly for applications that entail safety meetings as operators are frequently compensated for attendance. Because of their relative low cost, any potential reduction in bus-and-pedestrian collisions is viewed as a return on investment.

2.2.1 Applications of Operator Outreach

Specific applications of operator outreach, as reported by agencies, are shown in Table 2-3.

2.3 Strategy 3: Safety Checks

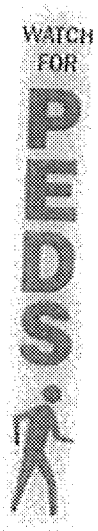
Safety checks are an approach to pedestrian safety that include observing bus operator behavior to determine whether the operator is acting according to operating procedure, according to policy, or in a manner that is believed to be safe. In some cases, safety checks occur on-board the bus (with or without the operators' awareness). In other cases, safety checks occur from the roadway, generally unbeknownst to the operators. Consequences of a failed safety check vary, but can include speaking with the operators about their behavior, required follow-up training, or a warning system that results in termination if the behavior is not corrected.

Safety checks can be an effective means of mitigating all bus-and-pedestrian collision types. Several agencies noted that they use safety checks as a way specifically to prevent the occurrence of bus-and-pedestrian collisions.

Table 2-3. Applications of operator outreach.

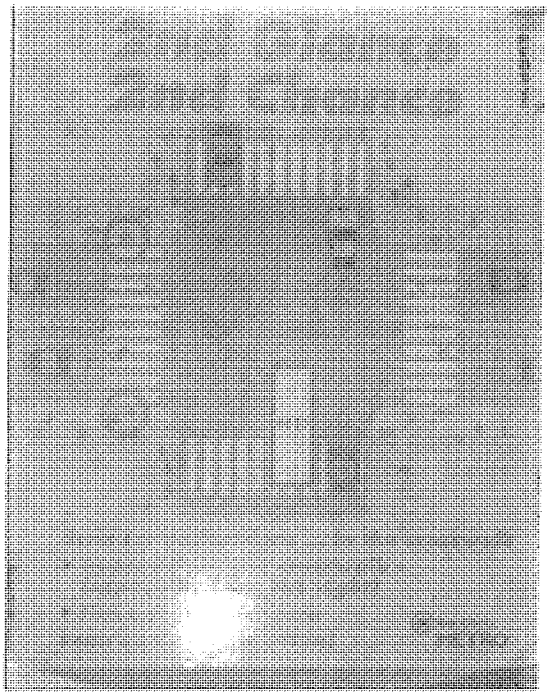
Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
"No trash on the dash" campaign	To reduce personal and other items from dash that could be obstructing operators' views of pedestrians	Message posted on LED boards in operator cruise room and on a portable message sign on the driveway from the transit station. Explained why it was important to keep the windshield clear of obstructions. Operators called in for 15 minutes of instruction with an instructor. Were told they would be monitored, and if they were seen to have anything on the dash, they would get a warning. Any subsequent incidents would result in formal discipline.	• It was effective as they don't really have a problem with this anymore, but didn't eliminate pedestrian accidents. • Rated a 4 for operator acceptance. The operators took it seriously because it was run for awhile.
Pedestrian safety campaign for contra-flow lanes	To change bus operator behavior in the areas of the dedicated contraflow bus lanes	Dedicated contra-flow bus lanes increased the occurrence of bus-and-pedestrian collisions and near-misses. Agency carried out a heavy campaign to change bus operator behavior. The campaign instructed bus operators to go slowly and to use their horns. The messages were communicated to the operators' in their route information and text messages.	The campaign was rated as very effective.
"Watch for pedestrians" decals on telephone/radio handsets (see Figure 2-1)	To remind operators to look for pedestrians when turning left	Yellow sticker with the words "Watch for Pedestrians" and a figure of person. Black lettering and a yellow background. Placed on the back of black handsets, which are located on left. Done following a pedestrian collision when making a left turn At one agency, two different sizes were used: 6⅝ × 1 in. and 3½ × 1 in., for two different size handsets for bus radios.	• Ratings: – 4 for reducing collisions – 4 for operator acceptance (some thought they were visually distracting) • There was a reported novelty effect. Rated a 3–4 for operator acceptance (they were reportedly more effective when they were brand new.)
"Watch for pedestrians" sticker on farebox	To remind operators to look for pedestrians when turning right	Stickers were placed on all fareboxes in conjunction with the agency's new video and special training on operator turning procedures.	Not reported
Posted signs of most dangerous intersections	To make operators aware of the most dangerous intersections and the routes that go through them	Annually posts signs of top 10 most dangerous local intersections. Information on which routes go through those intersections is included.	Not reported
Posted collision location map	To make operators aware of past collision locations	Annually post map with bus accident locations over past year for operators.	Not reported
Themed safety outreach slogans	To communicate important safety messages to operators and to saturate them with the messages	Over a 12-week period, the agency posted flyers inside each restroom stall (a.k.a., "outhouse journal"). A different flyer was placed in each stall. Banners and posters were also hung. Messages that focused on pedestrian safety included "Track them once. Track them twice." and "Second Glance. Second Chance." (see Figure 2-2) The idea behind these slogans was that, before the intersection, operators should be scanning for people who may want to cross and then upon entering the intersection, they should look to see where each of those pedestrians went.	Operators notice the signs and appreciate the reminders, but behavior is not likely changed with flyers once a week. By saturating the operators with safety messages, agency hopes that change will occur.
Radio broadcast of safety messages Safety flyers, bulletins, signs, general notices	To keep operators alert to safety issues To communicate important safety messages to operators	Safety messages broadcast over operators' radio 4 to 5 times a day. Examples: "Raining, watch your speed" or "Parade in this location, watch for pedestrians." • Posters, flyers, bulletins, and signs usually posted in operators' areas. Examples: • Tri-fold brochure, "Pedestrian safety tips all operators should know" • Signs and photos with detailed information about recent collisions and preventative recommendations • Bulletins reminding operators to be aware of pedestrians crossing the street • Notices of important rules to follow such as yielding to pedestrians, operating in congested areas, and clearing off the dash board. The rules are enforced by road supervisors who monitor operators. There are consequences when operators are caught not following the rules.	Not reported • Operators become accustomed to messages and no longer pay attention. • Not all operators go into operators' room, so they miss signs. • With saturation, may change behavior.
Safety meetings with operators	To communicate important safety messages to operators	• Focus on preventing accidents at meetings. These meetings can include everyone in the agency or just the safety department and bus operators and can be held monthly, quarterly, or semi-annually. Examples: • Monthly between safety department and bus operators. • Twice a year with everyone in organization	Operators can give safety suggestions to safety department about things such as mirror placement.

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."



Source: Cowlitz Metro

Figure 2-1. Watch for Pedestrians decal.



Source: King County Metro

Figure 2-2. Second Glance, Second Chance poster.

The cost for check rides generally ranges from low to moderately high. If in-house transit staff is used, the check rides only incur fixed labor costs. Costs rise moderately if the checks are performed by staff on overtime. Use of a contracted service to perform checks raises costs significantly. One very large transit agency reported an annual cost of $120,000 for its safety checks.

2.3.1 Applications of Safety Checks

Specific applications of safety checks, as reported by agencies, are shown in Table 2-1.

2.4 Strategy 4: Defensive-Driving Techniques and Policies

Defensive-driving techniques and policies can be developed in an attempt to mitigate the future occurrence of specific types of collisions, such as collisions with pedestrians. To be most effective, bus operators must apply the techniques with knowledge, judgment, and skill; therefore, operating techniques and policies are typically implemented as part of an operator training program, during both new-hire and refresher training.

When carried out as part of new-hire and refresher training, the cost of implementing specific operating techniques is relatively low as it is only one of several components of the training program. The cost of informing operators of a new or revised policy is also low as it may be as simple as issuing the information through bulletins. The cost, however, can be high if the techniques/policies are implemented outside of the usual operator training cycle or if operator meetings are required.

Table 2-4. Applications of safety checks.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
Bus safety ride checks	To improve safety through operator behavior	Evaluator rides on bus and observes behavior	Not reported
On-street safety checks	To improve safety through operator behavior	On street, supervisor watches for operator violations	Not reported
Safety audits	To improve safety through operator behavior	Safety audits conducted by committee of operators and supervisors. Stand on street corner to observe driver compliance with rules and procedures. Results are anonymous.	Not reported
Speed checks	To improve safety through operator behavior	Speed checks using radar gun	Not reported
Undercover safety observations	To improve safety through operator behavior	A member of the safety department rides the bus during a one-way trip and makes a complete observation of performance. If the results are negative, the operator may receive disciplinary action or retraining. Two types of observations: a random ride and a ride request. If someone is reported as having fatigue problems, the observer makes two rides within 72 hours to monitor safety as well as fatigue	• Rated a 3 for effectiveness • Requires large amount of staff time and only get a partial picture of driver safety • Observations are complex to set up and administer

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

2.4.1 Applications of Defensive-Driving Techniques and Policies

Several agencies reported specific defensive-driving techniques or policies they developed or implemented to manage or control operations in locations where pedestrian safety is critical, such as intersections and service stops. The specific applications of these defensive-driving techniques and policies, as reported by agencies, are shown in Tables 2-5 and 2-6, respectively.

2.5 Strategy 5: Public Outreach and Education

Public outreach and education campaigns are intended to raise awareness of issues and perhaps to change even attitudes and behaviors. A well-designed public education campaign can make a positive impact on public opinion, target specific audiences, and be a cost-effective way of providing critical information to a large number of people. To be successful, campaigns should (*2*)

- Convey a compelling statement;
- Create urgency about the problem;
- Emphasize a local impact of the problem;
- Identify opponents;
- Propose concrete, easily understandable solutions (ideally expressed in one sentence); and
- Urge a specific action.

A successful outreach campaign begins with clear, realistic, and measurable goals. Campaigns should focus on ultimate outcomes rather than on intermediate objectives. They should not try to change entrenched attitudes in a short time period or with too few resources. Campaigns should proceed in steps or phases, and each phase should lay out a mechanism that leads to the desired effect. Staffers should set forth a causal link, showing how the results are likely to be achieved (*2*).

In collaboration with national and local pedestrian safety advocates, FHWA created the Pedestrian Safety Campaign Planner to educate pedestrians and operators about ways to improve pedestrian safety (*3*). The Pedestrian Safety Campaign materials included in the kit are research-tested and designed for use by any organization to promote pedestrian safety. For more

Table 2-5. Applications of defensive-driving techniques.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
Operator covers brake with foot when approaching crosswalk	To be able to react quickly to pedestrians entering the roadway	Operator covers brake with foot when approaching a crosswalk.	Not reported
Operator moves in seat to see around obstructions	To overcome limitations due to blind spots	Bob-and-weave technique—operator bobs and weaves in seat to see around obstructions	• Not effective for a short operator • Repetitive bobbing and weaving may damage operator's back and neck
		Rock-and-roll technique—before operator rolls, he/she rocks in seat to see around obstructions	Not reported
		Lean left-or-forward technique—operator leans left or forward in seat to see around obstructions	Leaning forward is effective for tall operators. Leaning left is effective for short operators.
Service stop exit procedure	To improve exits from service stops	Part of 2.5-hour safety module. Referred to as "checking left-right-left" before exiting service stop. See further details in Section 3.1.2.	Not reported
Mandatory turning procedure	To reduce turning collisions with pedestrians	Procedure was developed in response to a series of pedestrian collisions during turns. Procedure is critical when the bus is the first vehicle in line at a red light. Requires operators to stop at STOP bar or 6 feet before crosswalk. Requires continual scanning of the intersection and a 2-second wait before entering the intersection after the light turns green. Operators must re-scan crosswalk before completing turn. See further details in Section 3.1.1.	• Very effective • 75–80% drop in bus-and-pedestrian collisions • Ratings: – 4.5 to 5 for reducing collisions – 4.5 for reducing claims
Square left turns	To put the crosswalk in front of the operators and get them out from behind the A-pillar	The advantage of the square left turns are that the driver only crosses through one lane width of the crosswalk and the crosswalk is in the operator's forward vision instead of off to the left as the driver goes through the crosswalk. If a driver makes an early turn or lazy left turn, the bus crosses through two lanes of traffic and a larger portion of the crosswalk.	• Tends to minimize the risk of striking pedestrians during a turn • Takes toll on operator's body, increases disability rates • Can cause those on-board to fall • Can be misleading to other operators.
Operator keeps eyes moving	To teach operators to get the "big picture" by looking at the whole environment	Avoid the fixed stare. Keep moving eyes. Constantly sweep and periodically look at mirrors. Maintain a high eye level—don't focus on the tailgate of the car in front. Make sure that pedestrians see you.	Not reported

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

Table 2-6. Applications of policies.

Application	Purpose	Description	*Subjective Ratings and Other Comments on Effectiveness
Slow down at intersections	To increase safe operations around pedestrians	Operators must slow down when approaching an intersection.	Not reported
Stop at yellow lights	To increase safe operations around pedestrians	Operators must stop at yellow lights at signalized intersections.	Not reported
No right turn on red	To increase safe operations around pedestrians	Bus operators not allowed to make a right turn at a red light at an intersection where there is a near-side bus stop as pedestrians are likely to be crossing in front of the bus.	Not reported
No stopping after closing door	To increase safe operations around pedestrians	Bus operators are instructed not to stop to pick up passengers after closing the door. However, agency gives operators flexibility with the rule.	• There are customer service ramifications. If not in middle of traffic, operator will open door. Not very practical • Not effective as operators will not follow policy because of relationships with passengers
Written Standard Operating Procedures (SOP) regarding pedestrians	To help prevent collisions with pedestrians	Operators are trained on a written SOP, which includes a section that deals specifically with preventing pedestrian accidents. Procedures include what to do when pedestrians are ahead, behind, or alongside the bus as well as when they are alighting. SOP gives operators definite guidance on driving safely and defensively.	• Believes it is effective in reducing collisions • Rated a 4 or 5 on operator acceptance

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

information about the Pedestrian Safety Campaign materials visit safety.fhwa.dot.gov/local_program/pedcampaign/guide.htm#4.

During the research conducted for this Guidebook, stakeholders suggested that, to be successful, campaigns should focus on conveying one message (as opposed to multiple messages), campaigns directed toward pedestrians should be clever, and the message should come directly from the transit agency. In addition, it was suggested by pedestrians that the messages be accompanied with incentives for change from the transit agency as a "give and take." For example, if the transit agency asks for a change in attitude or behavior from its riders, the agency should offer something in exchange that will benefit the riders such as increased lighting at poorly lighted shelters, the idea being that the riders are more likely to change their behaviors if they feel they are getting something in return from the agency.

When correctly designed and implemented, public outreach and education has the potential of reducing all collision types. To be most effective, outreach and education should be implemented in close coordination with local DOTs, pedestrian advocacy groups, schools, and others having an interest in pedestrian safety. Many of the transit agencies surveyed reported great acceptance of the education programs by the public. It is important to remember that the most effective campaigns are ongoing and an integral part of an overall pedestrian safety program. The costs of many outreach and education campaigns are considered low, but can be moderately costly for professional production of digital videos or public service announcements.

2.5.1 Applications of Public Outreach and Education

Several agencies reported specific campaigns they have implemented, while others reported more general information about public outreach and education. Specific applications of public outreach and education, as reported by agencies and stakeholders, are shown in Table 2-7.

2.5.2 Suggested Applications of Public Outreach and Education

Beyond the specific applications of public outreach and education shown in Table 2-7, transit agencies and stakeholders offered a variety of suggested or proposed applications of public outreach and education that might help mitigate collisions with pedestrians. These ideas included educating the public about the following:

- Blind spots on buses and how they might impact pedestrian safety;
- Mechanics of the turning bus and what pedestrians should be aware of in areas where buses are turning; and
- How to catch a bus (e.g., be ready to board to help with schedule, be aware that the bus cannot stop on a dime, be at a bus stop or the bus will not pick you up).

Other suggestions included

- Conduct campaigns in combination with enforcement "stings" in order to invoke change,
- Place a reminder on the back of day passes not to run after the bus, and
- Broadcast the campaign messages via video at stops and transit buildings.

2.6 Strategy 6: Traffic Engineering and Roadway Design

There are a wide variety of ways in which traffic engineering and roadway design can be applied to improve safety. Traffic engineering applications include traffic signalization techniques (e.g., traffic-signal phasing); signage; roadway markings; and physical devices (e.g., bol-

Table 2-7. Applications of public outreach and education.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
"Look again" campaign Bus safety campaign	To increase pedestrian awareness of buses To warn pedestrians about dangers of running after the bus, stepping in front of bus, etc.	Posters put on the outsides of buses. Message signs will be printed to be a reminder of the danger in chasing buses or trains for both operators and pedestrians. Examples of messages are "Stay Safe, Don't Chase" and "Don't Run, There is Another One" (see Figure 2-3).	One source reportedly as ineffective because agency did not partner with others Not reported
Pamphlets about not running after bus	To warn pedestrians about dangers of running after the bus	Passed out pamphlets on the bus to riders.	Reported to be a reasonably good program
Stay alert around buses and trains campaign	To increase pedestrian awareness of buses	Billboards, bus back signs, interior bus signs, monthly newsletters with message on staying alert around buses and trains	Not reported
Transit 101	To educate college students about bus safety	Transit 101 is a 1-hour presentation given by the local transit agency to incoming freshmen. The presentation focuses on how to safely use the system and brings students' attention to the pitfalls of the use of cell phones and portable music players, as well as the need for students to be aware of their surroundings when walking. As some of the students have never taken a bus prior to coming onto campus, the manager of operations instructs the students to board the bus at designated stops and what to do when getting off the bus.	• Ratings: - 5 for reducing collisions - 5 for reducing severity - 4 for reducing near misses • Students make up 20% of ridership, yet collisions are mainly with non-students and no collisions on campus • One of the most popular classes offered during fall orientation (usually about 200 students)
Public outreach to schools	To talk about safety to students	Agency staff goes to schools to explain that a bus does not behave in the same way as an automobile (different turning radius, the back end has a pivot point, longer stopping time) Agency educates students about transit safety in an interactive manner. They emphasize that transit buses are different than school buses and that with the transit buses you have to cross in back. Afterwards, the teachers have the kids send drawings as thank-you notes. They also have the schools put bus rider safety flyers in the school papers.	• Rated as 3–4 on public acceptance • Children are very receptive
Public outreach videos	To educate public on pedestrian safety issues around buses	Professionally developed videos focused on a number of pedestrian safety issues. One video focused on dangers and consequences of not being aware of a bus that is turning.	Very effective
Blinking red safety lights	To provide a signal light for early morning and late-night bus users going to and from bus stops	Bus operators distributed 3,000 blinking red safety lights to bus riders on routes throughout the system. The battery-operated lights are about the size of a campaign button with the message "Look Before You Cross" and can be clipped to jackets or other clothing.	Not reported

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

lards, channelization). Roadway design applications generally relate to geometric elements of the roadway and roadside.

The goal of applying traffic engineering and roadway design bus–pedestrian safety is to reduce the potential conflicts between buses and pedestrians by providing separation between the two modes. Buses and pedestrians can be separated physically by, roadway elements (e.g., curbs, refuge medians); devices (e.g., bollards, fences); structural elements (e.g., bridges, tunnels); and the use of aesthetics (e.g., shrubbery). Separation of buses and pedestrians can also be provided in time by allowing protected movements at different times with traffic-signal phasing. In addition, traffic engineering and roadway design strategies can be used to bring attention of one mode to the other. For example, roadway markings such as crosswalks and signage can be used to warn operators of the presence of pedestrians. Likewise, signs, markings, and even creative geometric design features can be used to warn pedestrians of the presence of buses.

Figure 2-3. Public outreach messages about bus safety.

Local and state roadway traffic engineering and roadway design are usually the responsibility of the transportation section within the local government and state, respectively. The cost of improvements can be minimized when incorporated during the early stages of roadway improvement projects. Implementation costs range from low for signal timing, striping, and traffic signs (no cost to hundreds of dollars); to moderate for special traffic signals and pedestrian channelization treatments (thousands of dollars); to high cost for major geometric treatments such as bulb-outs ($150,000–$250,000 per intersection).

2.6.1 Applications of Traffic Engineering and Roadway Design Strategies

Specific applications of traffic engineering and roadway design strategies, as reported by agencies and stakeholders, are shown in Table 2-8.

2.6.2 Suggested Applications of Traffic Engineering and Roadway Design

Beyond the specific applications of traffic engineering and roadway design shown in Table 2-8, there were a number of traffic engineering and roadway design applications that stakeholders felt might help to mitigate bus-and-pedestrian collisions. These suggestions included traffic signs and signalization techniques, signs and pavement markings, bus nubs, sidewalk improvements, pedestrian channelization, and pedestrian bridges or tunnels. Each of these suggested applications is presented in more detail below.

2.6.2.1 Traffic Signs and Signalization Techniques

Traffic signalization techniques or devices were suggested as strategies for mitigating bus-and-pedestrian collisions. Suggestions included the following:

Table 2-8. Applications of traffic engineering and roadway design.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
Protected left-turn signal	To eliminate conflict between left-turn vehicles and crossing pedestrians	Green left-turn arrow for vehicular traffic, indicating that the left-turn movement is protected (i.e., no yielding is required during the left turn).	Rated a 5 in reducing collisions; signal in for over 1 year and no bus-pedestrian collisions (about 3 in that area in the past 20 years)
Pedestrian scramble (see Figure 2-4)	To eliminate conflicts between pedestrians and vehicle traffic by providing a protected pedestrian crossing phase	A traffic signal is timed to provide an all-pedestrian phase, meaning that pedestrians are allowed protected crossing movements in all directions, including diagonally across the intersection.	• Effective in separating movements • Can cause an increase in vehicle delay at the intersection • Could be beneficial at intersections where pedestrians are making transfers
Bulb-outs (see Figure 2-5)	• To make pedestrians waiting for the bus more visible to bus operators • To prevent pedestrians from stepping into the street to get the attention of the operator • To help pedestrians cross street safely	Extensions of the curb/sidewalk into the parking lane in the areas of bus stops (at intersections). They reduce the roadway width and crossing distance for pedestrians. They are used in traffic calming to help reduce traffic speeds. Buses stop in the traffic lane instead of weaving into and out of traffic to access a bus stop located in the parking lane.	Very popular with public.
Leading pedestrian interval	To reduce intersection conflicts between pedestrians and turning vehicles	A leading pedestrian interval gives pedestrians the WALK signal 3 seconds before the motorists get the green light.	Has proven highly effective in reducing conflicts with turning vehicles and has been associated with crash reductions.
Pedestrian countdown signals (see Figure 2-6)	To give pedestrians a better idea of when they can be in the crosswalk.	Pedestrian signal heads that indicate to pedestrians how much time they have to cross the street (indicated by a count-down timer).	Not reported.
Shrubbery, fences, and depressions	To separate and demarcate safe spaces for pedestrians	• Between sidewalk and Bus Rapid Transit (BRT) lane.	Not reported.

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

- Install a static NO TURN ON RED sign (see Figure 2-7). This sign prohibits vehicles from making right turns when the traffic signal is installed in an effort to reduce potential conflicts between vehicles turning right on red and pedestrians crossing at the intersection.
- Install a dynamic NO RIGHT TURN ON RED sign or NO TURN ON RED sign (see Figure 2-8). This sign is activated either by the pedestrian push button or by automated pedestrian detection (e.g., infrared). When activated, the dynamic traffic sign displays the words

Figure 2-4. Pedestrian scramble—street view (left) and top view (right).

Source: Claude Mandl

Figure 2-5. Intersection bulb-out.

NO TURN ON RED to vehicle operators, prohibiting this maneuver and protecting pedestrians from potential conflicts with turning vehicles. The advantage of the dynamic sign is that operators are permitted to turn right on red when pedestrians are not present.

- Install audible pedestrian crossing signals. The idea behind this application is to alert the driver through the use of an audible tone that would be activated during the pedestrian crossing phase of the signal that a pedestrian may be in the crosswalk.

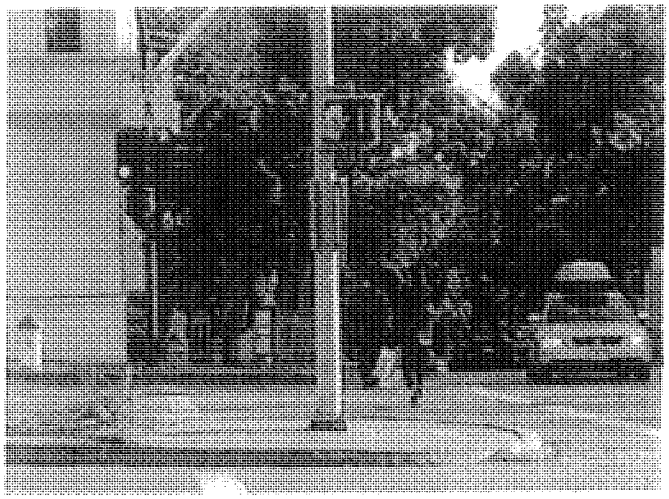


Figure 2-6. Pedestrian countdown signals.

