

Committee

- H. Douglas Robertson**, *Chair*, Highway Safety Research Center, University of North Carolina, Chapel Hill
- **Phyllis Agran**, University of California, Irvine
- **Richard D. Blomberg**, Dunlap and Associates, Stamford, Connecticut
- **Ann M. Dellinger**, Centers for Disease Control and Prevention, Atlanta, Georgia
- **Rodney G. Dobey**, St. Cloud State University, St. Cloud, Minnesota
- **Ned B. Einstein**, Transportation Alternatives, New York City
- **John S. Fabian**, New York State Public Transportation Safety Board, Schenectady, New York
- **James C. Fell**, Pacific Institute for Research and Evaluation, Calverton, Maryland
- **Ted Finlayson-Schueler**, Pupil Transportation Safety Institute, Syracuse, New York
- **Paul S. Fischbeck**, Associate Professor, Carnegie Mellon University
- **Lindsay I. Griffin, III**, Texas Transportation Institute, College Station, Texas
- **Ronald J. Hundenski**, San Francisco Municipal Railway, San Francisco, California
- **Ronald L. Kinney**, Laidlaw Education Services, Sacramento, California
- **Jeffrey C. Tsai**, Pupil Transportation Group, North Carolina State University, Raleigh



Committee's Charge

- Review available data
- Consider the basic characteristics of typical modes used by students
- Assess issues relevant to determining risk associated with each mode



Committee's Charge (continued)

- Assess the efficacy of drawing conclusions from the available data
- Evaluate the availability and adequacy of the salient data

The Problem

- School-aged children in MV crashes during normal school travel hours
 - 800 killed/year
 - 152,000 injured/year
- Relative risks of various modes not well understood
- How do local decision makers balance travel safety with environmental and resource constraints?



Fundamental Approach

- Risk Management Framework
 - Considers school transportation as a whole
 - If you modify one area (e.g., less bus travel) you affect other areas