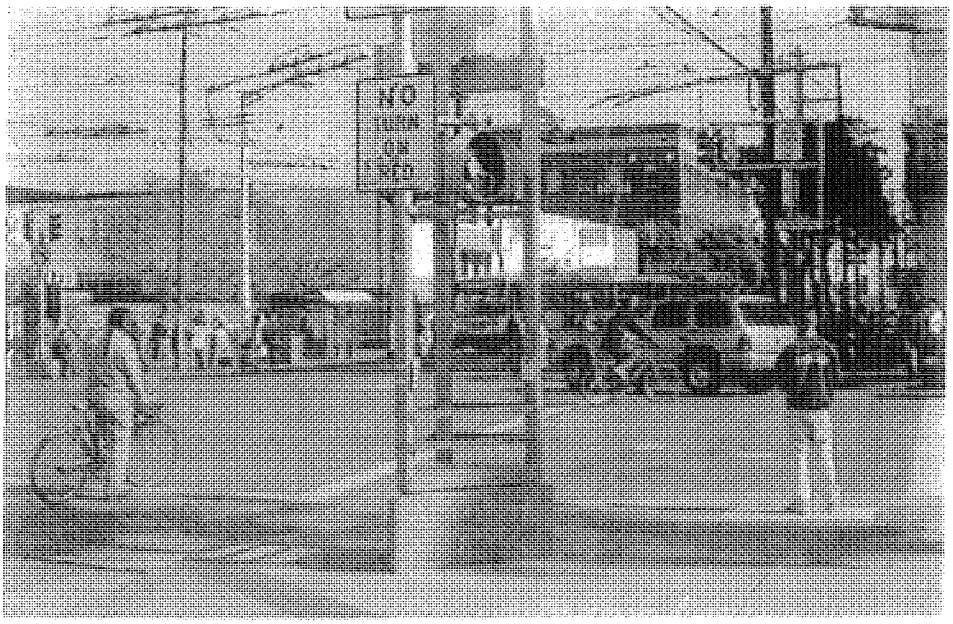


Figure 2-7. Static NO TURN ON RED sign.

2.6.2.2 Signs and Pavement Markings

There were a number of suggested uses of signs and markings for mitigating bus-and-pedestrian collisions. These suggestions included the following:

- Install enhanced crosswalks for better delineating the crosswalk area for operators.
- Install larger than normal YIELD TO PEDESTRIAN signs at intersections to draw the attention of drivers to pedestrians in the crosswalks.
- Install tactile strips on the edges of sidewalks at bus stops (see Figure 2-9). As tactile strips are uninviting to stand on, they might be used as a "barrier" between buses and

Figure 2-8. Dynamic NO RIGHT TURN ON RED sign.

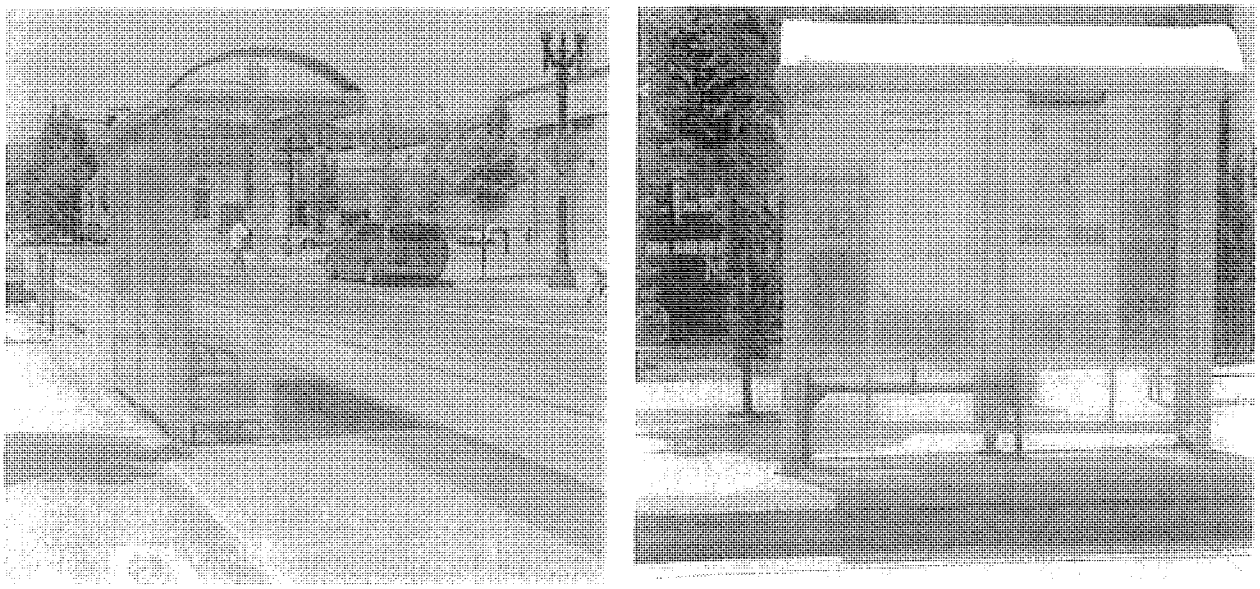


Figure 2-9. Application of tactile strips at a transit stop.

pedestrians. They may be a potentially effective method for keeping pedestrians away from the edge of the road (e.g., at intersections where buses are turning right) and for reducing the chance of pedestrians slipping and falling under a bus at bus stops and terminals. It is important to consider ADA standards and guidelines if implementing tactile strips.

2.6.2.3 Bus Nubs

Bus nubs were also suggested by several agencies or stakeholders as a possible application for mitigating bus-and-pedestrian collisions. A bus nub is essentially an extended version of a bulb-out to allow placement of the entire length of a bus stop adjacent to the travel lane. The primary motivations for installing bus nubs are to improve transit operations through the elimination of bus-weaving maneuvers into and out of a curbside bus stop and to reduce sidewalk congestion by adding sidewalk space with the bus nub design (4). In addition, bus nubs can reduce the crossing distance and time for pedestrians, make it easier for operators to see pedestrians waiting to cross the street or board the bus, slow right-turn movements, and reduce the use of bus pull-out areas for illegal parking. As these goals of nubs hit on several different issues surrounding bus-and-pedestrian collisions, nubs could be an interesting application, which could mitigate a variety of problems associated with bus-and-pedestrian collisions. Other names used for bus nubs include "curb extensions," "bus bulbs," and "bus bulges."

The cost of constructing nubs can range from $15000 to $55000 depending upon drainage needs, utility relocation, construction materials, and patron amenities (5). If street drainage systems need to be reconfigured, there is a steel-fabricated nub with a built-in shelter that can be installed over an existing street, allowing runoff to filter underneath; this system can be used to test a nub before a permanent installation is made (6).

2.6.2.4 Sidewalk Improvements

Sidewalk improvements were suggested as an application for mitigating bus-and-pedestrian collisions. Specific suggestions included

- Widen sidewalks to provide more space for pedestrians to walk and wait for the bus, reducing or eliminating conflicts between those walking and those waiting;
- Repair sidewalks that are in disrepair (e.g., fixing cracks and holes) to help reduce or eliminate tripping hazards that can cause pedestrians to fall into the roadway; and
- Maintain sidewalks before they fall into a state of disrepair.

2.6.2.5 Pedestrian Channelization

Pedestrian channelization was suggested by multiple agencies and stakeholders as a way to keep pedestrians from standing or crossing in areas where they are more likely to come into contact with buses. These suggestions included the following:

- Use pedestrian channelization at crowded bus stops where there is a problem of pedestrians being struck when buses are pulling into the stop. In this case, channelization can be accomplished through the use of fences, with openings indicating where the bus will stop.
- Use fences at intersection corners or signage (see Figure 2-10) to guide pedestrians to crosswalks and to keep them from entering the street in a place that would be unexpected to a bus operator.

2.6.2.6 Pedestrian Bridges or Tunnels

Pedestrian bridges or tunnels were suggested by pedestrian groups as a way to mitigate bus-and-pedestrian collisions. While grade-separated crossings achieve the goal of physically separating pedestrians from motor vehicles during crossing, pedestrian bridges are notoriously underused and tunnels can be dangerous for pedestrians due to crime and other activities. Therefore, the use of grade-separated crossings should be evaluated on a case-by-case basis and with

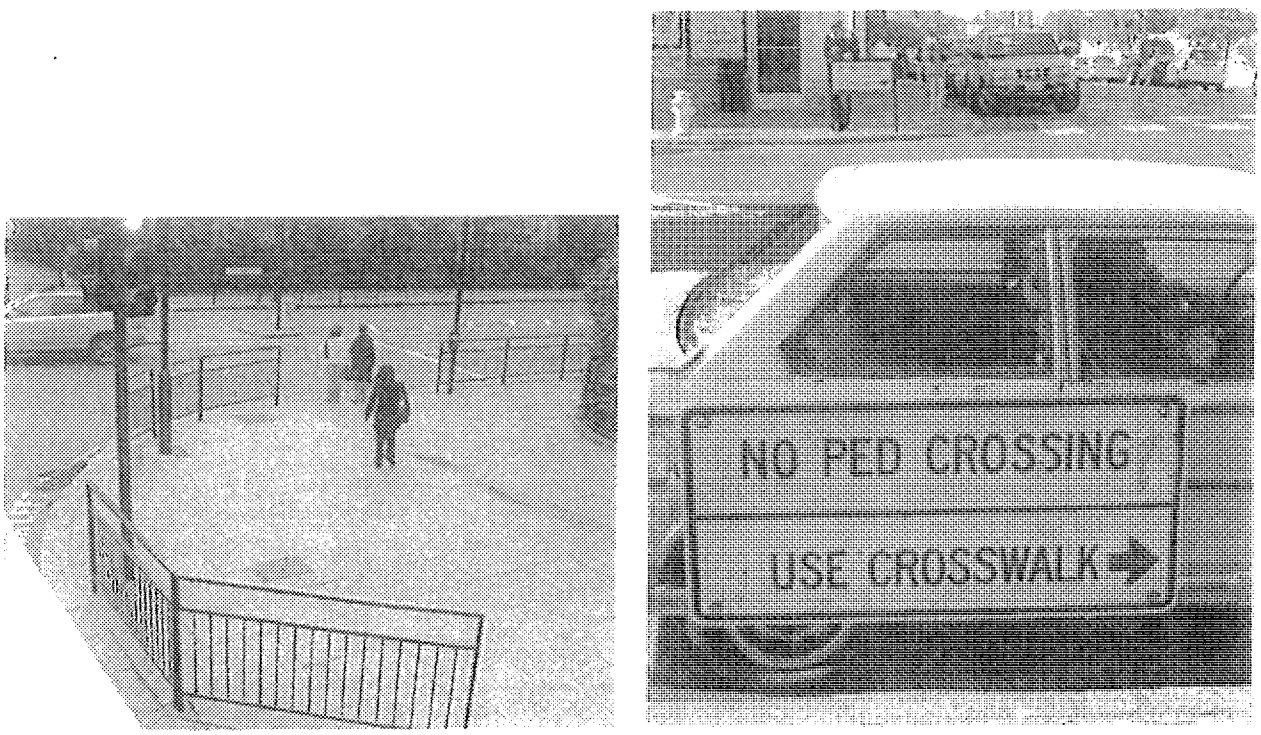


Figure 2-10. Applications of pedestrian channelization—fences (left) and signs (right).

input from the public. Agency partnering is also a good idea and can result in a better, more successful product.

2.7 Strategy 7: Bus Mirror Configuration and Placement

Mirrors are a major, ongoing issue for many agencies. Agencies and stakeholders discussed a variety of issues including mirror size, configuration, and placement. Mirrors were frequently reported by agencies, operators, and stakeholders as a contributing factor to bus-and-pedestrian collisions; consequently, specific mirror configurations and placements have been used as strategies for mitigating bus-and-pedestrian collisions. If not properly adjusted or configured in size and shape, mirrors may accentuate blind spots to the rear and to the forward left and right viewing areas. For example, mirrors can obstruct an operator's view of pedestrians in crosswalks during turning maneuvers at intersections or when pulling into a bus stop.

The cost of mirrors ranges greatly and is dependent on their complexity. Simple convex mirrors may be obtained for as little as $20 to $50 per mirror. Dual mirrors in a single housing are typically several hundreds of dollars. Remotely controlled and heated mirrors cost $1,200 or more per mirror. All costs are exclusive of labor. On a per-bus basis, these costs are relatively low; however, costs can be high when outfitting a fleet of buses with new mirrors.

2.7.1 Applications of Bus Mirror Configuration and Placement

Specific applications of bus mirror configuration and placement, as reported by agencies, are shown in Table 2-9.

2.8 Strategy 8: Bus Design/Modification

Beyond the applications associated with the size, configuration, and placement of bus mirrors, there are a number of bus design/modification applications that could help mitigate bus-and-pedestrian collisions, many of which involve installation of lights. It should be noted that modifications must be closely coordinated with the maintenance department and manufacturers to ensure changes do not create additional maintenance issues, nullify warranties, or violate federal or state motor vehicle regulations.

Bus design modification costs can be minimized when incorporated as part of new procurements. Modifications to existing fleets range from several hundreds of dollars for increasing the number of marker lights and LED light strips on the front-top of bus to thousands of dollars for the installation of curbs lights. On-board video systems cost several thousands of dollars, with one transit agency reporting a cost of $12,000 for a six-camera installation on a single bus.

2.8.1 Applications of Bus Design/Modification

Specific applications of bus design/modification, as reported by agencies, are shown in Table 2-10.

2.8.2 Suggested Applications of Bus Design/Modification

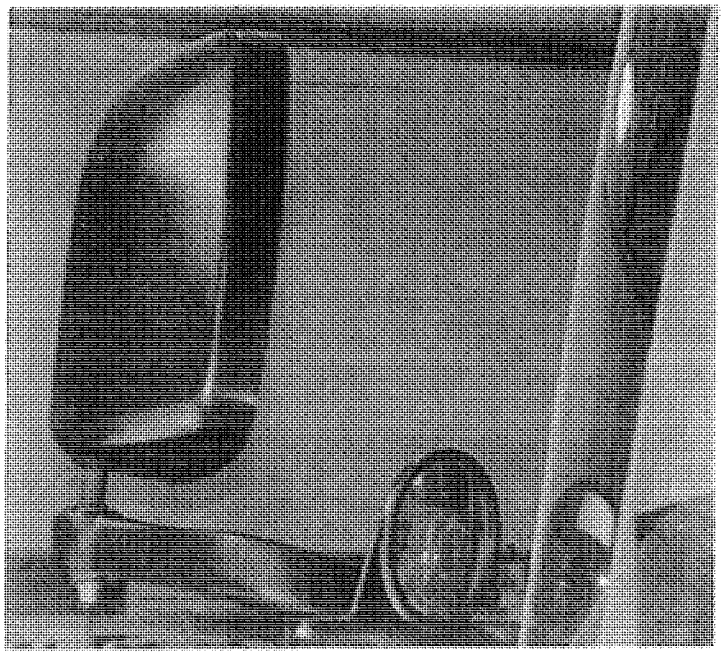
Beyond the specific applications of bus design/modification shown in Table 2-10, stakeholders suggested a number of bus design/modification applications that might mitigate bus-and-pedestrian collisions. These suggestions included the following:

- Use low-floor buses to increase visibility.
- Reduce the height of the farebox.

Table 2-9. Applications of bus mirror configuration and placement.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
Dual right-side mirrors	• To eliminate blind spot on right side of bus allowing operator to see tire and actual curb as they are turning • To prevent collisions with stationary objectives, other vehicles, and pedestrians on side of bus	Mirrors consist of one flat mirror on the top and a convex mirror on the bottom. The convex mirror helps the driver to see down the right side of the bus.	Rated a 3 for preventing bus-pedestrian collisions. Agency does not think this is very effective because most of their collisions occur in the front of the bus.
Right convex mirror(s)	• To allow operator to see the entire front bumper • To avoid hitting pedestrians in front of the bus, particularly important if driver sits low in the seat	Convex mirror on right side with a downward slant so as to see the entire front bumper (see Figure 2-11). Motivation for strategy was that in some cases, the operator would claim he/she didn't see the pedestrian in front of the bus, particularly if the pedestrian was short. The mirrors are placed on the right A-pillar, left A-pillar, or roof depending on the bus model. For use when the bus is at a stop and riders are boarding. The farebox and boarding riders can be a major visual obstruction. Began installing the mirrors when began using 41-in. fareboxes.	• No data, but reported as probably very effective • Rated a 5 for operator acceptance (they complain if they do not have it) Some operators have complained that there is a visual overload of mirrors on the buses, and some operators do not like that the mirrors can be in a different locations depending on the bus model.
Dual left-side mirrors placed lower on bus	To reduce blind spot on left side of bus	The dual flat and convex mirrors are on the left side and are separated instead of being housed in one panel with plastic casing. The mirrors are smaller. They give a wider view and are placed lower, below the line of sight. The dual left-side mirrors are oriented downward to minimize the sight obstruction (see Figure 2-12). The mirrors are placed lower, below the line of sight.	• Ratings: – 4 for reducing collisions although not long enough to really know – 5 on operator acceptance (they fight to drive buses with prototype mirrors because they like them so much better) • Hope to have the whole fleet retro-fitted for these mirrors within a couple of years. Found to be very effective
Dual mirrors in single housing	To help reduce blind spots	Dual flat and convex mirrors in single housing with flat mirror on top. The mirror angle and height can be controlled by operator from inside using a remote control (see Figure 2-13).	Ratings: • 4 for reducing collisions • 4 for reducing close calls • 3 for reducing claims • 5 for operator acceptance
Larger, wider, mirrors mounted higher	To allow bus operators to see the full range around back of bus	Mirrors were made larger and wider and were mounted higher on the bus.	Not reported
Standardized left-side mirror height	To allow operators to see over the top of the left-side mirror	Standardized mirror height to the average height of the majority of the operators. Safety committee did an assessment of the mirrors and found that the mirrors were at all different heights across their fleet. The operators were moving them based on their individual preferences. The drawback of this strategy is that one height doesn't work for everyone.	Ratings: • 3 for reducing collisions • 3 for reducing severity of collisions • 3 for reducing near misses • 5 for reducing claims • 3 for operator acceptance
Remote controlled mirrors	To allow operators to easily adjust mirrors and to customize for their needs	Mirrors that can be electronically controlled with a remote.	Not reported
Left-side mirror placement	To improve sightlines for operators on the left side of bus	New brackets, which are installed for the mirrors on the driver's side of nine Orion V and six double-length, accordion-style buses. The brackets allow operators to adjust the mirrors four inches up or down. On other buses, the left-side mirrors have been lowered. See further details in Section 3.1.3.4.	Currently being tested.
Smaller mirrors	To reduce blind spots	Mirrors made smaller.	This is being tested on five coaches and feedback is being solicited from operators. Not getting good reviews from operators.

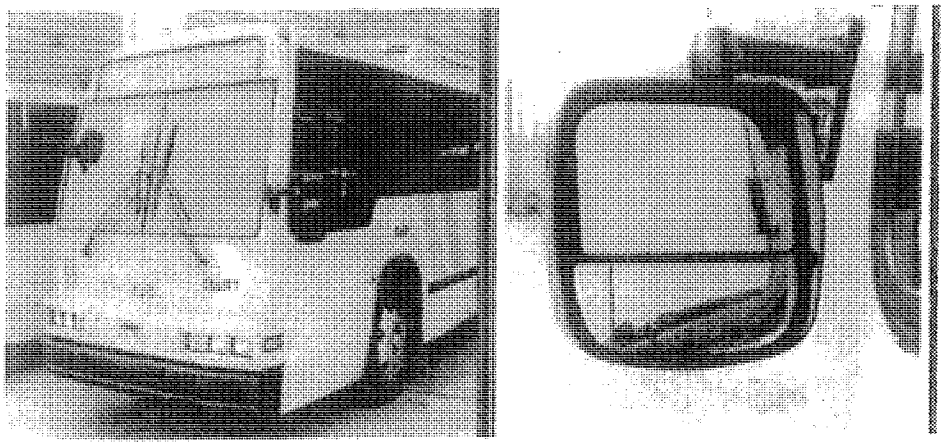
* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."



Source: New Jersey Transit

Figure 2-11. Convex mirror on right side with downward slant.

- Develop and install a pedestrian detection and warning system for buses. While there are object warning systems in use or under development, their effectiveness in detecting pedestrians is generally thought to be limited. The University of California at Berkeley has developed a collision warning system that would detect pedestrians. It is currently being tested. The system appears to work quite well; however, it is very large.
- Install count-down timers on the front and/or back of buses. The idea behind this strategy is to provide bus riders with better and more accurate bus arrival information. By providing



Source: APTA

Figure 2-12. Dual left-side mirrors oriented downward and placed lower on bus.

Source: New Jersey Transit

Figure 2-13. Dual mirrors in single housing (flat mirror on top).

information about how far away the next bus is, riders may not feel like they need to run to catch the bus. On the other hand, if the next bus is not due to arrive soon, this type of information may actually encourage pedestrians to run for the bus.

- Rotate the A-pillar on both the right and left sides of the bus to reduce the blind spot created by the A-pillar.
- Reduce the size of the A-pillar to approximately 1-in. wide and 2-in. deep to help reduce the blind spot caused by large A-pillars.
- Improve brakes and tires so that buses can stop more effectively.

2.9 Strategy 9: Bus Stop Location Planning and Bus Stop Design

Bus stop location planning and bus stop design applications include selecting a proper location for a stop, relocating a bus stop, designing the bus stop zone, and monitoring stops. The location and design of a bus stop play a role in improving the safety of passengers boarding and alighting buses. A bus stop with insufficient room to accommodate passenger loads may cause a passenger to inadvertently step into the path of an approaching bus. The location of bus stops and the related curb treatments and amenities contribute to bus operations and the safety of passengers.

Bus stops should be designed to minimize crowding and to protect passengers from passing traffic. As bus stops are typically controlled by the local municipality, the placement of or improvements to—the stops must be coordinated with the appropriate municipal department.

Cost associated with bus stop location planning and bus stop design range from moderately low to high. Relocating a bus stop may incur a series of costs, depending on the location and stop amenities: moving the bus stop sign and shelter (if applicable) and accessibility improvements such as curb cuts and concrete pads for mobility devices. While each of these costs may be

Table 2-10. Applications of bus design/modification.

Application	Purpose	Description	Stakeholder Comments on[a]
Increased number of side marker lamps	To provide warning to pedestrians and other drivers that the bus is turning or about to turn	Added three side marker lamps on the right and left side of the bus (one between the doors and front bumper, one midway down the bus, and one near the rear of the bus). Marker lamps are activated by the turn signal and hazards. Replaced the incandescent lights (only allow 5 candlepower) to LED (effective light is about 20 candlepower) so that it can be seen in the daytime.	• Use of LEDs greatly increased illumination of each light over incandescent bulb while staying within regulation • LEDs last longer than incandescent lights • Do not know effectiveness as only about 12% of fleet has new lights
Blinking chevrons on side mirrors	To provide warning to pedestrians and other drivers that the bus is turning or about to turn	Added a blinking chevron on the side mirrors, which is activated by the turn signal and hazards.	
Audible turn signals	To provide warning to pedestrians and other drivers that the bus is turning or about to turn	Agency tested a version about 5 or 6 years ago that used a backup beeper. Now they are looking at a right-turn voice warning system similar to "bus turning right... bus turning right" that would be activated when the turn signal is activated and when the bus hits a certain degree of turning on the wheel. About 60 decibels is heard. The problem is getting someone to come forward with an audible chip and speaker. Another agency wired a small noise-emitting device on all buses. Noise was about 70 decibels.	Back-up beeper warning was not effective—people thought the bus was backing up and it was too loud Public forced them to take them off as they objected to hearing it go off at 1:00 A.M.
Safety warning strobe light atop buses (see Figure 2-14)	To help pedestrians and other motorists spot buses operating along city streets and to provide additional lighting for early morning and evening bus users	Flashing yellow strobe light on top of buses. See further details in Section 3.1.3.6.	Not implemented due to the following: • Did not conform to state motor vehicle regulations • Residents complained of light being too bright • It was not evident to people where the light was coming from
LED light strip on front-top of bus (see Figure 2-15)	To get the attention of pedestrians and ultimately to improve safety	A LED strip of flashing lights across the front (top) of bus. Unlike the one single strobe light atop buses (as noted in previous application), these lights move back and forth and are meant to increase awareness about the presence of buses when it's dark. See further details in Section 3.1.3.6.	Currently being tested
Side strobe lights (see Figure 2-16)	To indicate to motorists and pedestrians that a bus is making a turn	Two lights are placed on each side of 40-foot buses. Three lights are placed on each side of the articulated buses. Lights are controlled by the turn signal and flash at a higher frequency than a typical turn signal. The articulated buses also have an audible signal during right turns, which is the same beep signal that is used to indicate that the ramp is being deployed. The 40-foot buses are not equipped with audible signals to avoid unwanted noises in residential areas and where pedestrian traffic is low.	Not reported
Bus curb lights (see Figure 2-17)	To increase operators' view of pedestrians running alongside the bus at night	Several lights along the lower right side of the bus activated by opening the bus door. To give the bus enough time to pull away from the curb, the lights stay on for about 16–20 seconds after the door has closed. See further details in Section 3.1.5.	Rated a 5 in reducing collisions involving pedestrians falling under the bus at night (since curb light installation, nighttime collisions of this type have been nearly eliminated)
Video clips as a forensic tool for accident investigation	• To use clips of accidents as a training aid for operators • To do accident investigations • To make recommendations on how to avoid accidents in the future	Six cameras are mounted on the buses. They are allowed to review 5 minutes of video prior to the incident occurrence	Very successful. Much more able to defend themselves in law suits Ratings: • 4 for reducing collisions • 3 for reducing severity • 1 for reducing close calls • 5 for reducing claims • 3 on operator acceptance • 4 on public acceptance
SI-GARD	To reduce the severity of injuries resulting from accidents involving pedestrians coming in contact with the rear right wheels of transit buses	Flexible plastic shield placed at the rear duals to deflect a person away from the path of the right rear dual.	Unknown

[a] Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

moderately low, the combination of costs could be high. The addition of striping and bollards and other barriers at bus stops are considered to be moderately low (thousands of dollars) in cost, depending on site conditions and the extent of the improvement.

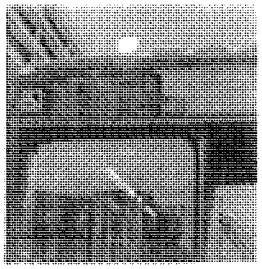


Figure 2-14. Safety warning strobe light atop bus.

2.9.1 Applications of Bus Stop Location Planning and Bus Stop Design

Easter Seals Project Action developed the Toolkit for the Assessment of Bus Stop Accessibility and Safety, which is primarily targeted toward staff at transit agencies and public works departments that are responsible for bus stop design and placement. The Toolkit is intended to be a resource that can be used to enhance the accessibility of specific bus stops or to help in the development of strategic plans to achieve systemwide accessibility. Application of the information and guidance presented in this Toolkit would not only help the disability community, but the general population of pedestrians and bus riders as well. The Toolkit includes good suggestions regarding the design of bus stop areas, landing pads, and lighting (7).

Specific applications of bus stop location planning and bus stop design strategies, as reported by agencies and stakeholders, are shown in Table 2-11.

2.9.2 Suggested Applications of Bus Stop Location Planning and Bus Stop Design

Beyond the specific applications of bus stop location planning and bus stop design shown in Table 2-11, stakeholders suggested a number of bus stop location planning and bus stop design applications that might mitigate bus-and-pedestrian collisions. These suggestions included real-time bus arrival information, bus stop supervision, traffic control, bus nubs, painted bus "pads," and better bus stop planning. Each of theses suggestions is discussed in more detail below.

2.9.2.1 Real-time Bus Arrival Information

Providing real-time bus arrival information was suggested by the pedestrian groups, as well as the stakeholder groups that participated in the research. The premise behind real-time bus arrival information as an application for mitigating bus-and-pedestrian collisions is that better information will help pedestrians make better decisions. For example, if riders know that the next bus is only a few minutes away, they may be less inclined to run after the bus that is pulling out of the stop. Conversely, however, if the next bus is known to be more than a few minutes away, it may encourage patrons to run after the bus that is just leaving the stop. The real-time information could be provided on LED signs in the bus shelters or on the exterior of the buses.

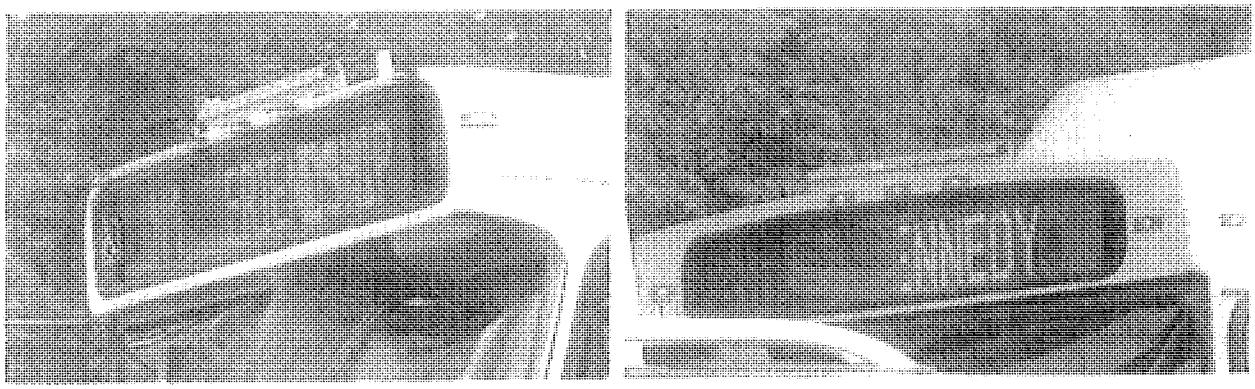
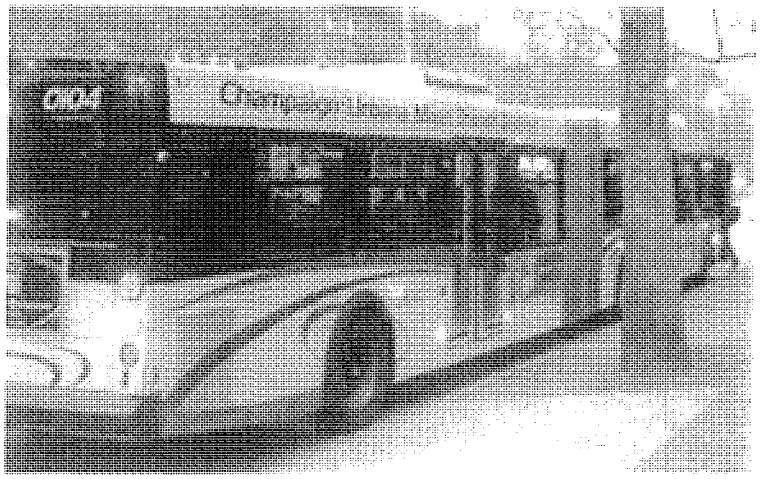


Figure 2-15. LED light strip on front-top of bus.



Source: Champaign-Urbana Mass Transit District

Figure 2-16. Side strobe lights.

2.9.2.2 Bus Stop Supervision

Bus stop supervision was suggested by a stakeholder group and a bus operator group. The suggestions included

- Place supervisors at busy stop locations to help with boarding and alighting, and
- Provide supervision through video cameras at busy or problematic stops.

These strategies are meant to monitor pedestrian activity while waiting at stops. Supervision, either in-person or via video, could help mitigate crowding and pushing at busy stops and roughhousing, all of which can lead to pedestrians being pushed into the roadway under the bus.

2.9.2.3 Traffic Control

Traffic control was suggested as a necessary ingredient when locating bus stops; bus stops should not be located where there is no traffic control. The presence of some traffic control might

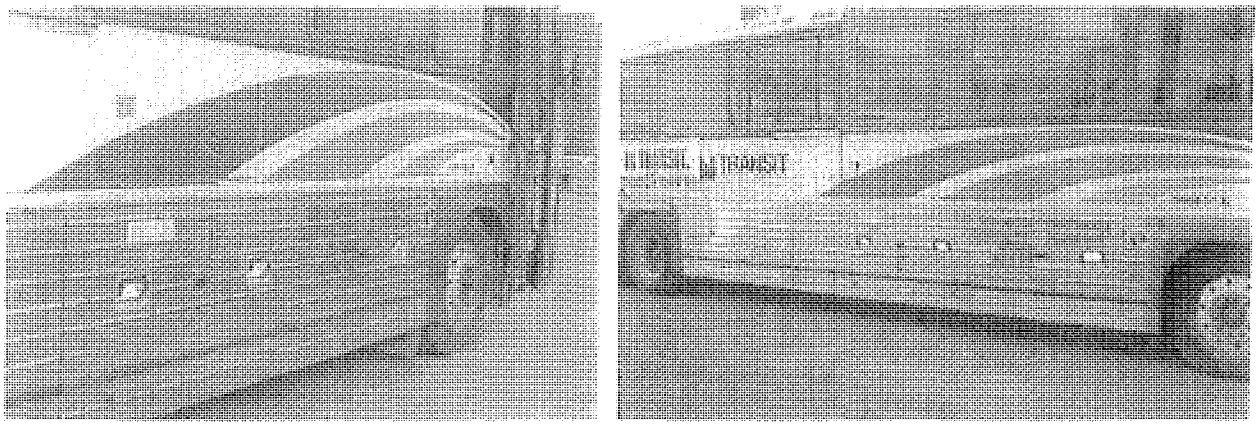


Figure 2-17. Bus curb lights.

Table 2-11. Applications of bus stop location planning and bus stop design.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
Monitoring, relocation, and removal of bus stops	• To identify bus stop locations that lead to unsafe behaviors • To identify bus stop locations that improve the visibility of pedestrians • To relocate or remove stops that are unsafe	Agency monitors bus stops and removes those stops that are creating unsafe pedestrian behaviors A bus stop committee is composed of safety representatives and police officers. The committee looks at bus stop locations. They look at the place that will allow the bus to get into the stop safely and smoothly. They also reallocate stops to make pedestrians more visible.	Not reported Not reported
Far-side bus stops (see Figure 2-18)	To reduce collisions between pedestrians who have just alighted the bus and the departing bus	By locating the bus stop on the far side of the intersection, pedestrians who have just alighted the bus cross the street at the intersection behind the bus. This is opposed to cross at near-side bus stop, where pedestrians who have just alighted the bus cross at the intersection in front of the bus.	Highly recommended by various agencies and groups
Bollards, barriers, and striping	To keep people from being in the bus area	A line of bollards, barriers, or striping	Not reported
Stanchion lines at bus stops	To reduce pushing at crowded stops	Multiple buses lined up. Only the leader bus doors open and they would have light duty personnel assigned. They help the passengers to board. Monitor pedestrians entering bus. Once bus is loaded, the following bus moves up into lead position and then opens the doors. Passengers form lines to board.	Not reported

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."

assist pedestrians in understanding when it is safe to cross and in allowing pedestrians to obtain a sufficient gap to cross.

2.9.2.4 Bus Nubs

Bus nubs were suggested by one or more agencies and stakeholders as a possible strategy for mitigating bus-and-pedestrian collisions. A bus nub is essentially an extended version of a bulb-out that allows placement of the entire length of a bus stop adjacent to the travel lane. The primary motivations for installing bus nubs are to improve transit operations through the elimination of bus-weaving maneuvers into and out of a curbside bus stop and to reduce

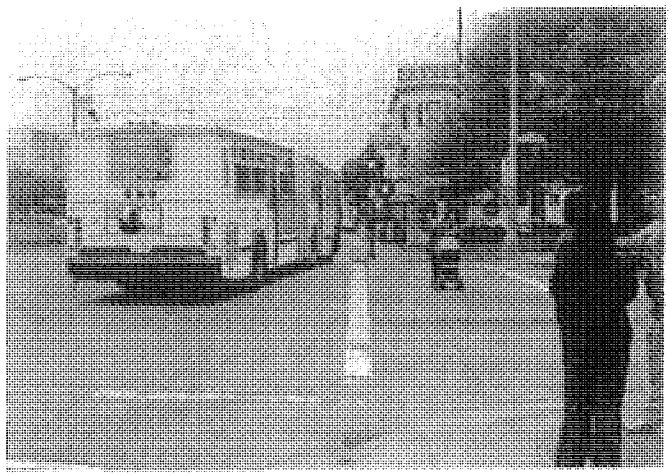


Figure 2-18. Bus stop located on far-side of intersection.

sidewalk congestion by adding sidewalk space with the bus nub design (4). In addition, bus nubs can reduce the crossing distance and time for pedestrians, make it easier for operators to see pedestrians waiting to cross the street or board the bus, slow right-turn movements, and reduce the use of bus pull-out areas for illegal parking. As these goals of nubs hit on several different issues surrounding bus-and-pedestrian collisions, nubs could be an interesting strategy that could mitigate a variety of problems associated with bus-and-pedestrian collisions. Other names used for bus nubs include "curb extensions," "bus bulbs," and "bus bulges."

The cost of constructing nubs can range from $15000 to $55000 depending upon drainage needs, utility relocation, construction materials, and patron amenities (5). If street drainage systems need to be reconfigured, there is a steel-fabricated nub with a built-in shelter that can be installed over an existing street, allowing runoff to filter underneath; this system can be used to test a nub before a permanent installation is made (6).

2.9.2.5 Painted Bus "Pads"

Two types of bus pad installations were suggested by stakeholders for mitigating bus-and-pedestrian collisions:

1. Install painted bus "pads" on the pavement to delineate to pedestrians where the bus will stop, or
2. Install landing pads to provide pedestrians with a clear, level area with which to maneuver while waiting for, boarding, or alighting buses. Landing pads could reduce the frequency with which a pedestrian might trip or get "pushed" by stationery objects (such as waste receptacles) into the roadway or an oncoming bus.

2.9.2.6 Better Bus Stop Planning

Better bus stop planning, in general, was recommended by many stakeholders. It was reported that, in some instances, bus stop placement is a "second thought" and not part of the overall planning process. Bus stops are sometimes developed as a result of citizen requests and do not include sufficient collaboration or design analysis. Older stops are often not updated to integrate with new roads, traffic volumes, or routes. Additionally, in areas where construction is ongoing or weather is an issue (e.g., flooding, snow), stops are not always accessible or visible, causing pedestrians to make unsafe and unexpected maneuvers.

2.10 Strategy 10: Bus Stop Lighting and Illumination

Bus stop lighting and illumination are important issues. The primary concern, as it relates to bus-and-pedestrian collisions, is the visibility of pedestrians waiting at bus stops. This is a frequent concern expressed by pedestrians as well as bus operators and stakeholders. Passengers worry that they will not be seen by operators and, as a result, will be passed by. In an attempt to be seen, they may inadvertently step into the path of an approaching bus trying to "flag down" the operator.

In general, the bus stop lighting and illumination strategy is moderate in cost. For example, the cost of a flashing beacon ranges from $1,200 per bus stop for solar-powered lights to $200–$300 per bus stop for non-solar-powered lighting systems. Similarly, bus stop solar illumination units average around $1,600 per stop location. Although conventional illumination systems are less expensive, they require an immediate power source. Costs rise sharply when power must be brought to the stop, potentially increasing the costs by several thousands of dollars. Non-technology solutions—such as the retro-reflective "paddles" used by one agency ($20 per paddle) and retro-reflective bus stop signs—are low in cost.

2.10.1 Applications of Bus Stop Lighting and Illumination

In response to bus stop lighting concerns, an interesting and unique mix of applications have been employed by several different agencies. These applications include passive and active systems that indicate to an operator that an intending passenger is present at a stop. These systems may be as simple and inexpensive as a flashlight or retro-reflective paddle held by the waiting pedestrian or a pedestrian-activated flashing beacon located atop a pole at a stop. Specific applications of bus stop lighting and illumination, as reported by agencies and stakeholders, are shown in Table 2-12.

2.11 Strategy 11: Other

This section first presents other strategies that have been implemented by transit agencies and stakeholders and then presents suggested strategies that could mitigate bus-and-pedestrian collisions.

2.11.1 Other Strategies

Other strategies reported by transit agencies and stakeholders include

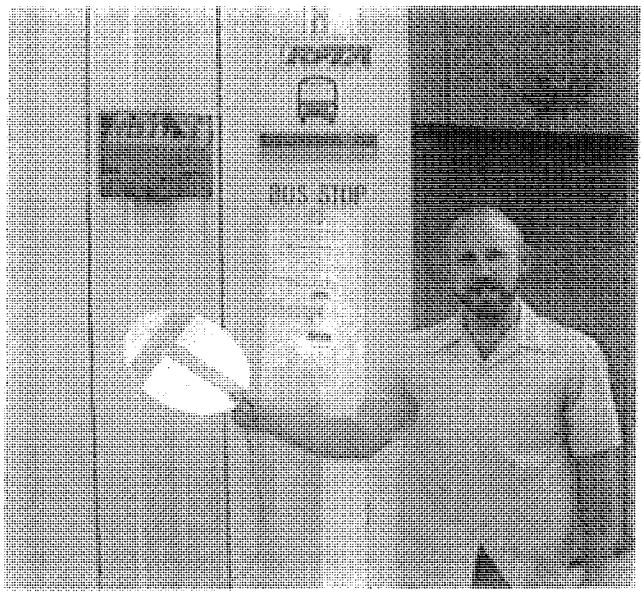
- Focus on operator health issues,
- Develop working relationship with local DOT, and
- Analysis of root cause of collisions.

These strategies and specific applications are presented in more detail below.

Table 2-12. Applications of bus stop lighting and illumination.

Application	Purpose	Description	Stakeholder Subjective Ratings and Comments on Effectiveness*
Retro-reflective paddles (see Figure 2-19)	To alert the operator of a pedestrian at the stop	A round paddle made of aluminum (1-ft diameter) with retro-reflective tape. The paddles are attached to the shelters with a 6 ft piece of cable that allows patrons to pick it up and move it around when waiting at the stop. The headlights of the bus reflect off the tape alerting the operator that someone is waiting at the stop. Drawback: new riders may not know how to use paddles.	Ratings: • 4 for reducing collisions • 5 for reducing severity • 5 on operator acceptance • 5 on public acceptance (if stop does not have them, patrons call and ask for them)
Flashing beacons (see Figure 2-20)	To alert the operator of a pedestrian at the stop	A simple flashing light is mounted on top of the stop and hooked to a user switch. Riders push the button or switch and the light flashes for about 2 minutes. One agency uses the paddles (see above strategy) at stops without power. Beacons can be used at stops with very poor sight lines. Beacons are electric or solar powered.	• Operators love it. They report that it makes their job easier and they are more alert to a rider waiting. • High public acceptance. Agency has received phone calls from the public saying how much they like it.
Retro-reflective bus stop signs	To increase the visibility of the bus stop	Signs designating the bus stop location that are high in retro-reflectivity.	Rated a 2 or 3 for reducing collisions Reportedly much better than the standard *Manual for Uniform Traffic Control Devices (MUTCD)* bus stop signs in terms of visibility
Solar-powered shelter lights	To provide light for pedestrians and bus operators	The lights put out a subtle glow rather than a glare, just enough to light the shelters. The shelters are solar powered. One drawback is that chemicals used to treat snow and ice on roads interfered with functioning of solar panels and electronics. One agency reported they had to clean them twice a day and eventually stopped using them.	Not reported
Pocket and pen lights (see Figure 2-21)	To allow a bus driver to see more easily a rider waiting at a bus stop	Small hand-held light that pedestrians can activate when walking to and from a stop and standing at the stop. Operators hand them out primarily to riders who catch the bus in dark conditions	Rated a 5 for bus stops on rural and high-speed roads although difficult to rate because agency rarely has a bus and pedestrian collision. Very high public acceptance—"people love them," according to the director of the transit agency.

* Stakeholder subjective ratings are based on a scale of 1 to 5, with 1 being "very ineffective" and 5 being "very effective" or with 1 being "very unsuccessful" and 5 being "very successful."



Source: Roaring Fork Transportation Authority

Figure 2-19. Retro-reflective paddle.

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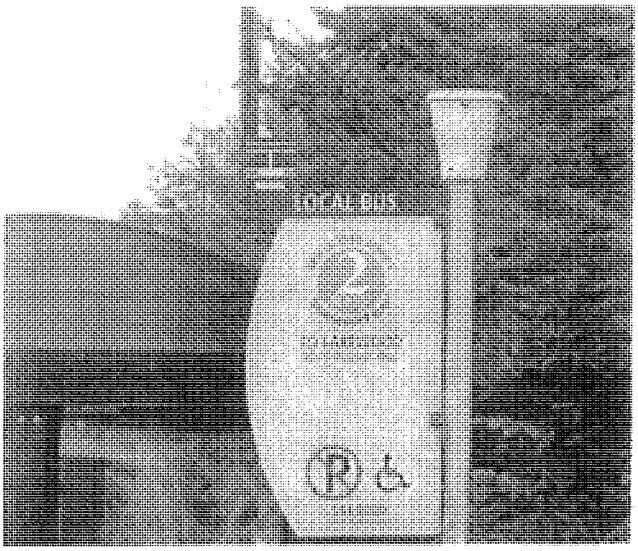
2.11.1.1 Focus on Operator Health Issues

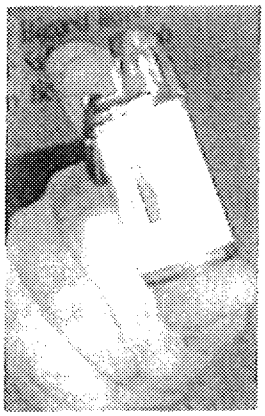
The purpose of this strategy is to improve operator performance through better health. One agency that focuses on operator health issues reported several applications of this strategy, including

- Fatigue awareness training,
- On-sight physical therapist, and



Source: Pierce Transit

Figure 2-20. Bus stop flashing beacon.



Source: Island Transit

Figure 2-21. Pocket light.

- Redesign of the interior operator compartment to reduce collisions, improve operator health by making compartment more comfortable and ergonomically correct, and decrease driver distraction (see Figure 2-22).

See Section 3.1.8 for further details on this strategy.

2.11.1.2 Develop Working Relationship with Local DOT

The purpose of this strategy is to improve pedestrian safety through a coordination of efforts. One agency reported that it meets and communicates regularly with the local DOT. For example, when the DOT makes roadway improvements, the transit agency simultaneously improves the bus stop areas.

2.11.1.3 Analysis of Root Cause of Collisions

The purpose of this strategy is to determine the root cause of collisions as there is often more than one root cause. One agency uses commercially produced software, which forces the agency to step through all potential root causes of its collisions. The software considers such things as equipment, policies and procedures, and management responsibilities.

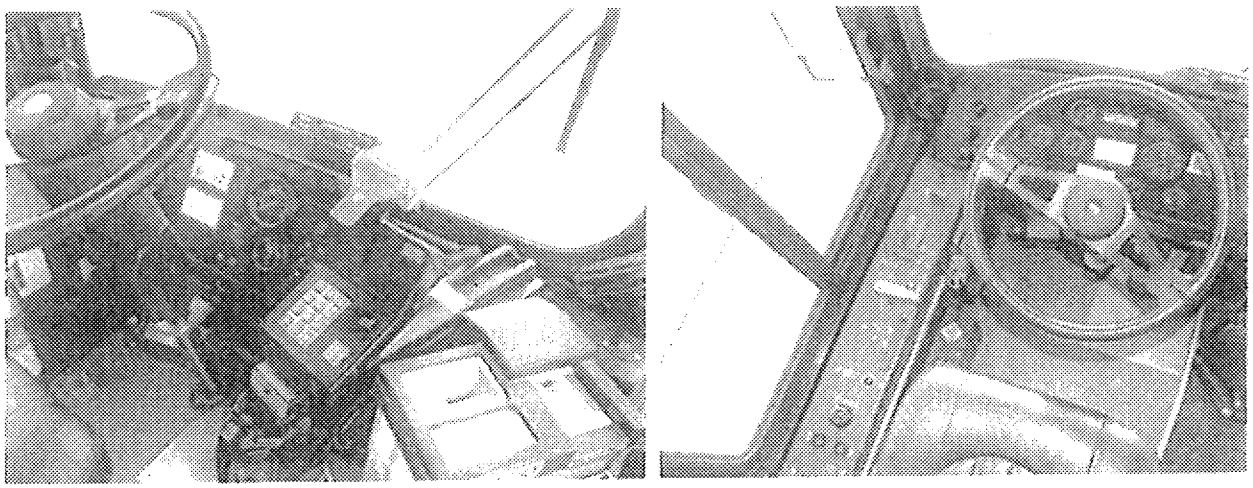
2.11.2 Other Suggested Strategies

Transit agencies and stakeholders suggested a variety of other strategies as well. These suggested strategies, along with specific applications of the strategies, are discussed in more detail below.

2.11.2.1 Enforcement

One source suggested the following as potential ways to mitigate bus-and-pedestrian collisions:

- Enforce no parking laws on bus routes (e.g., no double parking and no parking in bus pull-out areas).
- Place supervisors at problem stops to enforce safe behaviors of those waiting for the bus.



Source: Pierce Transit

Figure 2-22. Example of new interior operator compartment design.

2.11.2.2 Improve Bus Scheduling and Routing

Pedestrians and operators alike felt that bus schedules could play an indirect role in the occurrence of bus-and-pedestrian collisions. There were also a number of strategies involving bus schedules and routing:

- Bring together the scheduling department with the operators to talk about how the schedules could be improved. This would give operators the opportunity to voice concerns about routes with problematic schedules and the potential safety consequences.
- Develop and run schedules that include more time to complete routes. When operators are pushed to maintain schedules that do not allow enough time to complete, they may be inclined to rush and, as a result, may lose sight of pedestrians. If schedule times are more appropriate for the routes, buses are more likely to stay on schedule.
- Keep buses on schedule. Some felt that keeping buses on schedule (versus buses bunching at a bus stop) would help somewhat with pedestrians running after buses. If a passenger sees that all of the potential buses are at the stop, he or she will realize that it may be awhile before another bus arrives and may hurry or run to try to catch one.
- Modify bus routes to avoid high conflict situations, like right or left turns at busy pedestrian intersections.
- Run buses more frequently.

2.11.2.3 Remove Sidewalk Obstructions

A few agencies and stakeholders suggested keeping intersections and sidewalks free of obstacles and objects—such as trash receptacles or fire hydrants—near bus stop locations (see Figure 2-23). Freeing sidewalks of obstacles could have several positive benefits:

- Increasing the amount of space where intending passengers wait and other pedestrians pass by, reducing conflicts between the two;
- Reducing visual obstructions that can block operators' views of pedestrians; and
- Reducing the objects that pedestrians could trip on or run into, both of which could result in them falling into the roadway or in front of oncoming buses.

Figure 2-23. Sidewalk obstructions near bus stop.

PART 3

Case Studies

The purpose of this section of the Guidebook is to provide the reader with in-depth examples of the best-documented strategies and applications for mitigating bus-and-pedestrian collisions. In some instances, the examples are presented in the form of single-agency case studies, which detail how individual agencies have addressed pedestrian safety issues. In other instances, the examples are presented as multi-agency case studies, which compare the same strategy implemented across multiple agencies. The case studies include detailed information regarding what is known about the bus-and-pedestrian collision problem, the implementation of one or more mitigating strategies, the goals and costs of implementation, and the successful and problematic elements of strategy implementation. The 14 case studies are listed in Table 3-1.

3.1 Single-Agency Case Studies

This section discusses the single-agency case studies. These agency case studies present one or more strategies implemented by an agency, the motivation for the strategy, how the strategy was implemented, and the cost and effectiveness of the strategy if available.

3.1.1 Case Study 1: Turning Procedure Video and Training

In 2003, Cincinnati Metro developed a supplemental operator training program following a series of approximately 17 pedestrian collisions over a 14-month period. In 2002 and 2003, Metro equipped each of its buses with four video cameras. After examining the accident scene and speaking with operators and witnesses, Metro's safety specialists made educated guesses as to why the collisions occurred, but could not find a definitive answer. The operators claimed that they did not see the pedestrians. This motivated Metro's safety specialists to study the video footage from the collisions to look for clues. After reviewing the videos, they realized that many of their assumptions were incorrect. By reviewing videos from several accidents, the safety specialists found a consistent pattern and determined why these collisions were occurring. They noticed this pattern to occur when an operator pulled up as the first vehicle in the queue at a red light and then sat at the light for more than 20 seconds. In each case, the operator looked at the crosswalk when pulling up to the light but after waiting for more than 20 seconds, the operator was no longer monitoring the crosswalk, but had become focused on traffic. When the light turned green, both the operator and the pedestrian immediately started into the intersection.