Travel Modes

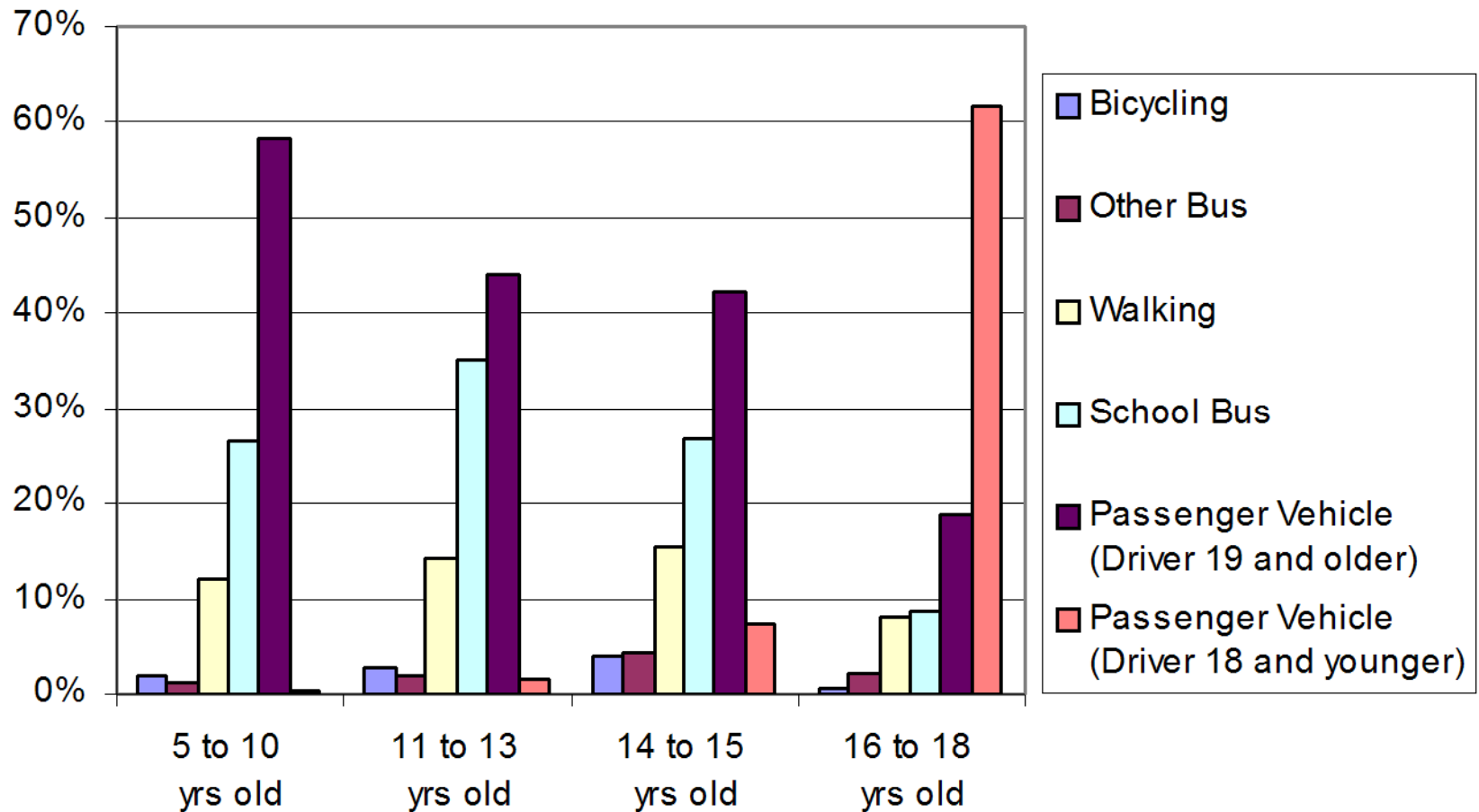
- School bus
- Other bus (transit)
- Passenger vehicle (driver 19 and older)
- Passenger vehicle (driver 18 and younger)
- Bicycle
- Walking