In response, Metro developed the following mandatory six-step turning procedure:

1. Activate your turn signal as you approach the intersection.
2. When pulling up to a red light as the first vehicle in line, stop at the marked stop line before the marked crosswalk. If there is no marked stop line, stop at least 6 feet back

Table 3-1. Case studies (index table for Part 3).

Case Study Number	Case Study Name	Section
Single-Agency Case Studies		
1	Turning Procedure Video and Training	3.1.1
2	Pedestrian-Focused Operator Training	3.1.2
3	Multi-Faceted Approach to Improving Pedestrian Safety	3.1.3
4	Multi-Faceted Operator Safety Program	3.1.4
5	Bus Curb Lights	3.1.5
6	Driving Simulator	3.1.6
7	Safety Impact Team	3.1.7
8	Focus on Operator Health Issues	3.1.8
Multi-Agency Case Studies		
9	Left- and Right-Turn Training Videos	3.2.1
10	Public Outreach Programs	3.2.2
11	Safety Posters and Flyers for Operators	3.2.3
12	Use of Bus Cameras to Determine Cause of Collision	3.2.4
13	Left-Side Mirror Design and Placement	3.2.5
14	S-1 Gard	3.2.6

from the crosswalk. All four corners of the intersection should be clearly visible from the driver's seat.

3. Continually scan the intersection as you wait for the light to change. Pay particular attention to the appropriate crosswalk and corners that will be affected by your turn. **Do not "creep up" while waiting for the light to change. Stay still! Do not jump the green light!**
4. When the light changes to green, *wait 2 seconds* before moving into the intersection. While waiting, look at the appropriate corner and crosswalk and look for any pedestrians.
5. After the 2-second delay, slowly accelerate into the intersection and begin your turn. When you come to the crosswalk you are turning into, *check around all blind spots, stopping if necessary* to make sure it is clear.
6. Once you have determined it is clear, safely complete your turn.

The supplemental training given in 2003 lasted 1 hour and consisted of a short video demonstrating the procedure for making safe left and right turns. The training also included a presentation that described how Metro safety specialists determined through bus videos why operators were striking pedestrians. During the training, they also show the operators the video of bus-and-pedestrian collisions so that they believe the reasons given for the accidents. In addition, operators are warned to "use extreme caution when turning, even when pedestrians don't have the right-of-way," "expect the unexpected," and "check and recheck . . . make whatever effort is necessary to overcome potential blind spots. . . ." Stickers are also placed on all fareboxes, reminding operators to look for pedestrians.

This supplemental training has since been incorporated into new-driver training, and reminders about the turning procedures are put out every 6 months for the operators. The agency's safety specialist rates the new training program as very effective in reducing collisions. In 2006, the agency had two bus-and-pedestrian collisions: a reduction of approximately 85% from before the training program.

3.1.2 Case Study 2: Pedestrian-Focused Operator Training

In the fall of 2003, Portland's TriMet developed a 2½-hour defensive-driving module focused on pedestrian safety in response to a fatal pedestrian collision that occurred when a bus made a

left turn. The module was part of an 8-hour class given to 837 of their approximately 1,250 operators between March 16 and November 29, 2004, for a total of 110 classes. This class was part of TriMet's 2004 Operator Training Campaign. TriMet holds special training campaigns for operator professional development about once a year on topics ranging from security awareness, to operator fatigue, to serving customers who are elderly or disabled. The pedestrian safety module developed in 2003 is now part of TriMet's ongoing defensive-driving training.

The pedestrian safety module included defensive-driving material from the Smith System, commercially produced driver safety training, crosswalk safety, line of sight, and the effective use of eyes. The safety module taught operators how the eye works and the need for the driver to keep his or her eyes moving so that stares do not develop and peripheral vision does not decrease. An additional exercise includes writing on a flip chart all of the things that keep operators from using their eyes properly: from drinking coffee to cell phone usage. TriMet reviewed with operators a recent change to an Oregon pedestrian safety law stating that automobiles must stop for any pedestrian in a crosswalk in the driver's lane or an adjacent lane. The module also went through specific locations in the region where operators need to be extra cautious and to reduce speed for pedestrians such as service stops, transit malls, or any place where pedestrian clearance is reduced. Operators were taught a six-step procedure for exiting service stops, internally referred to as "Checking Left–Right–Left." The six steps are shown below. If a driver is delayed before exiting, the driver must re-do Steps 4, 5, and 6:

1. Check doorway for clearance.
2. Close doors, but keep hand on the door control and eyes on doorway until fully shut.
3. Check central mirror for passenger stability.
4. Check left mirror for traffic.
5. Check back to right for pedestrians and other hazards that may have come up—also check right-side blind spots.
6. Check left again in mirror and blind spots.

The module also included two exercises for demonstrating blind spots to operators. For the first exercise, operators are asked to stare at the center of a card containing a grid. As the driver pulls the card toward his or her face, a red dot on the right side of the card disappears. The operators find this exercise revelatory and great fun. For the second exercise, the operators sit in the driver's seat of the bus and are asked to only look at the left mirror as if they were exiting a service stop. The instructor asks the driver to tap on the horn when the driver sees the instructor pass out of their line of sight as the instructor moves across the front of the bus from curbside to street side and then again a second time when the instructor reappears in their vision from out of their left blind spot. The instructor then quickly runs at an angle up to the left front corner of the bus. The instructor is typically out in front of the bus before the driver can honk the horn a second time, demonstrating the dangers of the blind spot on the left side of the bus.

During the 2007 operator professional development training session, half of the day was dedicated to a defensive-driving module that focused on a review of key skills, used video clips of difficult driving situations in the area, and asked operators to spot potential hazards including pedestrian conflicts. Tri-Met has not measured the effectiveness of this program in decreasing pedestrian and bus collisions.

3.1.3 Case Study 3: Multi-Faceted Approach to Improving Pedestrian Safety

To address the bus-and-pedestrian collision problem, the Washington Metropolitan Area Transit Authority (WMATA) implemented a comprehensive set of actions to improve the safety

of pedestrians with regard to transit buses. The actions build on the concept of "Education, Engineering, and Enforcement." The actions included the following:

- Assessing high-accident routes and locations to reduce the risk of accidents at these locations,
- Contacting bus operators,
- Establishing a new bus operator training module on pedestrian safety, and
- Installing flashing amber lights atop buses to make buses more visible.

3.1.3.1 Pedestrian Safety Design

The District of Columbia DOT (DCDOT) collaborated with WMATA in the identification and evaluation of high-accident intersections within the District of Columbia. Intersection selection was based on number of pedestrian fatalities, injuries, and other damage of all types and not just those involving transit buses. The preliminary list was then compared with the top 100 crash intersections to determine any correlation with pedestrian accidents. No correlation was found. For each site identified, site conditions, the vehicle and pedestrian environment, traffic control devices (including signal phasing), road alignments, transit interface, land use, traffic operations, vehicle speed, parking, lighting, and other factors were evaluated.

As a result of the study, 12 locations were identified for improvement. The improvements varied from location to location. In general, the improvements included

- Updating crosswalk striping to ladder-style striping;
- Modifying pedestrian signal timing;
- Replacing all flashing WALK pedestrian heads with the solid WALK pedestrian head;
- Installing fluorescent-yellow/green pedestrian signs (W-11-2) and advance warning signs on all approaches;
- Upgrading light intensity;
- Repairing sidewalk deficiencies;
- Relocating pedestrian signal heads on pole closest to the relevant crosswalk on all corners;
- Relocating the bus stop;
- Renewing pavement markings; and
- Installing pedestrian informational signing at pedestrian crossings.

3.1.3.2 Outreach

Before starting work, bus operators received a handout reminding them to give particular care to pedestrians crossing streets and of defensive-driving techniques. Posters with similar reminders were placed at all bus facilities. Additionally, WMATA safety representatives solicited suggestions on what can be done to improve pedestrian safety. This effort resulted in the development of a new pedestrian safety training program for bus operators and modifications to mirror placement.

3.1.3.3 Training Strategy

WMATA recently started a bus operator refresher training course that focuses on pedestrian safety in an effort to improve the overall safety of WMATA Metrobus operations. Content for the course, Street Smart, was developed with input from bus operators, superintendents, street supervisors, Transit Police, safety department staff and the DC DOT. Street Smart is a full-day training course that combines classroom training with a field trip to a top pedestrian accident location to raise awareness and give operators a pedestrian's perspective. The field trip allows bus operators to walk the area and observe the behavior of pedestrians, bicyclists, and motorists. A worksheet is used to tally certain behaviors including jaywalkers, pedestrians standing on the curb line, bicyclists or vehicles running red lights, reckless drivers, vehicles blocking intersections, distracted drivers using cell phones, discourteous drivers blowing their horns, cursing or yelling, and drivers turning right in front of stopped buses. The course aims to raise the aware-

ness of operators when it comes to addressing traffic safety, pedestrians, and operator alertness. It also reinforces standard operating procedures.

3.1.3.4 Mirror Placement

As a result of the bus operator outreach, a pilot program was launched to determine the placement of the side mirrors. Buses were equipped with mirrors at varying heights and brought to the operating bases for evaluation by bus operators. Based on operator input, mirrors were lowered. Currently, WMATA is evaluating a bracket that permits an operator to adjust the height of the mirror.

3.1.3.5 Passenger Safety Lights

In an effort to improve the visibility of passengers waiting for a bus in the dark during early morning and evening hours, the WMATA Safety Department purchased safety flasher lights for distribution by bus operators to passengers who board buses in poorly lighted areas. When waiting for a bus, intending passengers activate the red flashing light by pushing a button and then clip the light onto bag straps or clothing. The light is designed to help bus operators and other motorists spot pedestrians who are crossing a street or waiting for a bus in the dark. The lights include the message "Look Before You Cross."

3.1.3.6 Roof-Mounted Strobe Lights

WMATA installed strobe lights on top of buses as part of a pilot program to improve pedestrian safety. The yellow warning strobe lights were designed to help pedestrians and motorists spot WMATA buses on city streets and to provide additional lighting for early morning and evening bus users. Initially, strobe lights were affixed to the buses. However, an early evaluation found the lights to be too bright and non-directional. The lights were replaced with a LED light strip that was visible only to those viewing the front end of the bus. The lights within the strip were designed to flash from left to right. The effectiveness of the strip is currently under evaluation. Because of motor vehicle regulations within Virginia and Maryland, use of the light strip is limited to DC. WMATA is working with Virginia and Maryland to grant an exemption to transit buses.

3.1.3.7 Enforcement

The safety of pedestrians boarding and exiting buses has been a particular concern in the DC area. A new law, Protection Bus Safety Amendment Act of 2006, specifically prohibits a motor vehicle driver from passing to the left and pulling in front of a bus in order to make a right turn when a bus is at a bus stop or at an intersection to receive or discharge passengers.

3.1.4 Case Study 4: Multi-Faceted Operator Safety Program

One transit agency has implemented a multi-faceted driver safety program that includes driver training classes, accident awareness sheets posted in the operators' room, bi-annual safety meetings, and safety reminders broadcast over the radio system. About 5 weeks of classroom instruction and behind-the-wheel training is given to operators when they join the agency. The agency purposefully has the operators navigate through the toughest pedestrian areas in the city and teaches them how to handle tough situations such as sun obscuring the view of the crosswalk.

Before being released from training, the Director of Risk Management spends 3 hours with the drivers, discussing traffic accidents, passenger injuries, and pedestrian-and-bus collisions. The Director of Risk Management reviews with the drivers all of the bus-pedestrian collisions that have occurred within the last couple of years, including details on how the collisions happened and what drivers can do to prevent them. Operators learn about monetary costs of pedestrian collisions and are reminded that a bus-and-pedestrian collision victim could be a family member. The director emphasizes the importance of maintaining a safe speed even when the drivers

get behind schedule. The transit agency also holds retraining for drivers who have had accidents and for all drivers every 2 or 3 years. The Director of Risk Management reports that with as much pedestrian traffic as they have at the downtown centers, their low rate of pedestrian collisions shows that the training is working.

When a bus accident occurs involving a pedestrian or another vehicle, the transit agency posts a bulletin in the operators' room that describes the accident including location and date, includes photos, and provides any recommendations that were made for preventing the accident. This strategy was rated a 4 in operator acceptance and reducing collisions. The Director of Risk Management notes that the bulletin does not reach all of the operators since some of them do not go into the operators' room.

Annually, the Director of Risk Management posts a street map in the operators' room showing the location of all types of bus accidents that occurred in the previous year. This alerts the operators to locations where extra caution is needed. The transit agency holds approximately two company-wide safety meetings a year where operators and other employees discuss accidents and strategies for preventing them.

The bus dispatchers also broadcast safety reminders over the driver radio four to five times a day. The messages pertain to current conditions such as, "It is raining, watch your speed," or the dispatcher will advise the operators of the location of a parade and tell them to watch for pedestrians.

3.1.5 Case Study 5: Bus Curb Lights

In response to nighttime accidents involving pedestrians running after and falling under a bus, New Jersey Transit began to use buses with several lights along the lower right side of the bus, referred to as "curb lights" (see Part 2, Figure 2-17). The lights are activated during the day and night by opening the bus door. To give the bus enough time to pull away from the curb, the lights stay on for 16–20 seconds after the door has closed. The curb lights were intended to increase operators' view of pedestrians running up alongside the bus at night because several urban areas along New Jersey Transit bus routes had moderate-to-poor lighting.

New Jersey Transit began ordering buses with curb lights in 1998 as a small pilot project, and by fall 2002, almost all New Jersey Transit buses had the lights. The curb lights are built into the specifications for new buses.

New Jersey Transit estimates that the curb lights have been very effective in reducing accidents involving pedestrians running alongside and falling under the bus at night. Since curb light installation, New Jersey Transit has nearly eliminated that type of accident at night. The curb lights have not impacted this type of accident during the day, but this has not been as much of an issue as the nighttime accidents.

Bus curb lights were rated a 5 in reducing the frequency and severity of accidents and reducing near misses involving the pedestrian moving along the right side of the bus and falling under the bus as it is pulling away at dark. They were rated as very effective in reducing claims. The curb lights were well received by the operators and given an acceptance rating of 5 out of 5 by the Director of Safety. Public acceptance was hard to evaluate, but was estimated as very high. The cost of the hardware and the installation performed during the manufacturing of the bus was estimated roughly at just under $1,000 per bus.

3.1.6 Case Study 6: Driving Simulator

In North Carolina, Charlotte Area Transit System (CATS) began using a driving simulator in September 2006 as a training tool in an effort to reduce all types of accidents, including pedes-

trian accidents. CATS purchased one virtual reality simulator and six driving assessment seats. The virtual reality simulator allows the operators to sit in a bus seat behind a bus dashboard and feel the bumps and movement that would normally be associated with driving a bus. It allows the trainers to alter driving conditions, such as weather, and to build their own scenarios. All new operators, operators involved in an accident, and operators who have been out for a long period of time receive training on the virtual reality simulator. CATS intends to train each driver on the simulator once a year. A variety of scenarios are used with the virtual reality simulator including potential collisions with pedestrians. The virtual reality driving simulator has been very well accepted by the operators and was rated a 5 out of 5 for driver acceptance. CATS uses its driving assessment seats to screen operators before hiring and to assist the agency in hiring highly skilled operators since the driving assessment seats measure reaction time as well as other skills that were previously difficult to assess. The virtual reality simulator cost $200,000, and the six driving assessment seats cost a total of $180,000. The General Manager for Safety and Security at CATS noted that the simulator will pay for itself if it prevents even one accident.

3.1.7 Case Study 7: Safety Impact Team

The New Jersey Transit Director of Safety is part of a safety impact team (SIT)—a collaborative effort among New Jersey DOT (NJDOT), local municipalities, public safety, engineers, consultants, the American Automobile Association (AAA), and New Jersey Transit. Based on crash information provided by NJDOT, the team evaluates specific roadways or corridors that have been problematic. Crash data are separated so that the team can see locations of bus and pedestrian collisions. Each corridor that SIT evaluates is a 3-day project. The corridors range from 1 to 3 miles in length. On the first day, the SIT members study the crash data of the corridor to get a better idea of where they should spend their time during the remaining 2 days. They look at the roadway geometry, pictures, traffic counts, pedestrian volumes, bus volumes, and frequency of buses. On the second day of the evaluation, the team goes into the field to evaluate roadway design and to find the reasons for the collisions. On the third day, the team prepares recommendations for short-, medium-, and long-term improvements in three categories: education, enforcement, and engineering. NJDOT and the other stakeholders work to implement the strategies.

Examples of recommended applications that would help to mitigate bus-and-pedestrians collisions include

- Relocate bus stops to a better location with curb cut-outs.
- Install sidewalks from pedestrian's origin to bus stop.
- Implement pedestrian countdown signals, pedestrian crossing push buttons, and roadway markings.
- Use fences and other barriers to control pedestrian access to the roadway so that pedestrians cross in designated locations.
- Install pedestrian signage such as YIELD TO PEDESTRIANS that is visible at night.
- Remove obstructions such as trees and overgrown brush that could impede an operator's view of pedestrians.
- Improve overhead lighting especially near bus stops.
- Enforce speed limits and no parking at bus stops.

3.1.8 Case Study 8: Focus on Operator Health Issues

In Seattle, Pierce Transit has been teaching a 2½-hour segment on fatigue awareness to operators, and it has been a huge success. They have had about 30 operators diagnosed with some type of sleep disorder—most commonly, sleep apnea. The fatigue awareness training includes a presentation with three videos: circadian rhythms, micro sleep, and a comparison showing the

difference between alcohol and fatigue. The goal of this training module is to increase driver safety and prevent all types of bus accidents. Additionally, the agency wants drivers to have better lives. The Safety and Training Manager at Pierce Transit rated the overall training a 5 for reducing pedestrian-and-bus collisions, but only 3 for reducing collision severity. It is too early to estimate the effectiveness of the fatigue awareness training.

Pierce Transit, an agency with an aging workforce, also has an on-sight physical therapist who works with operators on job-related injuries. Operators can schedule appointments with the physical therapist. This program began about a year ago and has been very popular with operators. It was rated a 5 on operator acceptance. The Safety and Training Manager believes that the physical therapy has had a positive impact on safety because operators are in better condition although the program is so new that there is no supportive evidence yet.

Pierce Transit has also taken into account driver focus and health by working with a bus manufacturer to re-design the interior operator compartment of the bus (see Part 2, Figure 2-22). Currently, about 20% of their fleet has this new design. The re-design includes moving the controls that are most commonly used to a location that is ergonomically correct and within easy reach.

TriMet also presented training modules on security and driver fatigue during its 2006 Operator Training Campaign.

3.2 Multi-Agency Case Studies

This section presents the multi-agency case studies. These case studies describe common applications across a number of different agencies and how the applications compare across the agencies.

3.2.1 Case Study 9: Left- and Right-Turn Training Videos

Motivated by a pattern of pedestrian incidents involving left turns at a downtown intersection, one agency created an in-house training video to demonstrate to operators proper left-turn procedures and to raise awareness of the potential dangers of that particular intersection. The video provided an over-the-shoulder view of a driver making a left turn at the target intersection using a bus in the agency's fleet. Cost effectiveness was the primary advantage of this strategy as reported by the agency. It took approximately 8 hours to create. While there have been no statistical analyses, they have seen a reduction of collisions at that site and rated the effectiveness of the video a 4 out of 5.

In the early 1990s, Metro Transit in Minneapolis created an instructional video for operators that focused on blind spots encountered while making right turns, especially the blind spot created by the middle of the passenger door. In response to collisions, in 2000 Metro Transit augmented the video to include training in avoiding pedestrian collisions during left turns. The video stresses the importance of bobbing and weaving in the seat to see around blind spots and of overall awareness of pedestrians. The video is about 6 minutes in duration and was developed in house. The cost is unknown, but Metro Transit estimates that it was developed in less than 16 hours. The video has been shown in the Metro Transit operators' room four times since 2000. Each showing is over a 3-day period where the 6-minute video loops on a TV screen and an instructor is present to answer questions from the operators. Metro Transit would like to make this an annual event. The video is also part of new operator training. When the video was first shown to operators, it was rated a 4 in effectiveness in reducing pedestrian-and-bus collisions. Six years later, Metro Transit believes the video's effectiveness has decreased to a 2 because it no longer draws the attention of the operators. There were fewer pedestrian-and-bus

collisions after the video was released, but the decrease could likely be a reaction by the operators to recent fatalities.

Transit Mutual Insurance of Wisconsin developed a short training video to communicate to bus operators the need for extra caution during right and left turns. The purpose of the video is to reduce the number and severity of bus-and-pedestrian collisions occurring during left and right turns. The video was produced in response to a finding by Transit Mutual that left turns were the main contributing factor to pedestrian accidents in Wisconsin. During 2000–2003, there was an increase in the number of pedestrian-and-bus turning claims in Wisconsin. Right turns were included in the video because findings in Michigan indicated that right turns were problematic. The video was filmed, edited, and produced by a production company, and the script was written by Transit Mutual's in-house counsel. Transit Mutual Insurance received a grant from Wisconsin DOT to cover 80% of the cost of this video along with a couple of safety-oriented videos.

The video has been distributed to the directors of all 19 member agencies of Transit Mutual, but the usage of the video varies by transit agency. Some agencies use the video as part of new-hire training, and other agencies require all operators to view the video. Transit Mutual has received very positive feedback from its member agencies, and operators have reported that the tips on the video are helpful. The impact the video has had in reducing pedestrian-and-bus collisions is unknown. There has been a decline in pedestrian incident claims since the film was produced, but this could be due to a number of factors.

3.2.2 Case Study 10: Public Outreach Programs

In Indiana, the Greater Lafayette Public Transit Corporation has taken an aggressive approach to teaching college students about bus safety. The majority of the Greater Lafayette Public Transit Corporation service is on the campus of Purdue University, and approximately 70% of its riders are students. Incoming freshmen arrive 1 week before classes start for orientation, and during this time, the transit agency offers a 1-hour class on the Purdue University campus titled Transit 101. According to Greater Lafayette's Manager of Operations, it is one of the more popular offerings during orientation and typically draws approximately 200 students.

Given by the Greater Lafayette Manager of Development, Transit 101 is a presentation on how to safely use the bus system. The presentation brings students' attention to the pitfalls of cell phone and portable music player use and the need for students to be aware of their surroundings when walking around. Since some of the students have never taken a bus prior to coming onto campus, the manager of operations instructs the students to board the bus at designated stops and what to do when getting off the bus. The Manager of Operations at Greater Lafayette believes that Transit 101 has been successful as evidenced by the absence of pedestrian-and-bus collisions on a pedestrian-heavy campus environment. Transit 101 was rated a 5 for its effectiveness in reducing collisions and severity of collisions and was rated a 4 for its effectiveness in reducing near misses. It is highly accepted by the public (rated a 5 out of 5), and the cost to the agency for Transit 101 is very minimal.

Some agencies conduct bus safety outreach programs at local schools. Since 1988, Washington State's Island Transit has gone to local elementary schools to teach 3rd and 4th graders about public transit safety in an interactive manner using music, an Island Transit bus, and a puppet named Buster. Island Transit targets elementary schools for safety education because a major segment of their riders are children taking public transit to and from school. Another agency provides an outreach session to schools that make a request for one. Agency representatives explain to the students the differences between a bus and a family vehicle including a larger turning radius, a pivot point at the back end, and longer stopping distance. The agency

receives approximately one request per year and estimates public acceptance of the sessions at about a 3 or 4 out of 5.

3.2.3 Case Study 11: Safety Posters and Flyers for Operators

Several transit agencies reported the use of posters and flyers to encourage safe driving around pedestrians and to communicate important pedestrian safety procedures to bus operators. As mentioned in a single-agency case study above, one agency posts bulletins to alert operators to past accidents in order to learn from past experiences. CATS hangs safety bulletins reminding operators to be aware of pedestrians crossing the street in its two transit stations.

Seattle's King County Metro developed a themed safety campaign each week for its operators and refers to the program as the "Outhouse Journal." Banners are hung and flyers are posted on the back of restroom stall doors to communicate each week's safety message. The themes commonly have a pedestrian focus and use slogans such as "Track them once, Track them twice." The idea behind this particular message is that even before entering an intersection, operators should be scanning for people who may want to cross and then upon entering the intersection, operators should look to see where each of those pedestrians went. The cost is minimal since the flyers and banners are made in house. One of Metro's safety administrators reports that operators notice the signs and appreciate the reminders, but realizes that behavior is likely impacted with flyers posted once a week, so Metro works to saturate the operators with safety messages in order to affect change.

Pennsylvania's Port Authority of Allegheny County uses general notices posted in the operator room to communicate to operators important rules to follow. The paper notices are posted on a "hot board" located in the operator room with other new announcements. The notices are collected in a binder kept in the Instructor's office. The rules highlighted by the notices pertain to yielding to pedestrians, operating in congested areas, clearing off the dash board, and others. These rules are enforced by road supervisors who monitor operators and all road activity. Discipline is issued to employees who are caught not following rules specified in the general notices.

When a bus accident occurs involving a pedestrian or another vehicle, one agency posts a bulletin in the operators' room that describes the accident including location and date, shows photos, and provides any recommendations that were made for preventing the accident. This strategy was rated a 4 in operator acceptance and reducing collisions. The Director of Risk Management notes that the bulletin does not reach all of the operators since some of them do not go into the operators' room. The bus dispatchers also broadcast safety reminders over the driver radio four to five times a day with messages pertaining to current conditions such as weather and special events.

3.2.4 Case Study 12: Use of Bus Cameras to Determine Cause of Collision

In addition to Cincinnati Metro's use of video to determine what was causing turning collisions with pedestrians, three other transit agencies use or have used video cameras on their buses to aid in determining the cause of an accident. Although one agency's primary purpose for installing cameras was to assist the agency in defending itself against claims in accidents and onboard security, the videos have been useful in determining the causes of bus-and-pedestrian accidents. Video clips of accidents from the six cameras on Miami-Dade Transit's buses are used as a training aid for other operators. The video enables Miami-Dade Transit in making recommendations on how to avoid accidents in the future. The cameras used on CATS buses have been helpful in determining the actual series of events during pedestrian-and-bus collisions and helps

to keep operators in check. One agency reported the cost of outfitting a bus with six video cameras to be approximately $12,000 per bus.

3.2.5 Case Study 13: Left-Side Mirror Design and Placement

One agency has worked with a bus manufacturer to design new left-side view mirrors to reduce the blind spot caused by the mirrors. This agency experiences a number of collisions with vehicles and pedestrians during left turns in which the operators reported not seeing the vehicle or pedestrian. The two left-side mirrors on the buses involved in the accidents were held in a single plastic casing that enlarged the blind spot caused by the mirrors. In one of the configurations, it was reported that the operator could lose an entire semi-truck on the left behind a side-view mirror when stopped at a traffic light. The agency was able to develop prototype mirrors for the left side that were separated, not in a single plastic panel, and brought down below the driver's line of sight. The flat mirror was also reduced in size. The agency began retrofitting some of their buses with these mirrors 2 years ago and hopes to have them on their entire fleet within the next 2 years. According to the Manager of Safety Training and Security, the operators are fighting to drive the buses with the re-designed mirrors because they like them so much better. The effectiveness of the mirrors was rated a 4 out of 5 in reducing pedestrian-and-bus collisions as there has been a reduction in the occurrences of accidents where the driver did not even see the pedestrian or car; however, the mirrors have not been used enough to gather sufficient data. Driver acceptance was rated a 5. The cost for the mirror including labor for installation is estimated at under $50 per bus.

3.2.6 Case Study 14: S-1 Gard

The S-1 Gard is a device designed to reduce the severity but not the likelihood of injuries resulting from accidents involving pedestrians and bicyclists coming in contact with the rear right wheels of transit buses only. Further research is needed to determine its effectiveness.

PART 4

Important Considerations for Improving Pedestrian Safety Around Transit Buses

Parts 1 through 3 of this Guidebook provide a presentation of strategies for mitigating bus-and-pedestrian collisions in several different ways. Part 1 of this Guidebook presents some contributing factors to the four primary types of bus-and-pedestrian collisions, as well as a list of strategies for mitigating collisions. Part 2 presents strategies and provides detailed information about particular agency and stakeholder applications of each strategy. Part 3 presents case studies of actual situations in which agencies have implemented strategies to mitigate pedestrian collisions; why and how the strategies were selected; and the results, if any, of the implementation.

This fourth section of the Guidebook presents a discussion of pedestrian-and-bus safety from a more top-down, holistic approach. First, this section discusses contributing factors that are not necessarily directly linked to one of the four primary types of bus-and-pedestrian collisions. While not directly linked to a particular collision type, the contributing factors discussed here were reported by transit agencies and other stakeholders as playing an important contributing role in bus-and-pedestrian collisions. By understanding the indirect links these factors have to bus-and-pedestrian collisions, agencies and stakeholders can develop mitigation strategies that could not only improve pedestrian safety, but that also might result in an overall improvement in safety. Second, this section looks at how the combination of two or more strategies presented in this Guidebook can add to the potential for success in reducing bus-and-pedestrian collisions and in improving overall safety.

4.1 General Factors that Contribute to Bus-and-Pedestrian Collisions

Part 1 of this Guidebook discussed factors that contribute to each of the four primary types of bus-and-pedestrian collisions. However, during the research process, transit agencies and stakeholders reported a large number of contributing factors they felt were important, but that could not necessarily be directly linked to one of the primary four collision types. Rather, these contributing factors could contribute to any of the collision types and even to collisions with other vehicles. These factors include

- Operator distraction, multi-tasking, and fatigue;
- Pedestrian inattention and distraction;
- Tight or problematic schedules;
- Timing/scheduling of buses;
- Lack of training and follow-up enforcement by transit agency; and
- Lack of pedestrian friendly environments.

Understanding the indirect links that these general issues have to bus-and-pedestrian collisions can foster the development of mitigation strategies. These strategies, then, are not only

likely to reduce the occurrence of bus-and-pedestrian collisions, but are also likely to reduce other types of collisions, resulting in improved overall safety. Each of these contributing factors is discussed in more detail below.

4.1.1 Operator Distraction, Multi-Tasking, and Fatigue

The issue of operator distraction was raised by transit agencies and different stakeholders, including operators. Operator distraction does not necessarily suggest negligence on the part of the operator; distractions were often linked to the "stressful and distracting" environment in which the operators work, as a variety of things are constantly competing for the operators' attention (e.g., vehicle traffic, passengers, on-board electronic equipment, inclement weather, and poor lighting). It is a common belief amongst the agencies and stakeholders participating in this research that the occurrence of collisions with pedestrians during left-turns is linked to the fact that the operators must focus on finding a gap in oncoming traffic to make the turn and, while doing so, lose sight of pedestrians in the crosswalk.

Exacerbating the problem of a distracting environment is the issue of operator multi-tasking. An operator's workload includes performing multiple physical and cognitive duties from simple driving behaviors, to implementing procedures unique to bus operations, to providing good customer service and monitoring a route schedule. While the issues of distraction and multi-tasking are somewhat overlapping (operators are sometimes distracted due to their multi-tasking), strategies for countering operator multi-tasking may be different than strategies for countering operator distraction; therefore, it is important to note the distinction of the issues, as well as the overlap.

Bus operator fatigue was also reported as a potential contributing factor to bus-and-pedestrian collisions by a number of agencies and stakeholders. Fatigue is a result of both time spent driving and length of wakefulness (i.e., amount of time since the operator last slept). When overly tired, humans do not function optimally, which can result in slower reaction times and errors or misjudgments that they otherwise may not normally make in the same situation.

Analysis of the collision data showed that operator time on duty does in fact appear to play a role in the occurrence of bus-and-pedestrian collisions. The length of time that the operator was on duty was reported in 94 of the incident records. As shown in Figure 4-1, the number of inci-

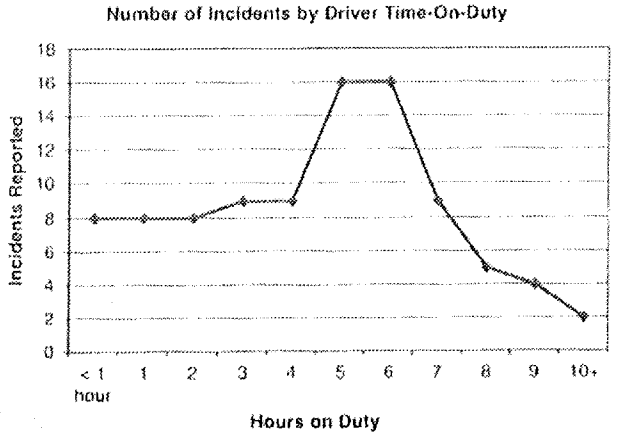


Figure 4-1. Number of bus-and-pedestrian collisions by driver time on duty.

dents compared with the number of hours on duty remained steady (at about 8 to 9 incidents) for every hour worked until 5 hours. After 5 hours on duty, the number of incidents almost doubled. At 5 and 6 hours on duty, the number of incidents jumped to 16. Above 6 hours on duty, the number of incidents begins to fall. This drop is most likely due to the fact that there are fewer shifts that extend beyond 6 to 7 hours.

Operator distraction, multi-tasking, and fatigue could lead to any type of collision; however, the relevance of discussing these issues in this Guidebook is that pedestrians are the most vulnerable road users. Due to pedestrians' size (as compared with automobiles) and the speed at which they move relative to a bus, operators—if distracted or overly tired—are more likely to overlook a pedestrian than they are to overlook another vehicle. For example, a distracted or multi-tasking operator may just happen to catch a moving vehicle in his or her peripheral vision in enough time to avoid a collision. Due to the size and movement of pedestrians, in the same situation the pedestrians are far less likely to catch the eye of the operator before a collision occurs.

Therefore, the environment in which the operator operates, the tasks he or she is asked to manage, and the number and combination of hours and days an operator works in a week are important issues to consider when thinking about pedestrian safety. One suggested strategy was to minimize on-board operator tasks such as eliminating the need for operators to collect fares by using smart cards.

4.1.2 Pedestrian Inattention and Distraction

Bus-and-pedestrian collisions involve two parties: the bus operator and the pedestrian. While bus operator distraction, multi-tasking, and fatigue can lead to collisions with pedestrians, pedestrian inattention and distraction can also lead to collisions. Getting pedestrians to understand, appreciate, and respect their role in their own safety is an important part of reducing the occurrence of bus-and-pedestrian collisions. Pedestrians are often times distracted by the use of cell phones and other portable electronic devices. For instance, pedestrians who use earphones may not be paying attention to their surroundings; however, they also may not be able to pick up important audible cues that could warn them of potential danger.

Even pedestrians admit to being in a hurry too often. Pedestrians, like operators, are less likely to respect other road users when they are in a hurry or running late, especially if they are trying to catch a bus that is about to leave. Other pedestrian behaviors that were reported as contributing factors to bus-and-pedestrian collisions included not using crosswalks, challenging the right-of-way, and violating the traffic signals.

With all of these pedestrian-related contributing factors, there is a place for well-planned and well-developed pedestrian outreach and education in an overall pedestrian safety program. Education programs like Transit 101 (see Table 2-7 and Section 3.2.2) have been successful at keeping pedestrians on a college campus from being involved in bus-and-pedestrian collisions and are relatively low in cost.

4.1.3 Tight or Problematic Schedules

Tight or problematic schedules were also reported by agencies, pedestrian groups, and operators as a contributing factor in collisions, particularly in bus-and-pedestrian collisions. Schedules that are too tight or unrealistically set can lead to operators getting off schedule, which can result in the operators being counseled by their supervisors. In an attempt to avoid counseling, operators may feel they have to rush to stay on schedule and to make up time on their runs. It is human nature that when we rush, we lose sight of things that we otherwise would not.

There were a number of suggested strategies involving bus schedules. Stakeholders, particularly bus operators, suggested more realistic schedules and more time to complete routes. One interesting suggestion was to bring together the scheduling department and the operators to talk about the schedules. By doing this, operators would have the opportunity to voice their concerns about routes with problematic schedules and their potential safety consequences.

4.1.4 Timing/Scheduling of Buses

There was a lot of discussion during both pedestrian focus groups about safety issues surrounding the timing of buses at transfer locations. Most of the pedestrians felt that when the buses are not well timed or do not arrive when they should (i.e., they are behind schedule), it can put bus riders in a position of running to catch a bus. In addition, the actual bus stop placement at these locations (usually intersections) can add to the problem. For example, if bus riders must alight one bus and then cross to the far side of the intersection to catch their next bus, bus schedules, heavy traffic, and poorly timed signals (e.g., not providing enough time for pedestrians to cross or providing too much time to the major street as compared with the minor street) can make it nearly impossible for a rider to make a smooth transfer.

At locations where a number of bus lines stop at the same location, bus stops should be well thought out and well laid out, and bus schedules should be developed to accommodate riders making transfers. Signal timing—such as the pedestrian scramble (i.e., all pedestrian phase)—might also be altered to accommodate pedestrians at busy times of the day.

4.1.5 Lack of Training and Follow-up Enforcement by Transit Agency

Agencies should take responsibility for providing quality training that places a focus on operator retention; the rules, policies, and procedures that are set forth in the training program should be enforced. For example, while operator cell phone use while driving is almost always forbidden, it was reported that it is not always enforced. When policies are not enforced and operators are not held accountable, they will have no respect for the policy. A reward system could be put in place to provide praise to operators who uphold safety policies and procedures, which will also contribute to operator retention. In the long run, the agency will save money as there will be more experienced operators and fewer new hires who need training. Experienced, well-trained operators with good safety records will result in fewer collisions and fewer claims.

4.1.6 Lack of Pedestrian Friendly Environments

Another big issue voiced by the pedestrian groups was the need for more pedestrian-friendly environments. There was a reported "lack of sensitivity about investing in walkable, pedestrian friendly environments around transit stops and along transit corridors." Pedestrians also reported they had seen collisions that occurred when people slipped or tripped on poor sidewalks and fell under a bus. In fact, broken and uneven sidewalks, narrow sidewalks, sidewalk obstacles, and lack of sidewalks or other positive separation were all rated as being some of the most common hazards to pedestrians by the pedestrian focus groups.

Improving sidewalks, removing obstacles, and providing pedestrian-friendly amenities at and around bus stop locations could be an effective way of reducing collisions involving pedestrians falling under the bus. Partnerships with the local department of transportation or public works, as well as pedestrian advocacy groups and input from the public, will assist with the identification of stops most in need and strategies most likely to improve pedestrian safety.

4.2 Combining Strategies for Added Potential for Success

This research has shown that the circumstances of and contributing factors to bus-and-pedestrian collisions are multi-faceted. For any collision type, the bus operator, the pedestrian, and the environment (i.e., bus design, bus stop location, and roadway geometry) play a part. There is no simple single answer to mitigating collisions. Instead, various approaches may reduce collision frequency, severity, or both. In many cases, implementing two or more strategies in combination might make the most sense and provide the "biggest bang for the buck." Some principles for successful strategy selection include the following:

- **Consider all circumstances.** When a collision occurs, it is tempting to focus on the assignment of fault. However, this research shows that it is likely that multiple factors contributed to a collision—the pedestrian, the bus operator, and the environment. Implementing a strategy that focuses only on one aspect of the collision overlooks the depth of the collision problem. For instance, we must assume that humans are prone to error. Thus, bus operators and pedestrians must both behave defensively when navigating roads, assuming the worst about the other's intentions. The extra energy and costs involved in fully addressing the collision problem (versus narrowly focusing on one aspect) might in the long-run be the most economical approach.
- **Collaborate and partner.** When a collision occurs, the results are felt most directly by the pedestrian, the bus operator, their families, and the transit agency. Also impacted, however, are many in the community at large (pedestrians and bus riders, law enforcement officials, transportation engineers, etc.). When implementing a collision mitigation plan, it is wise to take advantage of all of these stakeholders through brainstorming, collaboration, and partnership to implement a pedestrian-and-bus safety plan. Bringing together a "meeting of the minds" will contribute to greater success of the mitigation strategies and the safety program as a whole.
- **Follow-up.** Once an application is in place, follow-up is required in order to promote success of the application. Follow-up could include enforcement of a policy or procedure (through on-board or roadside safety checks or observations) or of a law (through police enforcement). Follow-up could include refresher training or safety reminders posted at regular intervals, counts of near misses and related incidents, and candid discussions with operators and pedestrians.
- **Evaluate.** One challenge of this research was to assess the success and effectiveness of the applications. Bus-and-pedestrian collisions, while often catastrophic, are relatively infrequent. Thus, before-and-after measures of the number of collisions are often an inappropriate approach to measuring success due to the length of time needed to gather and analyze a statistically significant set of data. Instead, candid discussions with operators and pedestrians and subsequent analysis of the information should be used to assess whether the application is having the intended results. Measures of effectiveness could be near misses; claims; and ratings of success by operators, bus riders, and community stakeholders. In addition, the accurate, consistent, and detailed reporting of information associated with bus-and-pedestrian collisions will greatly improve the ability to determine causal factors, as well as appropriate solutions.

The following are some examples of how to combine two or more different types of strategies in order to increase the success of the individual strategies implemented alone.

4.2.1 Policy and Pedestrian Outreach

Running after buses was one of the most commonly reported behaviors resulting in bus-and-pedestrian collisions across all stakeholder groups. One suggested application to counter this

problem was to set the policy of not stopping to let passengers on after the bus has left the stop. While some agencies have these policies, many leave it up to the operator's discretion to determine whether it is safe to stop and let a rider on the bus. Stopping at non-stop locations can be very dangerous, not only to the pedestrian, but also to other operators. When operators do stop to let passengers on after they have left the stop, it reinforces the running behavior because passengers know the bus will stop for them. On the other hand, if the operator does not stop, it is viewed as poor customer service by bus patrons.

When it comes to this situation, there is a definite conflict between safety and customer service. Ironically, not stopping for pedestrians is in the their best interest, as well as in the interest of other road users who could be impacted by a bus stopping where it is not supposed to.

This situation requires a multi-faceted approach. The policy of not stopping for passengers who are not at a stop is a good one; however, the transit agency must uphold its duty to provide reliable bus service. If buses arrive at stops in "clumps," passengers will have no reason to wait for the next bus because there is no telling when the next bus will arrive—and passengers know it. If running after buses is an issue on routes where bus service is reliable, the policy of not stopping outside of designated stop locations could be implemented hand in hand with a public education and outreach program. Posters could be hung at stops, shelters, or on-board buses, and flyers could be handed to passengers letting them know of the new policy and why it is going into effect. It should be explained to them that it is for their own safety as well as the safety of others. In return for riders not running after the bus, the transit agency might let the riders know how they are working to keep the buses on schedule so that riders will not have to wait too long for the next bus or that the agency is adding extra service or an extra bus at the end of the day. By doing so, riders will be more understanding and accepting of the policy and will feel that there is a "give-and-take" exchange on the part of the transit agency not only to improve safety, but also to improve service.

4.2.2 Defensive-Driving Techniques, Policies, Training, and Enforcement

Defensive driving can be an effective way of improving bus safety around pedestrians. Defensive-driving techniques and policies can be developed in an attempt to mitigate future collisions. After developed, the bus operator must apply the techniques and policies with knowledge, judgment, and skill; therefore, operating techniques and policies should be implemented as part of an operator training program. New hires should be taught the techniques and policies, and these techniques and policies can be reinforced through refresher training. But this is not enough. In order to have continued success with special techniques and policies, the transit agency must be committed to keeping the ideas in the forefront of operators' minds. This can be done relatively inexpensively through bulletins, posters, flyers, and videos that express the importance of the techniques and policies, as well as the commitment of the agency and drivers to upholding them. Finally, operator use of the strategies can be checked or reinforced through on-board and roadway observations. Check rides or proficiency checks may be performed by agency staff or a contracted service.

When carried out as part of new hire and refresher training, the cost of implementing specific operating techniques and policies is relatively low since it is only one of several components of the training program. The cost, however, can be high if the techniques and policies are implemented to address a particular pedestrian safety issue and are outside of the usual operator training cycle.

4.2.3 Lack of Lighting and Visual Obstructions

Lack of lighting and visual obstructions were both big issues voiced by many stakeholders. Both issues deal with the ability of the operator to see pedestrians whether waiting at a stop or

shelter or when crossing the street. An operator's visibility is reportedly limited due to bus features (e.g., mirrors, farebox, or door) and roadway features that block the line of sight from the driver's seat to pedestrians (e.g., light poles, traffic signals, trash cans, electrical boxes, and vendors). Therefore, when a location is found to have problems with bus operators reportedly not seeing pedestrians, the problem should be addressed from different angles.

Lack of lighting was rated by both pedestrian groups and one stakeholder group as one of the most common hazards to pedestrians. Agencies should solicit information from operators and the public about locations with particular lighting problems. There are a variety of low-cost solutions that can be implemented, including retro-reflective paddles, flashing beacons, and pocket and pen lights (see Table 2-12). The cost effectiveness of these strategies will be improved if potential problem locations are examined on a case-by-case basis rather than taking a one-size-fits-all approach.

Bus design and its impact on operator visibility are controversial. Some agencies reported that bus features can cause obstructions that play a role in collisions, while others did not agree. Bus operators almost always reported that bus features can cause visibility problems that can lead to collisions. To counter visual obstructions on buses, agencies should work with operators and manufacturers to minimize the impacts of the bus-related obstructions (e.g., mirror size and placement). As mirror size, configuration, and placement are challenging and ongoing issues for many transit agencies, agencies could participate in peer-exchange activities to share ideas, successes, and failures.

To counter visual obstructions outside of the bus, transit agencies should develop partnerships and working relationships with their local DOT or public works—as well as pedestrian advocacy group—to identify problem locations and to create workable solutions that involve removing or re-locating objects and bus stops and shelters to locations where obstructions are minimized or eliminated.

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Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation

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EXHIBIT 7

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EXHIBIT 7

DISTRICT COURT

COUNTY OF CLARK, NEVADA

KEON KHIABANI and ARIA KHIABANI, minors by and through their natural mother, KATAYOUN BARIN, KATAYOUN BARIN, individually, KATAYOUN BARIN as Executrix of the Estate of Kayvan Khiabani, M.D. (decedent), and the Estate of Kayvan Khiabani, M.D. (Decedent),

Plaintiffs,

vs.

Case No. A-17-755977-C

MOTOR COACH INDUSTRIES, INC., a Delaware corporation; MICHAELANGELO LEASING, INC., d/b/a RYAN'S EXPRESS, an Arizona corporation; EDWARD HUBBARD, a Nevada resident; BELL SPORTS, INC., d/b/a GIRO SPORT DESIGN, a California corporation; SEVENPLUS BICYCLES, INC., d/b/a Pro Cyclery, a Nevada corporation; DOES 1 through 20; And ROE CORPORATIONS 1 through 20.

Defendants.

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ORAL DEPOSITION OF
PABLO FIERROS
October 8, 2017

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Job No.: 420700

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ORAL DEPOSITION of PABLO FIERROS, produced as a witness at the instance of the Plaintiffs, and duly sworn, was taken in the above-styled and numbered cause on Wednesday, the 4th of October, 2017, from 2:41 p.m. to 3:40 p.m., via telephone and Skype, before Caryn Miller, CSR in and for the State of Texas, reported by machine shorthand, at the offices of Rasberry & Associates, 420 E. San Antonio, Suite 200 Texas, pursuant to the Nevada Rules of Civil Procedure.

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(Exhibits 1 through 9 marked.)

PABLO FIERROS,

having been first duly sworn by the Certified Court Reporter, testified as follows:

EXAMINATION

BY MR. KEMP:

Q. Would you state your name again please and spell it for the court reporter

A. Pablo Fierros. P-A-B-L-O, F, as in Frank, I-E-R-R-O-S, as in Sam.

Q. Okay. And, Mr. Fierros, can you hear me okay?

A. Yes.

Q. And have you ever given a deposition before?

A. No.

Q. Okay. Let me -- let me explain to you what we're going to try to do today. The purpose of a deposition is to discover facts relevant in a lawsuit. In this case it's a lawsuit that involves an MCI bus that got into an accident on April 18th, 2017, here in Las Vegas and killed a bicyclist. I don't expect you to have any information about the accident that happened out here.

In any event I'm going to be asking you questions and answers about your former employment and hopefully you'll be able to answer those questions. My

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questions, your answers, any comments of counsel get typed up into a little booklet that you'll have an opportunity to review at a later time to see if it's an accurate answer. If it's not accurate, you have the right to make a change. So for example if you say A, you can change it to B at a later point, but if you do make a change, everybody has the right to comment upon the fact that you made a change. So there's a little trick in here in the accuracy; I'd ask you to give me the best answer you can.

I'm going to assume you understand the question. If you don't understand it, please ask me to stop and rephrase it and I'll be more than happy to do so. I don't think we're going to get too technical, but, you know, you worked for the bus company, as we understand it, for quite some period of time so there may be a term of art or a phrase that you used during your employment that a layperson is not familiar with. So if you see that there's something we don't understand, just stop me and let's try to get on the same wavelength. Okay?

A. (No verbal response.)

Q. The oath you've taken has the same force and effect as if it was administered in a court of law. Do you understand all that before we get started?

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A. Yes, I do.

Q. Yes? And you have to answer yes or no because the court reporter there cannot record you nodding your head or anything so we have to have an affirmative "yes" or "no" as opposed to "uh-huh" or a "yeah" or a head nod.

A. I said yes when you were talking. I said --

Q. Okay. All right. Where do you currently reside?

A. 3608 Colville Drive.

Q. In what city?

A. Horizon, Texas. 799 --

Q. And Colville --

A. 79928.

Q. And Colville is spelled how?

A. C-O-L-V-I-L-L-E.

Q. Okay. And can you describe your educational background.

A. I have 10 years of first to tenth grade. I went to the -- I -- I have a degree on auto and diesel technology from ITT Education Services in St. Louis, Missouri, and various years of college, several sales courses.

Q. Okay. And when did you get your degree from ITT?

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A. I don't remember the year. I believe it was '82. 1982, somewhere there.

Q. Okay. And I'm not familiar with ITT in St. Louis. Is that a technical school or what is that?

A. It's a technical school.

Q. And in addition to auto and diesel degrees, what other kind of degrees do they offer if you know?

A. I don't remember.

Q. Is -- okay. And prior to -- to going to school at ITT, what, if anything, did you do?

A. I was two years at College of the Ozarks in Point Lookout, Missouri.

Q. Was that -- did you get a degree from the College of the Ozarks?

A. No, I did not.

Q. And prior to that what did you do?

A. I attended high school at Mountain Grove High in Mountain Grove, Missouri.

Q. And where were you born at?

A. Mexico City.

Q. And approximately when did you come to the United States?

A. I came several times as a tourist with my family going back to since I was a little kid. So when did I came to stay, probably around 1977 I think it was.

Q. Okay. Great. Did there come a time that you worked for Motor Coach Industries or an affiliate of Motor Coach Industries?

A. I worked for Universal Coach Parts.

Q. And what time period did you work for them?

A. I believe it was '97 to 2000.

Q. And what was your job in general?

A. I was vice president and general manager.

Q. Where was Universal Coach Parts located?

A. In Chicago.

Q. And when you say Chicago, would that be Des Plaines?

A. That's correct.

Q. And that's D-E-S, new word P-L-A-I-N-E-S.

Who was your immediate supervisor while you were the vice president and general manager of Universal Coach Parts?

A. Jim Bernacchi.

Q. And I believe that's spelled B-E-R-N-A-C-C-H-I. Is that --

A. I believe that's -- I believe that's correct.

Q. Okay. And what was your understanding of Mr. Bernacchi's position at that time?

A. I believe he was the CEO of Motor Coach Industries.

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Q. Was he also the president?