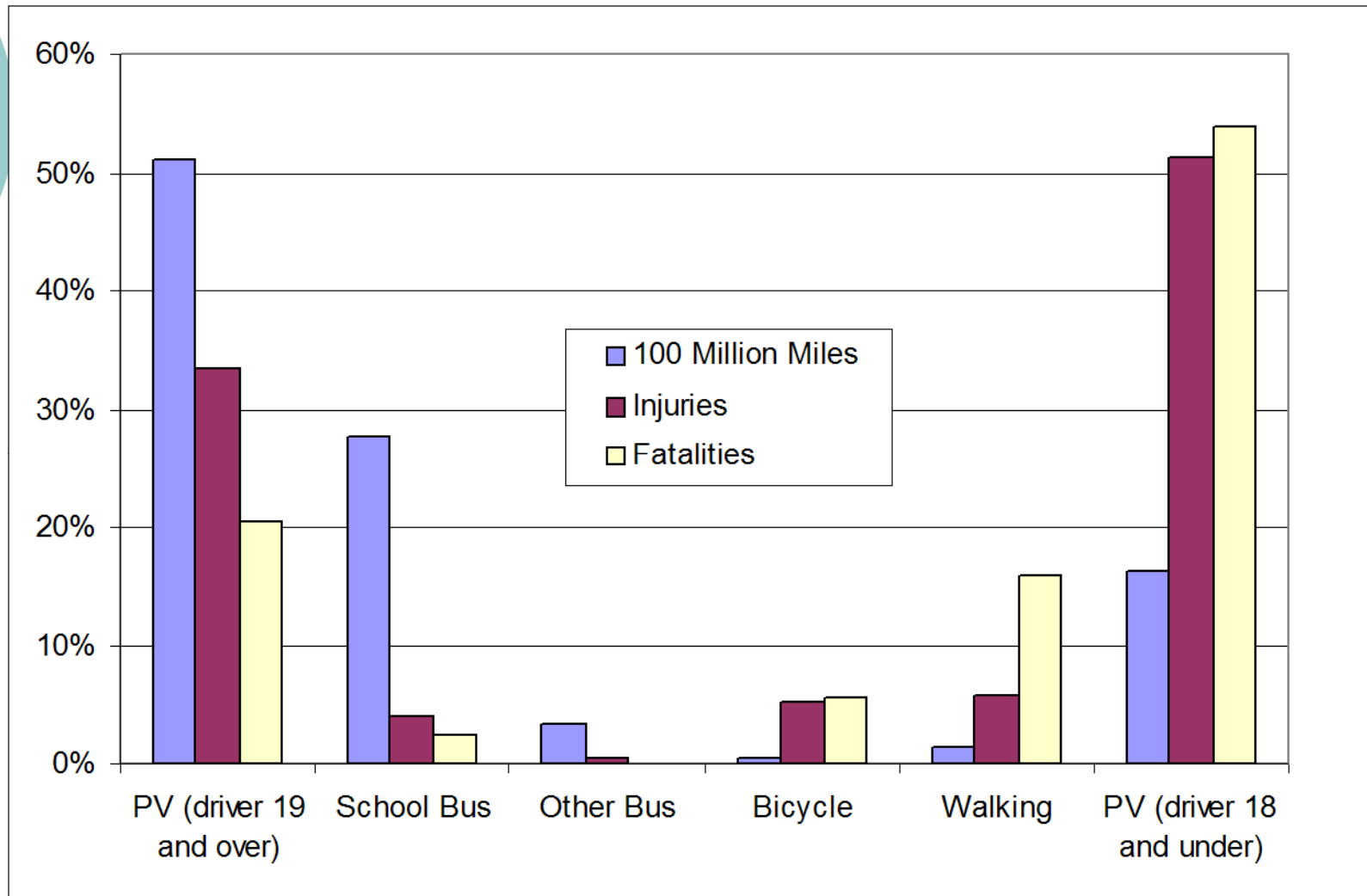
Typical “School Travel Times”

- Purpose of trip not available
- School days
 - Weekdays
 - September 1 through 15 June
- Time of day
 - Morning: 6-9 am
 - Afternoon: 2-5 pm

Distribution of Travel Modes by Age



Exposure and Outcome Comparison



Injury and Fatality Rates

Mode	Injuries		Fatalities	
	Per 100 Million Student Trips	Per 100 Million Student- Miles	Per 100 Million Student Trips	Per 100 Million Student- Miles
School Bus	100	20	0.3	0.1
Other Bus	120	20	0.1	<0.1
Passenger Vehicle, Adult Driver	490	90	1.6	0.3
Passenger Vehicle, Teen Driver	2,300	430	13.2	2.4
Bicycle	1,610	2,050	9.6	12.2
Walking	310	590	4.6	8.7
Overall Rate	650	130	3.5	0.7

Points

- Buses are very safe
- “Per trip” and “per mile” measures are different
- Teen drivers and bicycles have high rates



Scenarios

- Hypothetical examples of how national risk estimates could inform decisions
 - Changing school bus pick-up distance for an elementary school
 - Increasing parking for student drivers at a high school

Suburban Elementary School

- 250 children
- 180 days/year
- All live within 10 miles of school
- No transit bus service available