A. I don't remember.

Q. Okay. But you think he was the CEO from '97 to 2000 when you were at Universal Coach Parts. Is that correct?

A. I believe he was the CEO, yes. I don't remember if he was both president and CEO. That I don't remember.

Q. Okay. Did you report directly to Mr. Bernacchi?

A. Bernacchi. I did.

Q. Did you re- -- okay.

A. You asked me that. I said yes.

Q. And where were you located at physically in terms of an office building?

A. I don't remember the address, but it was in a separate building than -- than Jim Bernacchi.

Q. Okay. And was it near Mr. Bernacchi's building?

A. About -- about 10 blocks away.

Q. And how many employees did you have as the vice president and general manager of Universal Coach Parts?

A. I believe the number was close to 1,200.

Q. Were they located at the same place you were?

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A. They were located in seven different facilities.

Q. Across the United States?

A. Across United States, Canada and Mexico.

Q. Okay. And in general what did Universal Coach Parts do?

A. We sold parts to the bus industry, mostly -- primarily MCI parts.

Q. Okay. Was MCI one of the customers?

A. Was a supplier.

Q. MCI supplied parts to Universal Coach Parts?

A. Correct.

Q. And then you sold those parts?

A. To the bus industry.

Q. Including MCI or everybody but MCI?

A. MCI is the manufacturer. I sold to the users, to the people that bought MCI and other coaches.

Q. Okay. Did MCI own Universal Coach Parts at the time you were working for them?

A. Yes, they did.

Q. And as we sit here today, is Universal Coach Parts still in existence?

A. No, it does [sic] not. I believe they have since changed names and I don't know the latest name they are using.

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Q. Okay. In general what were your duties and responsibilities?

A. P and L, profit and loss.

Q. Your duties were to make money for Universal Coach Parts. Is that correct?

A. The profit and the loss. Make money is very easy. Anybody can make money.

Q. But making a profit's harder.

A. (No verbal response.)

Q. Is that what -- that's what you mean?

A. That's correct. Harder.

Q. During the time period you were at Universal Coach Parts, did you become aware of a product that's been referred to as an S-1 Gard Dangerzone Deflector? And if you want to look at Exhibit 3, feel free.

A. The first conversation I had with --

Q. Before -- before we get into the conversation, the first question was did you become familiar with the S-1 Gard?

A. I remember so very little about this product, I was going to answer with the first thing when one of -- one of the attorneys called me -- Pepperman I believe it is -- he asked me a coup- -- a couple of questions and up until then, I had zero recollection. Once he brought up the name, I -- yeah, I sort of remember something

about it. I don't know exactly how or when, but I do.

Q. Do you know a man named Chris Ferrone, F-E-R-R-O-N-E?

A. My God, I -- the -- the name sounds somehow familiar.

Q. Okay. And do you know a man named Mark Barron B-A-R-R-O-N, also named Mark Bowen, B-O-W-E-N?

A. The first one sounds more familiar than the second one.

Q. Does the second one, Mr. Barron or Bowen, sound familiar in any way, shape or form?

A. No, no.

Q. No? Okay.

A. Are you having --

Q. Do you remember?

A. Are you having problems hearing me?

Q. I think we're talking over each other a little bit.

A. Okay. Okay.

Q. I'm not having a problem hearing you, but -- but I think we're talking over each other a little bit.

Okay. Back to the S-1 Gard, do you remember at some point in time someone came to you and offered you this product, referring to the S-1 Gard?

A. Formally offering, no, I don't remember. I

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remember in a trade show having a conversation with some people, I don't even know who were in there. I don't remember if it was on the aisles or on the booth, whether it was my booth or somebody else's booth, I remember some conversation about this product.

Q. Okay. And I know it's going back a long time, but do you remember where the trade show was perhaps?

A. No, no. At the time I assisted to 16 trade shows a year. I have no clue which one it was.

Q. Okay. But would I be correct that this would have been during the time period 1997 through 2000 when you worked for Universal Coach Parts?

A. Yes.

Q. Okay. Now, looking at the product literature again, basically what the S-1 Gard is designed to do is push people out of the way if they fall under the bus. Do you see that?

A. I do on the second picture on page 1318, yes.

Q. Okay. Great.

Is that a product that you had an interest in?

A. Evidently from what I -- from the little I remember, I did not -- Universal Coach Parts was in the business of selling parts to the bus industry. Most of those parts were already fitted in the bus at the time

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of manufacture so there was a demand for that product. This would have been something that had little or no demand so I -- I -- I don't remember much of it.

Q. Okay. So basically you provided replacement parts. Is that right?

A. That is correct.

Q. And the reason it would have little or no demand is because MCI and other people weren't putting it on the buses when they first made the buses. Correct?

A. Or the customer -- or the customers were not -- were not demanding it. Factories themselves put products that the customers want.

Q. Okay.

A. The end users.

Q. If you take a look at --

Okay. If you take a look at Exhibit 3 again --

MR. RUSSELL: I don't think he's finished with his sentence.

Q. (BY MR. KEMP) Did you finish?

A. I think. I think I'm finished. I forgot already what I was going to say.

Q. Okay. If you take a look at Exhibit 3, again the front page, it says, quote, Installed on over 30,000

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buses worldwide since 1993.

Do you see that statement?

No, the very first page, first page, cover page.

A. Oh, I see it. I see, yes.

Q. Okay. Do you know whether -- whether or not that's true?

A. I -- I have no idea. I don't know what's sold in other countries or what is used -- I don't know even know where this was designed or developed. Buses come in many, many different configurations. What -- what is a bus for one person, it is not for another one. So this statement is to me very, very vague. Some people thinks they are catching the bus at the airport and all they have is a van. So there are people that call buses other vehicles than what we sold to so...

Q. Okay. Did -- did you sell parts for J4500s at the time you were there?

A. I did.

Q. Okay. And J4500s would be what you would call a bus?

A. Yes.

Q. All right. Now, directing your attention to Exhibit 5, would you look at that, please.

A. Okay. But I don't think the 30- -- we were

talking about the 30,000. I don't think the 30,000 are J4500 buses. Is that what you implied?

Q. No, no. I'm agreeing with you that they're not J4500. I'm trying to move on to a J4500.

A. Oh, okay.

Q. Okay. All right. Could you look at Exhibit 5, please.

A. Yes.

Q. Was New Flyer one of the entities that you sold parts to?

A. It was.

Q. Okay. And was there any particular branch or division of New Flyer that you dealt with more than others?

A. I did not have any direct contact with New Flyer. I sold parts to New Flyer users. So people that had bought New Flyer.

Q. You would sell them replacement parts?

A. Yes.

Q. And were those replacement parts made by New Flyer or MCI or both?

A. And many other manufacturers, yes.

Q. Okay. So you -- you also sold New Flyer replacement parts --

A. I sold --

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Q. -- for Universal Coach?

A. I sold some parts to New Flyer, yes.

Q. Okay. And if you see Exhibit 5, you'll see that it's written by Mr. Ellis who's an engineer at New Flyer. Do you see that?

A. I do.

Q. And can you read what he says?

A. (Reading) By way of this letter, New Flyer Engineering maintains the position that the installation of the S-1 Gard in New Flyer facilities does not compromise the integrity of the chassis or suspension of the coach in [sic] which it is installed, nor is it expected to impact the functionality or integrity of other systems in the coach.

Q. Okay. And based on your understanding of what an S-1 Gard is -- and I understand that may be limited -- do you have any reason to disagree with Mr. Ellis's assessment here?

A. I am not an expert in -- in -- in engineering. This -- this is -- this is an engineering question. I have absolutely no idea whether this fact is clear or not. I'm not an engineer so I cannot tell you that this statement is correct or incorrect.

Q. Okay. And the same would be true for a J4500, you can't tell me whether an S-1 Gard could be put on a

J4500 or not. Is that correct?

A. Agree. It is correct. I couldn't tell you.

Q. Okay. Fair.

And does this letter remind you that you provided S-1 GARDs to New Flyer customers -- customers that had New Flyer buses?

A. I do not.

Q. All right. Apart from the S-1 Gard, are you familiar with any other type of barrier safety device that manufacturers of buses either did or could put in front of the right rear tires to move people or objects out of the way?

A. There was a device, I believe it was British, I don't remember the -- the name, but it was in the front of the bus and it attempted to do something similar to this. If you -- if you remember some of the spoilers that were popular in the '70s and '80s in race cars that looked like they were sweeping the front, that's what that device looked like.

Q. Okay. And did you sell any of those?

A. No.

Q. Okay. But that was designed for the front tires as opposed to the rear tires. Is that correct?

A. That was designed for the front of the bus for the whole bus.

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Q. Okay. And have you heard the term spats, S-P-A-T-S, before?

A. No, I have not.

Q. How about wheel guards, have you heard of wheel guards that are attached to the rear tires?

A. Yes.

Q. Okay. And what do you call those?

A. Did you say "splash" a while ago?

Q. I said "spats."

A. Oh, spats, no. Spats, no.

Q. Spats.

A. What do I call the devices that go behind the wheels? The -- the splash guards you said?

Q. Okay. All right. Have you heard of the device, a protective barrier that goes on the outside of the rear tires to prevent the tires from coming into contact with something on the outside of it?

A. No, I -- I don't.

Q. Okay. While you were at Universal Parts [sic], did MCI ever solicit your -- your input with regards to safety features?

A. No. I -- I don't --

Actually, let me take that back. It is possible that they would ask me a question like that on a bus that they didn't manufacture, but it most

likely -- it would have been a question as in check with your team, because they knew I was not an engineer so I couldn't give them a -- a -- an opinion. So -- so if they would have asked my opinion on a safety device, I think they would ask me more to check with my team.

Q. Okay. Did you have safety engineers on your team?

A. I did.

Q. How many?

A. I believe the department had three, four people that did some engineering work. They verified specs on products that we -- that we sold.

Q. Okay. And do you know whether or not those safety engineers ever evaluated the S-1 Gard?

A. I don't remember doing any evaluation of S-1 Gard.

Q. Before you sold or resold the product, would -- would the standard procedure be to do some sort of evaluation?

A. Absolutely.

Q. Okay.

A. I --

Q. Now --

A. There are many products in the bus that have already been used for years before that, no, we probably

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did not do a complete and thorough investigation of every single part.

Q. Do you know what a proximity sensor is?

A. Yes.

Q. And, for example, some cars have devices that alert you whether or not there's a car or bicycle either to your front or on the side of you. Right?

A. Yes.

Q. And -- and -- and do you have a car like that yourself?

A. No.

Q. Now with regards to proximity sensors, while you were at Universal Coach Parts, did you sell any proximity sensors?

A. I don't remember.

Q. Do you remember one way or the other whether or not any devices that you were involved with in any way, shape or form had proximity sensors on it?

A. Not specifically, no.

Q. And after leaving Universal Coach Parts in 2000, did you have any involvement with the bus industry?

A. I went to work for ENroute Communications, which was a startup company doing wireless communication between the base and the moving coach transit bus,

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train, vehicle. So we build wireless communication systems. And one of the industries that we attempted to go to was the bus industry.

Q. Okay. And what time period were you with them?

A. Them became me. I was part of the company. After the initial startup, I became owner of the company -- part owner of the company.

We -- 2000 to 2005 approximately.

Q. And then where'd you go in 2005?

A. I went back -- I went to -- I started a -- a consulting company doing sales consulting and I worked in the retail automobile. And after that I came to El Paso with my present employer.

Q. And that would be Stewart & Stevenson?

A. Correct.

Q. And that's spelled S-T-E-W-A-R-T, ampersand, Stevenson, S-T-E-V-E-N-S-O-N. Correct?

A. Stevenson, correct.

Q. Okay. Now, when you were with ENroute from 2000 to 2005, did you try and sell any products to MCI?

A. No.

Q. You didn't try to sell the wireless device to MCI?

A. No.

Q. Did you try to sell it to Universal Coach

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Parts?

A. No. The device --

Q. And why not?

A. -- the device was for the end user, not for the manufacturer. The device offered information and entertainment to the passengers of the -- of the vehicles. The manufacturer wouldn't fit that at the time. First when it -- we needed to create the need, we had a few bus companies that installed some of the systems. We did some trials. No, I never went to MCI or any bus manufacturer to try to sell them because they would not buy one if there was no demand for it.

Q. Okay. Is this kind of an entertainment system?

A. Entertainment and information for the passenger. For the base it would give them information on the performance of the engine, the location of the bus, the route that was taken, speed, various things.

Q. Okay. And as I understand it, some buses now are made with a similar system. Right?

A. 20 years later, yes.

Q. So 20 years later the manufacturers do put this in the new buses. Right?

A. Right. At the time there was no demand for it. We were the forbearers of that technology.

Q. Okay. And did this have a safety aspect to it,

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like knowing how fast the driver was going?

A. It had many safety devices, yes. That one was one.

Q. But you didn't take it to the manufacturer because you thought even though it was a safety device, the manufacturer wouldn't pay for it unless you had demand from the tour bus companies. Is that correct?

A. The manufacturer does not fit parts or systems that the customer doesn't want, order, need, several -- several -- several adjectives. If it has something new that they believe it is great, they may do some promotion, try to get somebody to use it. But if there's no interest, the factories are not going to fit it.

At the time no one knew what this was so, no, I did not offer it to -- to them because they wouldn't -- they -- they would have no market to sell that to.

Q. Okay. Is that why buses until recently haven't had seat belts?

A. I have no idea why -- I don't -- I have no idea why they don't have seat belts.

MR. DACUS: Object to form.

Q. (BY MR. KEMP) Okay. During the time period you were at Universal from '97 to 2000, did the buses

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you were servicing have seat belts?

MR. DACUS: Object to form.

A. Again, what -- what a bus is is something that needs to be defined. Some of the -- some of the airport shuttles that people mistakenly consider buses may have safety belts. In general we had a -- yes, there were some buses that had seat belts and we sold seat belts to those bus companies. Most of them were school buses.

Q. (BY MR. KEMP) Okay. Would I be correct that the J4500 did not have seat belts between '97 through 2000?

A. It depends -- it depends on the application. I don't know all of the applications. That model bus I believe was built for jail buses and in those cases, they may have had seat belts. I don't know. I don't know whether all had or not.

Q. Okay. And why is it you think the J4500 was built to be a jail bus?

A. In my recollection I believe that was one of the models that was converted to jail. But I might be wrong. It's 20 years.

Q. Okay. And do you know if the J stands for jail?

A. I don't know -- I don't know what the J stands for. I don't know if they went from A, B, C to J. I

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don't know.

Q. Would I be correct that the majority of buses made from 1997 through 2000 did not have seat belts as a standard feature?

A. That -- that would be --

MR. DACUS: Object to form and foundation.

Q. (BY MR. KEMP) Is that correct?

MR. DACUS: Objection.

A. I think that would be correct.

Q. (BY MR. KEMP) So basically bus manufacturers do not install safety equipment unless the customers. The tour companies, want them. Is that what you're saying?

A. No, no. That is not -- oh, my God. That is a -- that is -- brakes is a safety device. Manufacturers fit brakes and they fit better brakes. Sometimes even they put proven safety -- safety devices. What -- what you said was a -- an incredible leap. It's like if I would be giving an opinion on -- yeah.

Q. Okay. Why -- as you understand it, why didn't the majority of bus manufacturers put seat belts in buses from '97 through 2000?

A. I attempt -- I attempt.

MR. DACUS: Object to form and foundation.

A. I attended sometime back in those years a

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convention where the city bus association -- and I don't remember which association it was, there were -- there were 25 different associations -- they had a break-away session on seat belts. They -- the people that ran the buses, meaning the -- the bus entity -- city entities, put that break-away session where they show how harmful using seat belts was on buses. So I -- I don't think it's proven that a safety belt is a safety device in a bus.

Q. (BY MR. KEMP) Okay. And do you know whether or not manufacturers today are putting seat belts in the majority of buses made?

A. I have -- I have not been in a bus -- in a late model bus in a long time in the passenger's seat as a passenger. In the front for the driver, today most bus manufacturers install a safety -- a safety belt for the driver.

Q. And you think the driver should have a seat belt but the passengers should not. Is that what you're telling me?

A. You're asking me to think as a -- as a person that knows anything or as a lay -- because as an engineer, I'm not an engineer and I don't know. I don't know whether they are safer or not.

(Discussion off the record.)

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Q. (BY MR. KEMP) Okay. Just to make sure we got it right. As you understand it today, the majority of buses have driver seat belts. Right?

A. Yes.

Q. And you don't know one way or the other whether or not the majority have passenger seat belts?

A. I don't know.

Q. Correct?

A. I don't know.

Q. But do you know that passenger seat belts are used in more buses today than they were back in 1997 through 2000? Do you know that one way or the other?

MR. DACUS: Object to form and foundation.

A. I don't know.

Q. (BY MR. KEMP) Okay. Now, do you have an understanding one way or the other whether or not a bus such as the J4500 creates an air blast or air displacement at its right front when it's traveling?

A. I have no idea.

Q. Okay. And are you aware that there -- or, strike that.

Have you ever heard of a part called a spoiler that goes along the front right side or the left side of the bus to change the air flow?

A. Not specifically in buses, no.

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Q. Okay. In what capacity have you heard of spoilers that go on the right or left side of vehicles?

A. In the racing world.

Q. Got it. Okay. Do you have a general understanding that if you round the corners of a moving object like a bus, you will create better aerodynamic efficiency than if you don't round the corners? Do you have that understanding?

MR. DACUS: Object to form and foundation.

A. My God. I -- I don't know that I can -- that I can necessarily agree with that. Rounding -- rounding the front of the bus makes it safer? Is that what you say?

Q. (BY MR. KEMP) I didn't say safer. I said more aerodynamically efficient.

A. Yes, it does make it -- rounding it makes it more aerodynamic, yes.

Q. And do you know why?

A. Yeah, generally I think I understand why.

Q. And why is that?

A. Gee, man, I am not an expert in aerodynamics, but why do I think -- I mean you're asking me a question that I think should go to an engineer.

Q. Okay. When you were selling parts for Universal Coach Parts, did you ever sell replacement

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parts that would make the bus rounder, the sides of the bus rounder?

MR. DACUS: Object to form.

A. I don't remember.

Q. (BY MR. KEMP) And more specifically did you have any sort of fuel efficiency package that you sold to try to make the bus rounder so it would be more fuel efficient?

A. I don't remember that we did 20 years ago.

MR. DACUS: Object to form.

A. I don't remember that.

MR. KEMP: Okay. I have no further questions.

MR. RUSSELL: Go ahead, John.

EXAMINATION

BY MR. DACUS:

Q. Mr. Fierros, did you have a specific recollection of what a J4500 coach is and do you have a specific recollection that those buses were even being built when you worked for Universal Coach Parts?

A. No, I don't. I don't -- I'm not 100 percent -- I don't recall all the bus -- the model buses that MCI had and I don't remember if the J45 was on production or not. I believe if -- as a general, it looks similar to what a Greyhound bus is, if that is the J45 that I

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remember.

Q. But you're not sure in your own mind what J4500 bus is. Is that correct?

A. No, I don't.

Q. Or when it was first built?

A. No, I don't remember exactly which one it is.

Q. Okay. Okay. And do you have any recollection of anyone presenting to you in connection with the S-1 Gard any scientific studies or engineering studies that would prove the effectiveness or usefulness of such a product when it was presented to you when you were with Universal Coach Parts?

A. No, I -- I don't remember seeing any data or -- or -- or -- or -- or I don't even remember if it was ever presented to me. I -- I -- no.

Q. Do you recall if you ever even saw such a device?

A. No. I don't remember seeing it. I don't remember seeing it installed. I -- I think in one of the aisles, somebody came with a flier similar to the one that is presented here and I saw it at the time. But, no, I don't remember seeing one installed.

Q. Okay. And do you ever even remember seeing an S-1 Gard device in physical form, meaning someone going up and handed it to you or presented it to you in any

way?

A. No, I don't remember it, no.

MR. DACUS: Thank you. I don't believe I have any further questions.

MR. KEMP: Are you done, Mr. Dacus?

MR. DACUS: I am.

FURTHER EXAMINATION

BY MR. KEMP:

Q. Sir. You said that you saw a flier similar to and then you held up a document. Was that Exhibit 3?

A. No, the one that I held up was Exhibit 5. I was looking for the other one and I can't find it.

Q. Could you find Exhibit 3 for a second, please.

A. I have it.

Q. So the flier you saw was either the same or similar to Exhibit 3. Is that correct?

A. I guess. I guess. I don't specifically remember. It -- it -- it's -- it's vague in my memory.

Q. Okay. But you saw some flier similar to Exhibit 3 that related to the S-1 Gard. Is that correct?

A. Yeah, I think somebody handed to me something like that, yes.

Q. Okay. And Mr. Dacus asked you if you'd seen any technical papers.

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Could you look at Exhibit 7, please.

A. Okay.

Q. And you see the reference at the bottom of Exhibit 7 to the International truck and bus meeting and exposition at Indianapolis on November 16th, 1998?

A. Yes.

Q. Okay. Does that refresh your recollection as to where and when you met with Mr. Ferrone?

A. No.

Q. Okay. Now, this document that I've handed you, it's entitled SAE Technical Papers, period. Did you see that?

A. Yeah.

Q. Did you while you were at Universal subscribe to the SAE Technical series?

A. I don't even remember. No, I don't remember if I was or not.

Q. Okay. And this is entitled, quote, A Field Evaluation of the S-1 Pedestrian Gard, colon, Transit and Shuttle Bus Applications, unquote.

Did I read that right?

A. Yeah.

Q. Okay. Do you recall perhaps Mr. Ferrone mailing this to you after the exhibition?

A. No, no, I don't recall.

Q. Was that something that happened a lot when you went to these trade shows, people would mail you stuff afterwards?

A. Hundreds.

Q. Hundreds of times?

A. Correct.

Q. Because you're a customer, they're trying to get your business. Right?

A. I -- yeah.

Q. Okay. And Counsel asked you if you'd seen any technical paper on the S-1 Gard. As you sit here today, do you remember one way or the other whether you saw Exhibit 7 before at any time?

A. No, I don't remember.

Q. So this may and may not have been among the hundreds of things that you were mailed after trade shows. Is that correct?

A. That's correct.

Q. And with regards to this particular trade show at Indianapolis in November 1998, as we sit here today, do you remember whether or not you went to that?

A. I probably did. I went to most of the trade shows so the likelihood that I went to this one is very high.

Q. And is it also high because Indianapolis is

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close to where you had your place of employment?

A. No. I went many times -- most -- more times to trade shows that were far away, New York, Florida, California. Indianapolis was not a very common avenue.

Q. Okay.

MR. KEMP: All right. I have no further questions.

MR. DACUS: Nothing further.

MR. KEMP: We have a standard order for deposition and a miniscript and I guess we don't have a video today, but we have a standard order so whatever that is.

MR. DACUS: Actually, I'm going to defer to Mr. Russell who's probably more familiar with what the standard is than I am.

MR. RUSSELL: Yes. We also have a standing order through LIT Services. So whatever that would be, a rough -- we don't need a rough. We also have a standing order with LIT Services, whatever that would be.

(Deposition concluded at 3:40 p.m.)

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I, PABLO FIERROS, have read the foregoing deposition and hereby affix my signature that same is true and correct, except as noted above.

_____
PABLO FIERROS

The State of Texas)
County of El Paso)

Before me, _____, on this day personally appeared PABLO FIERROS, known to me (or proved to me under oath or through _____) to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that they executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this _____ day of _____, 2017.

_____
Notary Public in and for
El Paso County, Texas
My commission expires:

[CM]

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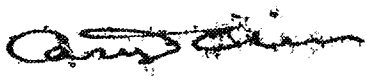
CERTIFICATE

State of Texas)
)
County of El Paso)

I, Caryn Miller, a Certified Shorthand Reporter, in and for the State of Texas, do hereby certify that this deposition transcript is a true record of the testimony given by PABLO FIERROS, after said witness was duly sworn by me, and that said transcription is done to the best of my ability.

Given under my hand and seal of office on this 12th day of October, 2017.



Caryn Miller, CSR, Texas #9276
Expiration Date: 12/31/17
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ERRATA SHEET

I declare under penalty of perjury that I have read the foregoing _____ pages of my testimony, taken on _____ (date) at _____(city), _____(state), and that the same is a true record of the testimony given by me at the time and place herein above set forth, with the following exceptions:

Page	Line	Should read:	Reason for Change:
___	___	_____	_____
		_____	_____
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ERRATA SHEET

Page Line Should read: Reason for Change:

Date: ____________ ______________________________

Signature of Witness

____

Name Typed or Printed

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EXHIBIT 8

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EXHIBIT 8

October 5, 2017

Will Kemp, Esq.
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Case: Khiabani vs MCI (MCI Tour Bus-Bicycle Fatal Accident In Las Vegas)

Dear Mr. Kemp, Esq. and Mr. Pepperman, Esq:

You have asked me to evaluate the April 18, 2017 MCI Tour Bus-Bicyclist Fatal Accident involving deceased cyclist Kayvan Khiabani, M.D. and a 2008 MCI J4500 Tour Bus, that occurred on in Las Vegas at the intersection of Charleston Boulevard and Pavilion Center Drive.

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You have specifically requested me to evaluate the forward direct visibility and proximity sensors of the subject 2008 MCI Tour Bus. This also included determining if proximity sensors were necessary and available at the time or the manufacture of the 2008 MCI Tour Bus. This also required determining and if those proximity sensors would be capable of detecting bicycles and pedestrians in front of or forward of the front right corner of the tour bus before this accident occurred and whether the tour bus driver could have warned of the close proximity of such a bicycle.

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You also requested whether the subject 2008 MCI Tour Bus could be updated with aftermarket proximity sensors to detect bicycles and pedestrians in the front of the Tour Bus and /or in front of or just to the right of the front of the Tour Bus.

This letter is a report of my work and findings in the Dr. Khiabani case to date. As part of that work, I have inspected, reviewed and photographed the subject MCI Tour Bus accident vehicle regarding its direct and indirect visibility capabilities. I have also viewed the accident site in Las Vegas along the east side of the Red Rock Casino & Spa (on southbound Charleston Boulevard at the intersection of Charleston and Pavilion Center Drive).

I have determined that the 2008 MCI Tour Bus involved in this fatal bus to bicycle accident had severely limited visibility in the right front corner of the bus. I have also determined that this MCI tour bus was not outfitted with any proximity sensors, collision warning system or an active cruise control system accompanied by bus driver warnings at all that could have notified the MCI tour bus driver of the impending fatal tour bus to bicycle accident in this case.

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The magnitude of serious right front corner blind spot on the 2008 MCI Tour Bus is due to the following:

- High Bus Cab Instrument Panel Top Relative To The Ground And To The Bus Driver's Seating Position.
- Reduced Downward Direct Visibility Of The Bus Driver.
- Reduced Right Front Corner Visibility Due To The Wide Right Hand Windshield Pillar("A" Pillar) And Door Frame Obstruction.
- Reduced Forward And Right Front Side Visibility Due To The Almost Solid Tour Bus Lower Door.

I have determined that proximity sensors and collision warning systems were available and in use to detect pedestrians and bicyclists in these types of blind spots before 2008. Additionally retrofit proximity sensors and collision warning systems were available and in use to detect pedestrians and bicyclists in these types of blind spots before 2008.

I believe that I have an extensive automotive direct and indirect visibility background and automotive sensor systems to make this evaluation. My background in this area is detailed below. Additional information regarding my education and engineering background is also included as Attachment A to this report. A complete listing of the items I have reviewed in preparation of the report is included as Attachment B.

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A. Background Of Thomas P. Flanagan Regarding Automotive Sensors And Driver Direct Visibility

My direct and indirect visibility background and automotive sensor system background is based on nearly 25 years of experience in the auto industry as a design engineer, supervisor and engineering manager in the Advanced Engineering and Safety Engineering Departments of both Chrysler and General Motors.

At Chrysler I was the Senior Engineer and Engineering Supervisor in Advanced Engineering responsible for both direct and indirect fields of view. Regarding indirect visibility, I was responsible for establishing the size and locations of both the inside and outside rear view mirrors and their respective fields of view.

A listing of my automotive engineering and visibility and automotive experience is included as Attachment A to this report.

A complete listing of the items I have reviewed in preparation of the report is included as Attachment B.

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This report contains my current professional opinions in this case. Recognizing that discovery and investigation in this case is continuing, I reserve the right to amend or supplement these professional opinions as additional information is received.

B. THE MAGNITUDE OF THE PROBLEM – BUS, PEDESTRIAN AND BICYCLE ACCIDENTS

Pedestrian and bicycle safety have been and remain a primary safety issue. This is particularly true in the urban community. These incidents represent a considerable hazard to the public because they often represent severe injuries or fatalities.

It is therefore a great incentive to deploy modern technology to assist drivers in identifying the presence and movement of pedestrians and bicycles around motor vehicles. This is particularly important with bus to pedestrian accidents.

With regards to **bus to pedestrian accidents, they occur eight time more per miles traveled than all other types of motor vehicles, including passenger cars, light duty truck, crossover vehicles, sport utility vehicles, vans and minivans.**

The above statement is supported by governmental accident data bases such as the NHTSA FARS database, CDC databases, and other state databases.

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With respect to the national statistics or studies involving either (1) bus to pedestrian annual fatalities and (2) bus to bicycle annual fatalities, the following has been reported:

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1. Annual Bus To Pedestrian Fatalities And Injuries

The statements below are supported by governmental accident data bases such as the NHTSA FARS database, CDC databases, and other state databases.

Over approximately last decade, typically 5,000 pedestrians die in motor vehicle accidents annually and nearly 76,000 pedestrians suffered injuries when hit by a car, truck or a bus. Recently it has been reported that pedestrian fatalities are at the highest rate in the last two decades.

Pedestrian deaths as a share of total motor vehicle crash deaths increased from 11 percent in 2006 to 15 percent in 2015. (See Governors Highway Safety Association Reports). And pedestrian deaths are sharply outpacing fatalities overall, climbing 25 percent from 2010 to 2015, according to Retting's research while total traffic deaths increase about 6 percent over the same period.

The Center For Decease Control (CDC) indicates 5,376 pedestrians were killed in traffic crashes in 2015 in the United States. This averages to one crash-related pedestrian death every 1.6 hours.

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Additionally, almost 129,000 pedestrians were treated in emergency departments for non-fatal crash-related injuries in 2015. Pedestrians are 1.5 times more likely than passenger vehicle occupants to be killed in a car crash on each trip.

Nearly seven of every ten pedestrian fatalities happen in urban areas. Nine out of every ten pedestrian fatalities occur during normal weather conditions.

A NTSB Member recently stated that "Pedestrians are our most vulnerable road users," (NTSB member Bella Dinh-Zarr).

The National Highway Traffic Safety Association (NHTSA) reports that each year nearly 5,000 pedestrians die in motor vehicle related accidents, and approximately 76,000 pedestrians in 2012 suffered injuries when hit by a car, bus or truck.

In 2013, the NHTSA indicated pedestrian deaths accounted for 14 percent of all traffic fatalities in motor vehicle traffic crashes.

Most studies note that on a population basis, higher pedestrian fatality rates occur in urban areas. The excess urban risk is usually attributed to greater numbers of both vehicles and pedestrians per square mile.

In the study below, **the rural/urban rate difference for buses versus all other motor vehicles is nearly eightfold. http://injuryprevention.bmj.com/content/11/4/232**

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So the large number of pedestrian fatalities and serious personal injuries, especially with buses, is an area of serious concern and a high risk that cannot be ignored.

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Conclusion:

The large number pedestrian fatalities and serious personal injuries is an area of serious concern and a high public safety risk that cannot be ignored. And the reduction of these pedestrian accidents requires attention and mitigation methods to reduce these accidents. Pedestrian deaths by collision with a motor vehicle (especially buses) is a serious public safety problem and should be mitigated by all reasonable means possible.

2. Total Annual Motor Vehicle To Bicycle Fatalities

The statements below are supported by governmental accident data bases such as the NHTSA FARS database, CDC databases, and other state databases.

Per mile of vehicle travel, **buses kill eight times as many pedestrians as cars.**

http://injuryprevention.bmj.com/content/11/4/232

Buses are eight times more likely to kill a bicyclist in a bus to bicycle accident than any other type of motor vehicle.

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In research studies, **the rural/urban rate difference for buses is nearly eightfold.**

http://injuryprevention.bmj.com/content/11/4/232

Between 750 to more than 818 bicyclists are killed every year by a bus. That is more than 2 bicyclists per day.

The NHTSA has also indicated that a total of **720 bicyclists were killed in crashes with motor vehicles in 2014.**

In 2014, **86** percent of bicyclist deaths were those ages 20 and older.

In 2015, 818 people lost their lives in bicycle/motor vehicle crashes. This is more than two people every day of the year in the U.S. It also represents a 6 percent increase in bicyclist fatalities since 2006 and a 12.2 percent increase from the previous year (2014).

Most studies note that on a population basis, higher pedestrian fatality rates occur in urban areas.

http://injuryprevention.bmj.com/content/11/4/232

Buses were much more likely than passenger cars to be involved in a pedestrian fatality for every mile of travel. They were almost eight times more likely to be involved in pedestrian fatalities per mile traveled.

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http://injuryprevention.bmj.com/content/11/4/232

The average age of bicyclists killed in crashes with motor vehicles continues to increase, climbing to 45 years old in 2014, up from 39 in 2004, 32 in 1998, and 24 in 1988. 88 percent of those killed were male.

71 percent of bicyclist fatalities occurred in urban areas.

Conclusion:

The large number of bus to bicycle fatalities and serious personal injuries is an area of serious concern and a high public safety risk that cannot be ignored. And the reduction of these bus to pedestrian accidents requires attention and mitigation methods to reduce these bus to bicycle accidents. This is especially true since a bus or a tour bus is eight times more likely to kill pedestrians and bicyclist that passenger cars

C. THE NEED FOR GOOD TOUR BUS DRIVER VISIBILITY

In 1992 a National Bus Ergonomics Report by the Transportation Research Council (TRC) indicated that **"bus driver visibility was of utmost importance".**

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This committee was comprised of numerous bus safety stakeholders and bus manufacturers that supported this recommendation.

1. Driver direct visibility is of paramount importance to the safe operation of a tour bus.

2. Providing the best feasible direct and indirect vision to the tour bus driver is of extreme and paramount importance to the safety of:

- Preventing bus accidents.
- Protecting the bus driver.
- Protecting the bus occupants.
- Vehicles and bicycles to the front, rear and side of the transit bus.
- Vehicles and bicycles in the adjacent lanes to the transit bus.
- Bicycles and pedestrians on the sidewalks, at the curbs, in the crosswalks, and in the roadway as the bus is traveling forward or while stopped.
- Bicycles and pedestrians on the sidewalk, at the curb, in the crosswalks, and in the roadway when the bus is making a left or right hand turn.
- Bicycles and pedestrians near or around the bus.
- Pedestrians and other vulnerable persons waiting for the bus.
- Pedestrians entering and exiting the tour bus.
- Being able for the bus driver to see all necessary objects (including bicycles and pedestrians) regardless of the bus driver's seated height.
- Being able to adequately see bicycles, motor cycles, motor bikes, motor scooters, pedestrians, baby carriages, other moving objects and other vulnerable persons around the bus.

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3. An essential principle of the safe operation of a bus is to provide an adequate "day light opening" (DLO) for the direct visibility of the bus driver.

4. This would include the largest feasible DLO for the windshield, doors, side windows and rear window.

5. This would include having a large-as-feasible windshield with the best feasible lateral, downward and vertical direct visibility for the bus driver.

6. Those who design, manufacture, advertise and sell vehicles such as automobiles, light duty trucks commercial vehicles and buses etc. must recognize that the bus driver's direct visibility is an essential condition for driver to see pedestrians, bicyclists, children, moving or stationary objects and vulnerable persons and such direct visibility is essential to public and traffic safety.

7. Bus blind spots preventing the bus driver from seeing other vehicles, bicycles, pedestrians, children, stationary objects, moving objects and other vulnerable persons should be minimized.

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8. If significant bus vehicle blind spots limit the bus driver from seeing other vehicles, bicycles, pedestrians, children and other vulnerable persons must be mitigated as best as possible, including technically and economically feasible blind spot mitigation techniques.

9. If significant bus vehicle blind spots limit the bus driver from seeing other vehicles, bicycles, pedestrians and other vulnerable persons cannot mitigated these blind spots to a safe level, then the bus driver must be warned that such a bicyclist or pedestrian is or is about to be in the blind spot.

10. This would include proximity sensor systems and audible and visual collision warning systems of the bus with pedestrians, bicyclists, children, moving or stationary objects and vulnerable persons

D. PROXIMITY SENSORS AND COLLISION WARNING SYSTEMS WERE AVAILABLE TO DETECT PEDESTIANS AND BICYCLISTS BEFORE 2008

1. Between 1992 and 2008 numerous front proximity sensor systems and forward collision warding systems (FCW) and active cruise control systems (ACC) were available to all types of vehicles, including buses and tour buses as either original equipment or as an aftermarket item.

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2. Well before the subject 2008 MCI J4500 Tour Bus was manufactured, and sold, numerous auto manufacturers (OEM), commercial vehicle manufacturers (OEM), coach manufacturers, tour bus manufacturers and commercial vehicle fleets were utilizing OEM proximity sensor systems or aftermarket proximity sensor systems for providing forward collision warnings (FCW) systems or active cruise control (ACC) systems.

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3. The subject 2008 MCI Tour Bus was designed and manufactured by MCI without forward proximity sensors and without front corner proximity sensors.

4. At the time, the subject 2008 J4500 MCI Tour Bus was designed and built, it had a significant hazardous right front blind spot in its lower front corner. This blind spot could completely hide a bicyclist on a bike from the tour bus driver's direct field of view in front of the right corner of the bus and along the front corner of the bus.

5. Proximity sensors and collision warning systems were available and in use to detect pedestrians and bicyclists before 2008.

6. Retrofit proximity sensors and collision warning systems were available and in use to detect pedestrians and bicyclists before 2008.

E. THE SAFETY HIERARCHY OF DESIGN PRINCIPLES

Safety engineers regularly analyze safety problems using **the three-part safety hierarchy of design**, which sets out priorities for addressing product hazards. See, for example,

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http://www.safetyhumanfactors.org/wp-content/uploads/2011/12/314LaugheryWogalter2010.pdf

Part 1: The first preferred solution to a safety problem is to redesign the product to design out the hazard.

Part 2: Where a safer design to design out the hazard is not feasible, the next preferred approach is creating a guard or shield against the hazard to prevent injury, such as a blade guard on a table saw or a fan shroud on a radiator fan.

Part 3: Where guards or shields to protect against the hazard are not feasible, then **strong warnings** on the product or active warning systems are required regarding the hazard. These warnings must do more than just inform the users about the design hazard. It is much preferred that these strong warnings will change behavior of the users regarding the hazard.

The manufacturer's first responsibility is to detect in the product as many foreseeable hazards as possible.

The manufacturer's second responsibility is to design out any hazards that could be designed out, as long as these design changes are technically and economically feasible. This would include utilizing guard to protect against the hazard.

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The manufacturer's third responsibility is to adequately warn about any remaining hazards that could not either be designed out or guarded against.

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MCI violated all the principles of the "Hierarchy of Design" when MCI designed, manufactured, and sold the 2008 MCI J4500 Tour Bus with a dangerous and defective right front blind spot.

MCI Management did not follow the principles of the "Hierarchy of Design" when it designed and developed a dangerous and defective right front visibility blind spot.

In designing the 2008 MCI J4500 Tour Bus with a dangerous and defective right front blind spot, MCI Management violated the First Principle of "Hierarchy of Design" because they "designed in the blind spot".

MCI Management violated the Second Principle of "Hierarchy of Design" because they did not design out the hazard or to guard against the hazard of a dangerous and defective right front blind spot to safety detect pedestrians, bicycles and other vulnerable persons to protect them from highly foreseeable bus to bicycle and bus to pedestrian accidents.

Since MCI did not give any warnings its tour bus driver regarding the dangerous right front blind spot condition, such as providing a proximity sensors system with an audible and visual warning regarding pedestrian and bicycle impact hazards with the 2008 MCI J4500 Tour Bus, MCI violated the Third Principle of the "Hierarchy of Design" because there were no such warning systems provided at all.

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F. SUMMARY OF PROFESSIONAL OPINIONS

1. The serious bus-pedestrian and bus-bicyclist impact problem was well known by the mid 1990's by the transportation industry. It continued to be increasingly known up until the time the 2008 MCI J4500 Tour Bus was designed, advertised, manufactured and sold by MCI.

2. Bus to bicycle accidents represent a considerable hazard to the public because they often represent severe injuries or fatalities.

3. The large number of bus to bicycle fatalities and serious personal injuries is an area of serious concern and a high public safety risk that cannot be ignored. And the reduction of these bus to bicycle accidents requires attention and mitigation methods to reduce these type accidents.

4. This is especially true since a bus or a tour bus is eight times more likely to kill pedestrians and bicyclist that passenger cars

5. This is because bus to pedestrian accidents, occur eight time more per miles traveled than all other types of motor vehicles (including passenger cars, light duty trucks, crossover vehicles, sport utility vehicles, vans and minivans).

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6. Thus, there is a strong need to reduce bus to bicycle accidents because of their high safety risk.

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7. It is therefore of great incentive to deploy modern technology to assist drivers in identifying the presence and movement of pedestrians and bicycles around motor vehicles, particularly buses.

8. Between 1992 and 2008 numerous front proximity sensor systems and forward collision warding systems (FCW) and active cruise control systems (ACC) were available to all types of vehicles, including buses and tour buses as either original equipment or as an aftermarket item.

9. Well before the subject 2008 MCI J4500 Tour Bus was manufactured, and sold, numerous auto manufacturers (OEM), commercial vehicle manufacturers (OEM) and commercial vehicle fleets were utilizing OEM systems or aftermarket systems for providing forward collision warnings (FCW) systems or active cruise control (ACC).

10. The subject 2008 MCI Tour Bus was designed, manufactured, marketed, advertised and sold by MCI without forward proximity sensors or front corner proximity sensors.

11. At the time, the subject 2008 J4500 MCI Tour Bus was designed and built, it had a significant hazardous right front blind spot in its lower front corner. This blind spot could completely hide a bicyclist on a bike from the drivers view at or in front of the tour bus's front end.

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12. The magnitude of serious right front corner blind spot on the 2008 MCI Tour Bus is due to the following:

- High Bus Cab Instrument Panel Top Relative To The Ground And To The Bus Driver's Seating Position.
- Reduced Downward Direct Visibility Of The Bus Driver.
- Reduced Right Front Corner Visibility Due To The Wide Right Hand Windshield Pillar("A" Pillar) And Door Frame Obstruction.
- Reduced Forward And Right Front Side Visibility Due To The Almost Solid Tour Bus Lower Door.

13. The lower right front direct visibility of the subject 2008 MCI Tour Bus was greatly limited. This is the area where Dr. Khiabani was when the MCI Tour Bus was approaching Dr. Khiabani on his road bike in the bike lane in front of the tour bus.

14. This direct visibility restriction was due to the severely restricted downward view of the tour bus driver though the lower portion of the windshield and the large size of the right hand windshield pillar (the right side "A" pillar).

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15. The solid lower portion to the tour bus entrance and exit door made is difficult for the tour bus driver to see Dr. Khiabani on his road bike when he was just behind the right front corner of the MCI Tour Bus.

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16. Well before the subject 2008 MCI J4500 Tour Bus was designed, manufactured, advertised and sold, numerous auto manufacturers (OEM), commercial truck manufacturers (OEM), commercial bus manufacturers (OEM), and commercial truck fleets were utilizing OEM systems or aftermarket systems for providing forward collision warnings (FCW) systems or active cruise control (ACC). See Excel spreadsheets showing available proximity sensors by year and motor vehicle type, Bates Nos. T.Flanagan000001-T.Flanagan00021, see also documents pertaining to proximity sensor information. (To be produced separately)

17. These systems were all utilizing proximity sensors as the main basis for these Active Cruise Control (ACC) and Forward Collision Warning (FCW) Systems.

18. Proximity sensor systems with audible and visual collision warning system were common in the market palace as either an original equipment manufacturer (OEM) system, a fleet installed system or an aftermarket system.

19. The subject 2008 MCI Tour Bus has a hazardous blind spot in its lower front corner.

20. The subject 2008 MCI Tour Bus was designed, manufactured, advertised, marketed and sold by MCI without either forward proximity sensors or front corner proximity sensors.

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21. Proximity sensors and collision warning systems were available and in use to detect pedestrians and bicyclists before 2008.

22. Retrofit proximity sensors and collision warning systems were available and in use to detect pedestrians and bicyclists before 2008.

23. In this case, MCI's first responsibility was to determine the hazards as many foreseeable hazards as possible (such as front corner blind spots).

24. In this case, MCI's second responsibility was to design out or guard against any hazards, as long as these design changes and guards were technically and economically feasibility.

25. In this case, MCI's third responsibility is to adequately warn about any remaining hazards that could not either be designed out or guarded against. One of the methods that could be utilized by MCI was to warn against right corner blind spots with front and front corner proximity sensor systems.

26. MCI violated all the principles of the "Hierarchy of Design" when MCI designed, manufactured, and sold the 2008 MCI J4500 Tour Bus with a dangerous and defective right front blind spot.

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27. MCI Management did not follow the principles of the "Hierarchy of Design" when it designed and developed a dangerous and defective right front visibility blind spot.

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28. In designing the 2008 MCI J4500 Tour Bus with a dangerous and defective right front blind spot, MCI Management violated the First Principle of "Hierarchy of Design" because they "designed in the blind spot".

29. MCI Management violated the Second Principle of "Hierarchy of Design" because they did not design out the front corner blind spot hazard to eliminate safety detect for pedestrians, bicycles and other vulnerable persons and to protect them from highly foreseeable bus to bicycle and pedestrian accidents.

30. And MCI failed to provide front proximity systems to guard against the hazard of a dangerous and defective right front blind spot to safety detect and warn the bus drivers of the need to protect pedestrians, bicycles and other vulnerable persons from highly foreseeable bus to bicycle and bus to pedestrian accidents.

31. Since MCI did not give any warnings its tour bus driver regarding the dangerous right front blind spot condition, such as providing a proximity sensors system with an audible and visual warning regarding pedestrian and bicycle impact hazards with the 2008 MCI J4500 Tour Bus, MCI violated the Third Principle of the "Hierarchy of Design" because there were no such collision warnings given at all.

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32. This 2008 MCI Tour Bus lacked any front and forward and front right looking proximity sensor system to mitigate and warn about the dangers of this blind spot.

33. This presented an unreasonable risk to bicycles and pedestrians traveling at or near the front corner of a bus. Particularly with the eight times higher risk of a bus causing a fatal injury to a bicyclist than all other motor vehicle types.

34. The lack of these proximity sensors to detect high risk pedestrians, bicycles and other vulnerable persons made the subject 2008 MCI Tour Bus to be unreasonably dangerous and defective as designed and manufactured.

35. Proximity sensors systems coupled with a driver collision warning system would have contributed significantly to reducing the risk of a bicycle or pedestrian accident with the subject MCI Tour Bus, such as the tragic bus accident involving the severe injuries and death of Dr. Khiabani.

36. Specifically, considering the design features of the 2008 MCI Tour Bus, the utility of the 2008 MCI Tour Bus, and the high bicyclist and pedestrian collision risks involved in its use, the subject tour bus was inadequate to protect bicyclists and pedestrian from crashes involving persons located directly in front of it or around the front corner area of the bus.

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37. Proximity sensors with a bus driver collision warning system were a safer alternate design to the severely restricted forward "driver only" visibility system utilized by MCI. Some bus manufacturers, such as Volvo Bus, include proximity sensors as standard original equipment on their buses.

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38. Proximity sensors systems with a bus driver collision warning systems would have greatly increased electronic visibility of these buses vehicles to bicyclists and pedestrians located directly in front of the bus or front corner area of the bus subject MCI Tour Bus.

39. Proximity sensor systems and a collision warning systems were commercially available and economically and technologically feasible at the time the subject 2008 MCI Tour Bus was designed, manufactured, marketed, advertised and sold.

40. Retrofit proximity sensors and collision warning systems were available and in use to detect pedestrians and bicyclists, and were commercially available and economically and technologically feasible at the time the subject 2008 MCI Tour Bus was designed, manufactured, marketed, advertised and sold.

41. The bus driver testified that he did not see Dr. Khiabani at any point after the first municipal bus stop on Pavilion Center Drive until Dr. Khiabani was behind the bus's right front corner at the bus door just before the accident occurred. While every fact witness testified that Dr. Khiabani was ahead of the bus the entire way down Pavilion Center until the bus began to overtake him as it entered the intersection with Griffith Peak, the bus driver did not see Dr. Khiabani for approximately 400-500 feet as the two travelled along Pavilion Center.

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42. The bus driver testified that he took evasive action by steering the bus to the left (away from Dr. Khiabani) as soon as he saw Dr. Khiabani at the bus's right side door, which is behind the right front corner of the bus. The driver further testified that, if he had seen Dr. Khiabani earlier, or if the bus had some sort of sensor system that had alerted him that Dr. Khiabani was near the bus (e.g., with a flashing red light or audible warning), he would have taken evasive action earlier.

43. Based on the bus driver's testimony, it is clear that the driver was not aware of Dr. Khiabani for approximately 400-500 feet along Pavilion Center between the municipal bus stop and the point in the intersection with Griffith Peak immediately before the accident occurred. The bus driver did not become aware of Dr. Khiabani's presence until it was too late to evade the accident.

44. Because the bus driver testified that he would have taken evasive action sooner if he had been given some sort of warning of Dr. Khiabani's presence (e.g., a visual or audible signal emitted by a proximity sensor/driver collision warning system), it is my opinion to a reasonable degree of professional and engineering certainty that a proximity sensor system/driver collision warning system on the subject bus would have likely prevented the subject accident involving the severe injuries and death of Dr. Khiabani.

45. Given the serious nature of severely restricted forward visibility design of the MCI Tour Bus, including the previously described right hand blind spot zone and door, the subject MCI Tour Bus was to a reasonable degree of engineering certainty partially responsible for the subject accident and Dr. Khiabani's subsequent injuries and death.

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46. The bus driver stated that, had he seen Dr. Khiabani, he would have taken evasive action earlier. Based on the bus driver's testimony, the bus driver clearly did not see Dr. Khiabani until after Dr. Khiabani was past the right front corner and side of the bus, where visibility is restricted. This is a crucial point because of the air blast emitting from the bus' broad flat front end and flat windshield. Any evasive action prior to the front of the bus catching up to Dr. Khiabani would have minimized the effect of the wind blast on Dr. Khiabani, likely preventing the subject accident. Thus, severely restricted forward visibility design of the MCI Tour Bus, including the right hand blind spot zone and door, was a substantial factor in causing the subject accident.

This report contains my current professional opinions in this case.

Recognizing that discovery and investigation in this case is continuing, I reserve the right to amend or supplement these professional opinions as additional information is received.

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Please feel free to contact me if you have any questions or need any additional information. I will be glad to discuss them with you.

Respectfully,

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ATTACHMENT B

ITEMS REVIEWED FOR THIS CASE

Accident Police Report.

Police Investigation Of Tour Bus Accident Involving Dr. Khiabani,

Coroner's Report Regarding Dr. Khiabani.

Dr. Khiabani Accident Scene Surveillance Video, Site Photographs And Illustrations.

Dr. Khiabani Accident Scene and Accident Site Aerial And Satellite Photos.

Dr. Khiabani Accident Scene Photogrammetry Illustrations, Graphics And Regarding The Tour Bus – Bicycle Accident Direct Visibility Simulations (By Fat Pencil Studio – Portland).

Examination, Review And Photographs Of The Subject 2008 MCI Tour Bus And The Accident Site Near The Red Rock Hotel In Las Vegas On August 9, 2017.

Canadian Transit Bus Occupant Compartment And Driver Requirements Design Study (1992).