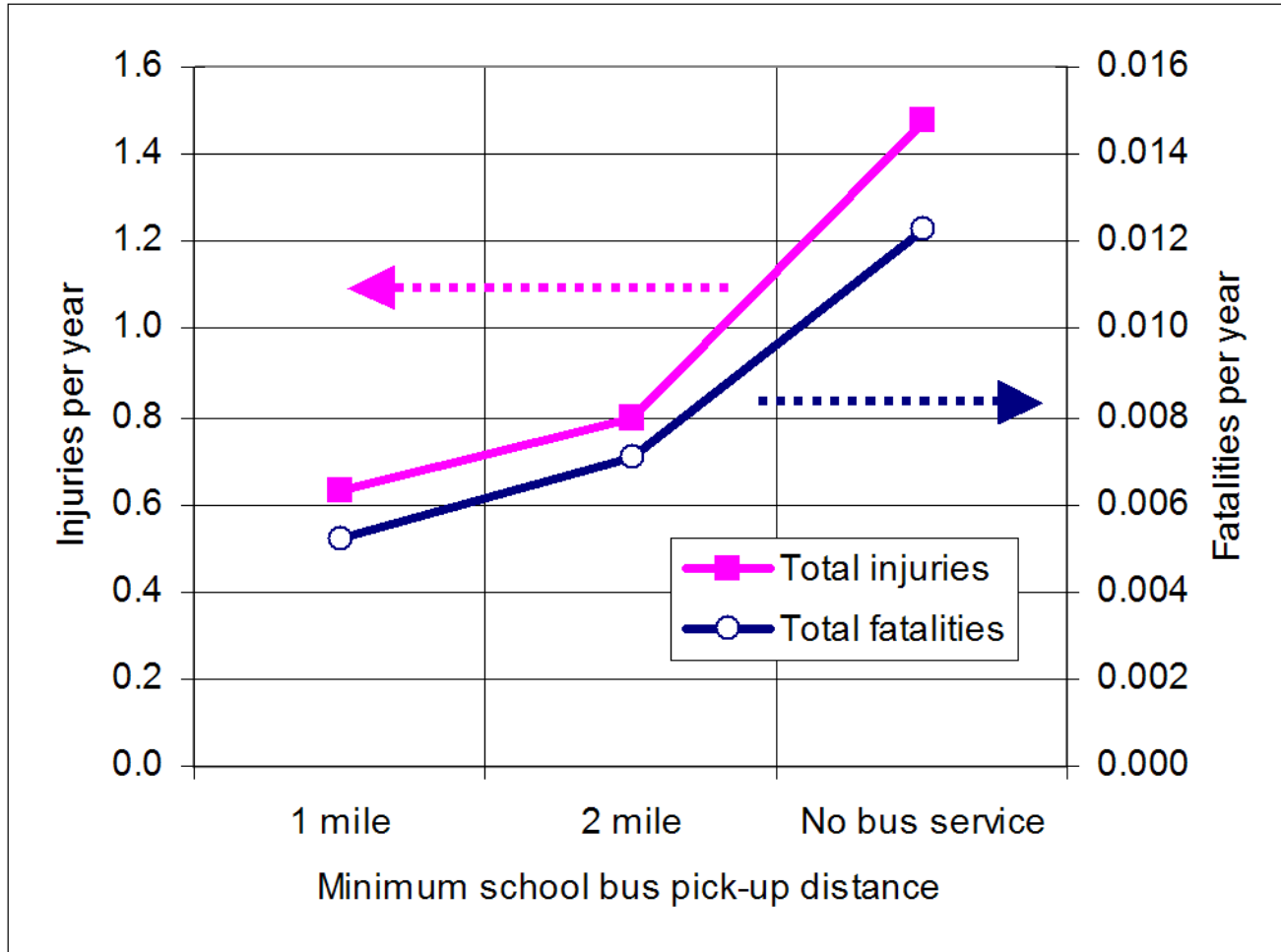
Miles from School	Number of Children
Less than 1	48
Between 1-1.5	24
Between 1.5 - 2	19
Between 2 - 3	38
Between 3 - 4	32
Between 4 - 5	27
Between 5 - 6	22
Between 6 - 7	18
Between 7 - 8	13
Between 8 - 9	7
Between 9 - 10	2
Total	250