TCRP Report 125 (1992).

TCRP Report 125 (2008).

Technical Information, Drawings, Illustrations and Correspondence Relating To The Subject MCI Tour Bus and other MCI Tour Buses Designed, Marketed, Advertised, Manufactured and sold by MCI (if any).

Depositions of MCI Employees and Representatives taken and associated exhibits (if any).

Depositions of Accident Scene Witnesses and Accident Scene Paramedic and associated exhibits.

Research Information And Parts Regarding Vehicle Proximity Sensors and Collison Warning Systems.

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Technical And Design Information From The Society Of Automotive Engineers (SAE) Regarding The SAE Recommended Practices For Measuring And Determining Driver Visibility (SAE Recommended Practice J985, Etc.; The SAE Eye Ellipse (SAE Eyellipse); And The Occupant "H" Point Design Aide Measuring Device.

Tour Bus Photos by myself and by Joshua Cohen of Fat Pencil Studio in Las Vegas (August 9, 2017).

Accident Scene Graphics by Joshua Cohen of Fat Pencil Studio in Portland.

Research Regarding Academic, Governmental And Transportation Group Research Papers Concerning Proximity Sensors And Collision Warning Systems, Etc.

Research Regarding Eaton VORAD, Bendix VORAD, Webcor, Delphi And Other Commercial Providers Of Proximity Sensors Systems, Collision Warning Systems, Active Cruise Control, Etc.

Research Regarding Various Manufacturers Active Cruise Control And Collision Warning Systems And Various Retrofit Proximity Sensor Systems And Collision Warning Systems.

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Research Regarding Other Supplier, Manufacturer, Fleet, Or Aftermarket Active Cruise Control And Collision Warning Provisions Systems.

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Research Regarding Various Supplier, Manufacturer, Fleet Or Aftermarket Side Collision Warning Systems.

Research Regarding Supplier, Manufacturer, Fleet Or Aftermarket Active Cruise Control And Collision Warning Provisions Systems, Etc.

Research Regarding Front / Front Corner Located Proximity Sensors, Forward Collision Warning Systems, Active Cruise Control Systems, Etc.

Various Supplier, Automotive, Commercial Vehicle, Bus, And Aftermarket Proximity Sensor Sales Brochures, Advertising, Service Manuals Operator Manuals, Tour Bus Information. Etc.

Research Information Regarding OEM And Aftermarket Proximity Sensors And Collision Warning Systems.

Research Information Regarding NHTSA, FARS, CDC, Governmental, State And Research Databases Regarding Bus, Bicycle And Pedestrian Accidents.

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Research Regarding Various Supplier, Commercial Vehicle Owner's Manuals, Operator's Manuals, Sales Brochures, Service Manuals, Advertising Press Releases, Etc. Related To Proximity Sensors Or Collision Warning Systems.

Various Auto, Automotive Supplier, Commercial Truck and Tour Bus Patents Regarding Proximity Sensors, Active Cruise Control, Collision Warning Systems, Etc.

Various Supplier, Commercial Truck Fleet Owner's Manuals, Sales Brochures, Service Manuals, Advertising, Press Releases, Etc.

Various Supplier, Passenger Car, Commercial Truck, Commercial Bus And Tour Bus Fleet Owner's Manuals, Sales Brochures, Service Manuals, Advertising, Press Releases, Etc.

Patents Regarding Proximity Sensors, Collision Warnings, Active Cruise Control, Side Sensors, Front Corner Sensors, Side Sensors, Etc.

MCI Discovery Responses and Documents Produced.

1. Amended Khiabani Complaint.
2. Scott Bike Manual - P00150-P00175.
3. Photos of Khiabani's Scott 10-speed road bike taken by KJC. P00291-P00335.
4. Bus dimensions and specs found on line for MCI J4500 (2008).
5. Photos, GoPro videos and 360-degree shots taken by Joshua Cohen at bus and at site inspection on August 9, 2017.
6. Post-accident video taken by accident scene witness Luis Sacarias (Red Rock Gardener) of April 18, 2017 (graphic).
7. Deposition of Erika Bradley plus exhibits taken on August 15, 2017.
8. Deposition of Aaron Bradley plus exhibits taken on August 15, 2017.
9. Deposition of Shaun Harney plus exhibits taken on August 17, 2017.
10. Deposition of Luis Sacarias plus exhibits taken on August 14, 2017.
11. Cohen photos at bus inspection taken on August 9, 2017.
12. Red Rock surveillance video (April 18, 2017).
13. Initial Traffic Accident Report.
14. Clark County Coroner/Medical Examiner's Scene Photographs (1-99).
15. Deposition of Zack Kieft plus exhibits dated August 30, 2017 (rough).
16. Deposition of Samantha Kolch plus exhibits dated August 30, 2017 (rough).
17. Deposition of Robert Pears plus exhibits dated August 17, 2017.
18. Deposition of Michael Plantz plus exhibits dated August 18, 2017.
19. Deposition Of The MCI Tour Bus Operator Edward Hubbard plus exhibits – September 20, 2017.
20. Clark County Coroner's Medical Records, Scene Photos and Victim Injury Photos.

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21 CI Documents: MCI 002960-002992, MCI 002993-003021, MCI 003022-003025.

22. Mentor Wabco Power Point Presentation Of Radar Based SideProximity Sensor System (On Guard), Front Corner Sensors, And Mentor Wabco 2015-2025 Product Plan (17 Pages).

23. Deposition of MCI Regional Sales Manager David Dorr plus exhibits dated September 13, 2017.

24. Deposition of Silverado Vice President Of Sales Chris Groepler plus exhibits dated September 14, 2017.

25. Deposition of S-1 Gard Danger Zone Deflector and MDZ Shield Inventor Mark B. Barron plus exhibits dated September 26, 2017 (rough).

26. Commercial Truck, Bus and Automotive Product Information.

27. Automotive, Truck And Bus Product Information.

28. Proximity Sensor And Collision Warning Product Information.

29. Motor Coach And Tour Bus Product Information (Setra, Volvo Bus, Prevost, Van Hoot, MCI, EvoBus, Daimler Bus, MAN Bus, etc.).

30. Pedestrian And Bicycle Blind Spot Information.

31. Governmental Information And Research Information Regarding Pedestrian, Bicycle. Bus Pedestrian And Bus Bicycle Accidents And Statistics.

32. Governmental, Research And Patent Information Regarding Proximity Sensor Systems And Collision Warning Systems.

33. Excel spreadsheets showing available proximity sensors by year and motor vehicle type, Bates Nos. T.Flanagan00001-T.Flanagan00021.

34. Documents pertaining to proximity sensor information. (To be produced separately).

35. 2008 Mercedes Benz S Class front corner proximity sensor (Part No. 0025409117).

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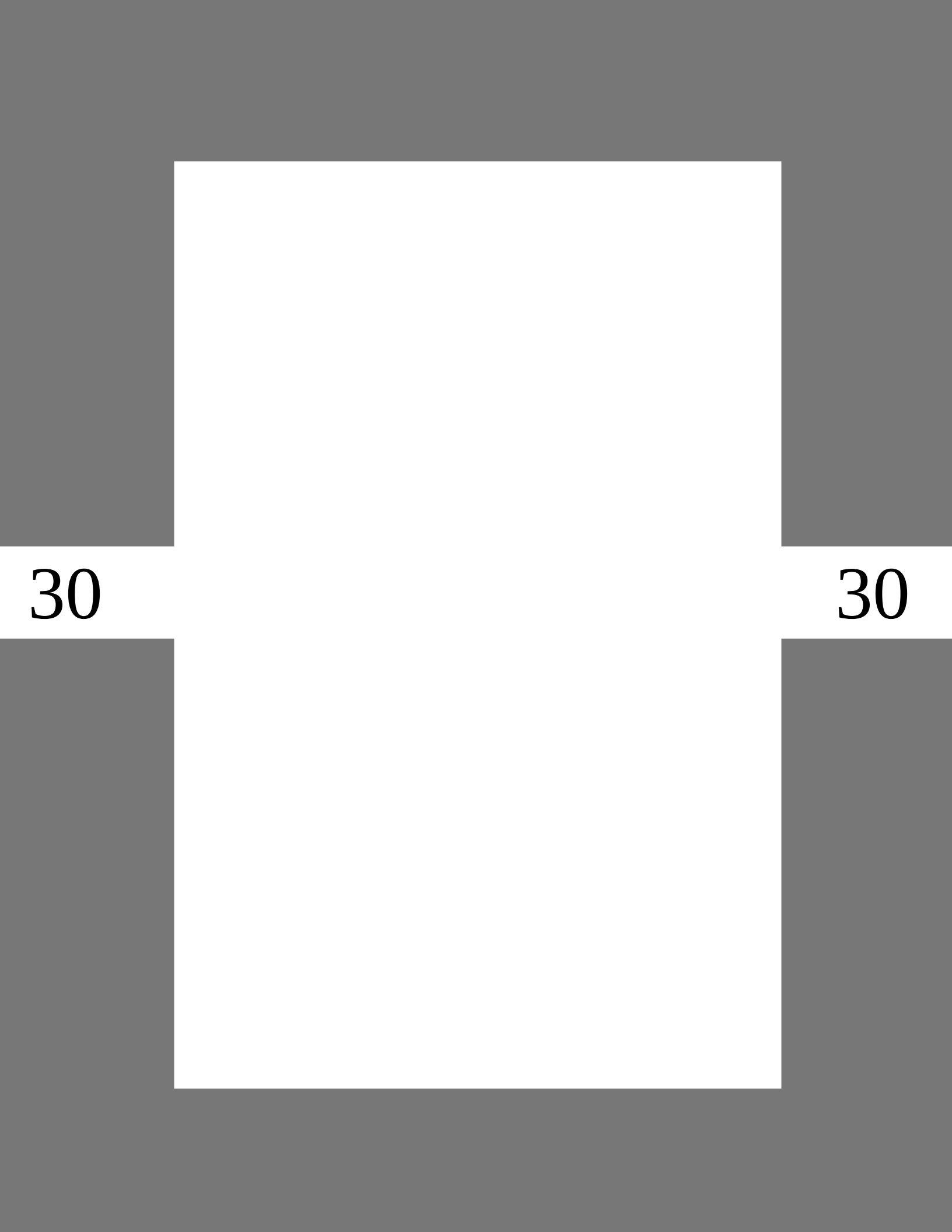
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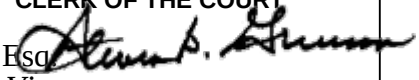

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DISTRICT COURT

CLARK COUNTY, NEVADA

KEON KHIABANI and ARIA KHIABANI, minors by and through their Guardian, MARIE-CLAUDE RIGAUD; SIAMAK BARIN, as Executor of the Estate of Kayvan Khiabani, M.D. (Decedent); the Estate of Kayvan Khiabani, M.D. (Decedent); SIAMAK BARIN, as Executor of the Estate of Katayoun Barin, DDS (Decedent); and the Estate of Katayoun Barin, DDS (Decedent);

Plaintiffs,

v.

MOTOR COACH INDUSTRIES, INC., a Delaware corporation; MICHELANGELO LEASING INC. d/b/a RYAN'S EXPRESS, an Arizona corporation; EDWARD HUBBARD, a Nevada resident; BELL SPORTS, INC. d/b/a GIRO SPORT DESIGN, a Delaware corporation; SEVENPLUS BICYCLES, INC. d/v/a PRO CYCLERY, a Nevada corporation, DOES 1 through 20; and ROE CORPORATIONS 1 through 20,

Defendants.

Case No.: A-17-755977-C

Dept. No.: XIV

MOTION FOR SUMMARY JUDGMENT ON ALL CLAIMS ALLEGING A PRODUCT DEFECT

Case Number: A-17-755977-C

Defendant Motor Coach Industries, Inc. ("MCI"), by and through its attorneys of record, the law firm of WEINBERG, WHEELER, HUDGINS, GUNN & DIAL, LLC, hereby submits the following Motion for Summary Judgment on all Claims Alleging a Product Defect, pursuant to Rule 56 of the Nevada Rules of Civil Procedure.

This Motion is supported by the accompanying Memorandum of Points and Authorities, all pleadings and filings of records, the exhibits attached hereto, and any oral argument the Court may allow.

DATED this 1st day of December, 2017.

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NOTICE OF MOTION

PLEASE TAKE NOTICE that **DEFENDANT'S MOTION FOR SUMMARY JUDGMENT ON ALL CLAIMS ALLEGING A PRODUCT DEFECT** will come on for hearing in the above-entitled Court on the 18 day of JANUARY 2018 9:30A 2017, at _____ a.m./p.m. before Dept. XIV of the above-entitled Court.

DATED this 1st day of December, 2017.

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MEMORANDUM OF POINTS AND AUTHORITIES

Everyone has ridden or at least seen a bus. They are massive. They are not transparent—although they have windows, much of their exterior is metal. Like almost all automobiles, their bodies ride high enough above the ground for a human head to fit underneath. And the danger of being in front of the rolling tires of a bus is obvious. Any ordinary person would expect that riding a bicycle two-to-three feet away from a bus traveling 25 mph can be a precarious place to be.

Plaintiffs theorize that adding certain gadgets and reshaping the body style would make the motor coach at issue safer—*i.e.*, that, comparing the risks and benefits, their alternative design is superior to this one. Yet, even *assuming for purposes of this motion* that Plaintiffs' alternative-design proposal has merit, weighing the relative risks and benefits of alternative designs will not be the jury's charge. The Nevada Supreme Court has reaffirmed that "Nevada will continue to be governed by the consumer-expectation test," which "focuses on the reasonable expectation of the consumer" rather than "focus on the product itself." *Ford Motor Company v. Trejo*, 133 Nev. Adv. Op. 68, *2, 402 P.3d 649, 656, 658 (2017). That means a product may be deemed defective only if it "fails to perform in the manner reasonably to be expected in light of its nature and intended function and it was more dangerous than would be contemplated by the ordinary user having the ordinary knowledge available in the community." *Trejo*, 402 P.3d at 650 (2017), quoting *Ginnis v. Mapes Hotel Corp.*, 86 Nev. 408, 413, 470 P.2d 135, 138 (1970).

Under the correct test, the subject motor coach cannot be deemed defective. Although the reality is sad, one reason that contemplating the incident in this case is so horrifying is *because the scenario is so easy to envision* in light of a bus's expected nature and function, as well as the obvious danger possibility of a driver mishandling a bus or a pedestrian or bicyclist disrespecting the risk of proximity. The bus performed just as an ordinary consumer would expect it should. The bus (or "coach") was not the problem.

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Statement of Undisputed Facts

A. Coach Purchasers and Drivers Have Specialized Knowledge

1. Those who purchase and drive coaches acquire specialized knowledge about those vehicles and their expected dangers. Companies such as Ryan's Express have extensive knowledge through their own experience about the dangers buses pose to their passengers and the public. Drivers of a motor coach require a specialized license and then complete internal training, and the coach company involved in this action trained both in the classroom and on the road. (Deposition of William Bartlett at 41:1-42:5, Ex. A at 2-3.) The former safety and risk management of Ryan's Express believes that all commercial vehicles have some blind spots.[1] (*Id.* at 126:1-8. Ex. A at 4.) The nature of coach operators' profession, of course, gives them extensive real-world experience in navigating the unavoidable hazards that any vehicle poses to passengers and others on the roadway.

2. Plaintiffs presented no expert testimony regarding the expectations of anyone in that community of coach purchasers and drivers with respect to risks posed by all large vehicles.

B. Plaintiffs Claim the Coach Created an "Air Blast" but Present No Evidence that this Created an Unexpected Danger

3. Plaintiffs' expert contends that the motor coach here was going approximately 25 mph at the time of the accident. (Caldwell Report at 4, Ex. B at 10.)

4. Despite that low speed, plaintiffs assert that the coach created an "air blast" that caused Dr. Khiabani to lose control of his bicycle and then be pulled under the right rear tires of the coach.

[1] MCI does not necessarily agree with or concede this overly broad characterization, but it shows that at least one consumer of a motor coach characterized a blind spot as an ordinary (not unreasonably dangerous) risk associated with large vehicles.

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5. Even if that were true, plaintiffs presented no evidence that an ordinary purchaser or driver of a motor coach, or even a passenger, pedestrian, cyclist, or motorist would find some alleged gusts from a passing motor coach to constitute an unexpected danger.[2]

C. Plaintiffs Claim that Blind Spots Rendered the Coach Defective

6. Plaintiffs also claim that MCI's coach should have been equipped with proximity sensors that allegedly would have prevented the accident. Plaintiffs never clearly identify what type of proximity sensors they believe should have been installed (forward-collision warning systems, adaptive cruise control, etc.). Such sensors are complex, and ordinary people would not expect a coach manufactured in 2007 to include them. MCI, an industry leader, was unaware of such proximity sensors being commercially available and technologically appropriate for the subject coach in 2007. (Hoogestraat Depo. at 69:14–70:16, Ex. C at 18-19.).

7. Plaintiffs do not dispute, moreover, the inevitability of blind spots. The placement and focus of a mirror necessarily substitutes the driver's view of one thing for another, obscuring what the driver would otherwise have seen. Blind spots are also a necessary consequence of a coach's structural components, alteration or elimination of which can make the coach less safe.

8. But the perceived risk associated with blind spots in large commercial vehicles is also noted in the Nevada Driver's Handbook, so it appears the Nevada Department of Motor Vehicles believes this to be a known, ordinary risk to all drivers. (Nevada Driver's Handbook at 53, Ex. D at 26.)[3]

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[2] As set forth in "MCI's Motion for Summary Judgment on Punitive Damages," it is MCI's position that any such "air blast" did not create a hazard, but in any event, the question before the Court here is what an ordinary user or consumer would anticipate, and plaintiffs have offered no evidence on that question.

[3] Again as set forth in "MCI's Motion for Summary Judgment on Punitive Damages," MCI does not concede any hazard created by its coach; the point, rather, is that if there is any risk it does not exceed reasonable consumer expectations.

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9. Plaintiffs presented no evidence that an ordinary purchaser or driver of a coach, or even a passenger, pedestrian, cyclist, or motorist would find the blind spots in this coach to constitute an unexpected danger.

D. Plaintiffs Claim that Not Installing the S-1 Gard Made the Coach Defective

10. An S-1 Gard Dangerzone Deflector ("S-1 Gard") is a polyurethane device that can be mounted just before the rear tires of a bus. (S-1 Gard Product information, Ex. E at 28.) The stated purpose of the S-1 Gard is to deflect a person's body away from the tires so as to minimize injury. Plaintiffs contend that if MCI had installed an S-1 Gard on the coach at issue, Dr. Khiabani would have only suffered minor injuries.

11. The S-1 Gard was developed to protect boarding and disembarking passengers on mass transit buses. The promotional video for the S-1 Gard demonstrates various scenarios where a passenger falls near the wheel well as the bus slowly starts from a stopped position. The S-1 Gard is primarily used on public transit buses (i.e., buses that make many stops around town and operate near curbs and bus stops) rather than long haul motor coaches like MCI's coach. The S-1 Gard's inventor admits that even among public transit agencies only fifty percent actually use the S-1 Gard. (Barron Deposition at 112:11-12, Ex. F at 37.) That fully half of such agencies reject the S-1 Gard is even more surprising given that the federal government will now pay public transit agencies to purchase the S-1 Gard. (*Id.* at 90:21-25-91:1-4, Ex. F at 35-36.)

12. Plaintiffs presented no evidence that an ordinary purchaser or driver of a coach, or even a passenger, pedestrian, cyclist, or motorist would find the absence of an S-1 Gard to constitution an unexpected danger. To the contrary, the ordinary person understands that falling in the path of any moving vehicle can lead to catastrophic injury or death.

Argument and Citation of Authority

I. Standard for Motion for Summary Judgment

Summary judgment must be granted "if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter

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of law." NRCP 56(c); *see Wood v. Safeway, Inc.*, 121 Nev. 724, 731, 121 P.3d 1026, 1031 (2005). An issue of material fact is genuine only when the evidence is such that a rational jury could return a verdict in favor of the nonmoving party. *Id.* at 731, 121 P.3d at 1031. When a defendant files a motion for summary judgment that identifies the absence of facts sufficient to establish a claim for relief, the claimant must come forward with facts that are both admissible and sufficient to support the asserted claims. *Id.*

If the nonmoving party bears the burden of persuasion at trial, as plaintiffs do here, "the party moving for summary judgment may satisfy the burden of production by either (1) submitting evidence that negates an essential element of the nonmoving party's claim, or (2) pointing out . . . that there is an absence of evidence to support the nonmoving party's case." *Cuzze vs. University Cmty. Coll. Sys. of Nev.*, 123 Nev. 578, 602–03, 172 P.3d 131, 134 (2007) (internal quotation omitted).

After the moving party demonstrates no genuine issue of material fact exists, to defeat summary judgment the nonmoving party must show the existence of a genuine issue of material fact. *Id*. at 602, 172 P.3d at 134. The party opposing summary judgment is not entitled to build a case on the "threads of whimsy, speculation and conjecture." *Collins v. Union Fed. Sav. & Loan Ass'n*, 99 Nev. 284, 302, 662 P.2d 610, 621 (1983) (affirming summary judgment because plaintiff's affidavit was insufficient to "produce the requisite quantum of evidence to enable him to reach the jury with his claims"). Further, speculative arguments about what the facts might be at the time of trial do not suffice to withstand a motion for summary judgment. *Wood*, 121 Nev. 731–32, 121 P.3d at 1031. The nonmoving party must present genuine issues of material fact to avoid summary judgment. *Id*. at 732, 121 P.3d at 1031 (The non-moving party "bears the burden to do more than simply show that there is some metaphysical doubt as to the operative facts in order to avoid summary judgment being entered in the moving party's favor.").

"The admissibility of evidence on a motion for summary judgment is subject to NRCP 43(a), and evidence that would be inadmissible at the trial of the case is inadmissible on a motion for summary judgment." *Adamson v. Bowker*, 85 Nev. 115, 119, 450 P.2d 796, 799 (1969). Thus,

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"[t]he trial court may not consider hearsay or other inadmissible evidence." *Id.*; NRCP 56(e) (summary judgment papers "shall set forth such facts as would be admissible in evidence").

II. As a Preliminary Matter, this is Not a Proper Product-Defect Case

Dr. Khiabani was neither a consumer nor user of the coach in question. The Nevada Supreme Court recently clarified its formal adoption of "the consumer-expectation test, which is set forth in Section 402A of the Restatement (Second) of Torts." *Trejo*, 402 P.3d at 653. And a literal interpretation of Section 402A, would not extend its scope beyond users or consumers:

> 402A. SPECIAL LIABILITY OF SELLER OF PRODUCT FOR PHYSICAL HARM TO USER OR CONSUMER
>
> (1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby *caused to the ultimate user or consumer*, or to his property . . .

RESTATEMENT (SECOND) OF TORTS § 402A. In fact, an express caveat to Section 402A recognizes that it does not necessarily extend strict-products liability against a manufacturer to a bystander:

> The Institute expresses no opinion as to whether the rules stated in this Section may not apply
>
> (1) to harm to persons other than users or consumers . . .

Id. Comment *o* to the section, moreover, states that "[T]he Institute expresses no opinion as to whether the rules stated in this Section may not apply to harm to persons other than users or consumers." One reason that liability to bystanders is not merely assumed is that the manufacturer makes no implied representation to the world at large as to the character of the product, but rather to the consumer. *See Ewen v. McLean Trucking Co.*, 706 P.2d 929, 932-33 (Or. 2009).

Whether standing extends to bystanders or other non-users technically remains an open question in Nevada. In candor, some opinions of the Nevada Supreme Court (without comment) assume (without comment) that the right to sue in strict liability extends to injured bystanders. *See,*

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e.g., *General Elec. Co. v. Bush*, 88 Nev. 360, 498 P.2d 366 (1972) (injury to person installing product). And it is true that many jurisdictions have extended the right to bystanders to pursue claims in strict liability for injuries caused by defects. Nevertheless, undersigned counsel find no case where the Nevada Supreme Court has squarely addressed the issue or ever held that product-defect claims extend to non-users.

This Court should not presume that Section 402A applies to non-users, as the plain reading of the section indicates that it would not apply, the Nevada Supreme Court has not squarely addressed the issue, and other lower courts have declined to assume that a jurisdiction would extend the right to bystanders where the state's legislature or high court has been silent. *See Davidson v. Leadingham*, 294 F. Supp. 155, 157 (E.D. Ky. 1968); *Mull v. Cold Co.*, 31 F.R.D. 154 (S.D. N.Y. 1962).

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III. Assuming Bystanders May Recover Directly from a Manufacturer, Plaintiffs Still Must Demonstrate that the Product is More Dangerous than an Ordinary User Would Expect

Manufacturers are not insurers of their products; "their liability is not absolute simply upon evidence of injury alone." *Worrell v. Barnes*, 87 Nev. 204, 206, 484 P.2d 573, 575 (1971) (citing P. Keeton, *Products Liability*, 41 TEX. L. REV. 855, 858 (1963)), *overruled on other grounds by Calloway v. City of Reno*, 116 Nev. 250, 993 P.2d 1259 (2000).[4] Thus, the jury cannot presume a defect exists anytime a product causes an injury. *Ginnis*, 86 Nev. at 413, 470 P.2d at 138 (holding

[4] *See also Horst v. Deere & Co.*, 769 N.W.2d 536, 543 (Wis. 2009) ("Strict products liability is not, however, absolute liability. . . . Hence, all of the strict products liability analytical frameworks-including . . . our own focus on consumer expectations-have at least a partial grounding in the necessity of guarding against absolute liability."); *Seattle-First Nat. Bank v. Tabert*, 542 P.2d 774, 779 (Wash. 1975) (en banc) ("the doctrine of strict liability does not impose legal responsibility simply because a product causes harm. Such a result would embody absolute liability which is not the import of strict liability."); Birnbaum, *Unmasking the Test for Design Defect: from Negligence [to Warranty] to Strict Liability to Negligence*, 33 VANDERBILT L. REV. 593, 598 (1980).

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