Distribution of Travel Modes under Different Minimum Walking Distances

A change in one mode will affect the others

One-mile pick-up distance						Two-mile pick-up distance				
Miles from School	Walk	Bike	School Bus	Adult Driver	Student Driver	Walk	Bike	School Bus	Adult Driver	Student Driver
Less than 1	60%	30%	-	10%	-	60%	30%	-	10%	-
Between 1-1.5	30%	20%	35%	15%	-	50%	35%	-	15%	-
Between 1.5 - 2	8%	8%	49%	35%	1%	36%	26%	-	37%	1%
Between 2 - 3	3%	8%	49%	40%	1%	3%	8%	49%	40%	1%
Between 3 - 4	-	-	54%	45%	1%	-	-	54%	45%	1%
Between 4 - 5	-	-	59%	40%	1%	-	-	59%	40%	1%
Between 5 - 6	-	-	59%	40%	1%	-	-	59%	40%	1%
Between 6 - 7	-	-	59%	40%	1%	-	-	59%	40%	1%
Between 7 - 8	-	-	59%	40%	1%	-	-	59%	40%	1%
Between 8 - 9	-	-	59%	40%	1%	-	-	59%	40%	1%
Between 9 - 10	-	-	59%	40%	1%	-	-	59%	40%	1%

Impact of Different Distances



Adding More Student Parking

300 Student Parking Spaces								
	14-15 years olds				16-18 years old			
	% per mode	# of Students	Injuries per Year	Fatalities per Year	% per mode	# of Students	Injuries per Year	Fatalities per Year
School Bus	35%	420	0.21	0.0004	25%	300	0.45	0.0002
Other Bus	10%	120	0.02	0.0000	5%	60	0.03	0.0000
PV (driver 19 and older)	20%	240	0.45	0.0011	25%	300	0.99	0.0048
Walking	15%	180	0.18	0.0023	12%	144	0.18	0.0019
Bicycling	5%	60	0.28	0.0010	3%	36	1.00	0.0032
PV (driver 18 and under)	15%	180	2.76	0.0184	30%	360	1.38	0.0152
Total by age group	100%	1,200	3.90	0.023	100%	1,200	4.02	0.025
	Years between events		0.3	43.1			0.2	39.4
					School totals		7.92	0.05
					Years between events for school		0.13	20.56

} Base Case

Adding More Student Parking

600 Student Parking Spaces								
	14-15 years olds				16-18 years old			
	% per mode	# of Students	Injuries per Year	Fatalities per Year	% per mode	# of Students	Injuries per Year	Fatalities per Year
School Bus	25%	300	0.15	0.0003	15%	180	0.32	0.0001
Other Bus	5%	60	0.01	0.0000	5%	60	0.01	0.0000
PV (driver 19 and older)	20%	240	0.45	0.0011	20%	240	1.24	0.0038
Walking	12%	144	0.14	0.0019	7%	84	0.14	0.0011
Bicycling	3%	36	0.17	0.0006	3%	36	0.60	0.0032
PV (driver 18 and under)	35%	420	6.43	0.0428	50%	600	2.76	0.0254
Total by age group	100%	1,200	7.36	0.047	100%	1,200	5.07	0.034
Years between events			0.1	21.4			0.2	29.7
					School totals		12.43	0.08
					Years between events for school		0.08	12.43

With
New
Parking

Adding More Student Parking

Net
Impact

Net effect of new policy			
		Injuries per Year	Fatalities per Year
% change in risk		57%	65%



Is the Additional Risk Acceptable?

- Local school decision
- How would the savings of reduced bus service be used?
- For this school, is the safety of the walking and bicycling much better than the national averages?
- What can be done to improve the various modes?

Recommendations

1:

School transportation planners and policy makers at all levels should analyze transportation risks comprehensively in their decision making related to school travel.

Recommendations

2:

Using a systematic risk-management framework, school districts should identify risk factors most salient for modes used by children in their community and identify approaches to manage and reduce those risks, including shifts to safer modes and safety improvements within each mode.

Recommendations

3:

USDOT should disseminate information on the relative risks of various modes of travel for school and school-related activities and on possible ways to mitigate the risks.

USDOT should also use this information to assess what role, if any, federal policy makers should have in efforts to improve the transportation safety of school children and the cost-effectiveness of specific safety measures.

Recommendations

4:

The compatibility and completeness of existing databases should be improved to allow better risk estimates.

To the extent possible, critical data elements (e.g., vehicle classifications, roadway classifications) should be included and defined consistently in all the datasets.

Recommendations

5:

USDOT and appropriate agencies, in consultation with outside experts, should analyze the advisability and cost-effectiveness of establishing and maintaining any new school transportation–related database.



Thank You!



Data Collection Opportunities

- Need for consistent data on ridership
- Random, unbiased collection schemes
- Sample from all trips
 - Include both to and from school
 - Select dates across the entire school year
 - After-school activity trips
- If possible, collection should not be related to payments to school districts

Exposure (Trips and Student-Miles)

Mode	100 Million Student Trips (%)	100 Million Student-Miles (%)
School Bus	58 (25)	313 (28)
Other Bus	5 (2)	38 (3)
Passenger Vehicle, Adult Driver	105 (45)	580 (51)
Passenger Vehicle, Teen Driver	34 (14)	184 (16)
Bicycle	5 (2)	4 (<1)
Walking	28 (12)	15 (1)
Total	235 (100)	1,134 (100)

Points

- Adult drivers are responsible for most trips and miles
- School buses are second in both categories
- Miles/trip varies across modes

Injuries and Fatalities

Mode	Injuries (%)	Fatalities (%)
School Bus	6,000* (4)	20* (2)
Other Bus	550 (<1)	1 (<1)
Passenger Vehicle, Adult Driver	51,000 (33)	169 (20)
Passenger Vehicle, Teen Driver	78,200 (51)	448 (54)
Bicycle	7,700 (5)	46 (6)
Walking	8,800 (6)	131 (16)
Total	152,250 (100)	830 (99)

Points

- Teen drivers are responsible for most injuries and fatalities
- School buses are ranked fifth in both categories
- *** School bus mode includes related pedestrians incidents**
(Fatalities: 10 caused by bus, 5 caused by cars passing buses)
(Injuries: 300 caused by bus or cars passing bus)

Number of Students by Travel Mode

(1-Mile Minimum Pick-up)

Miles from School	Walking	Bicycling	School Bus	Driver 19 or +	Driver 18 or -
Less than 1	28.5	14.3	-	4.8	-
Between 1-1.5	7.1	4.8	8.3	3.6	-
Between 1.5 - 2	1.4	1.4	9.2	6.6	0.2
Between 2 - 3	0.9	2.8	18.4	15.0	0.4
Between 3 - 4	-	-	17.6	14.6	0.3
Between 4 - 5	-	-	16.2	11.0	0.3
Between 5 - 6	-	-	13.3	9.0	0.2
Between 6 - 7	-	-	10.3	7.0	0.2
Between 7 - 8	-	-	7.4	5.0	0.1
Between 8 - 9	-	-	4.4	3.0	0.1
Between 9 - 10	-	-	1.5	1.0	0.0
Total Students	38	23	107	81	2
% of Students	15%	9%	43%	32%	1%

Miles per Year by Travel Mode

(1-Mile Minimum Pick-up)

Miles from School	Walking	Bicycling	School Bus	Driver 19 or +	Driver 18 or -
Less than 1	6,413	3,463	-	1,283	-
Between 1-1.5	4,008	2,886	6,546	2,405	-
Between 1.5 - 2	1,107	1,196	10,129	6,202	177
Between 2 - 3	1,055	3,417	28,941	20,250	506
Between 3 - 4	-	-	38,698	27,641	614
Between 4 - 5	-	-	45,998	26,730	668
Between 5 - 6	-	-	45,998	26,730	668
Between 6 - 7	-	-	42,281	24,570	614
Between 7 - 8	-	-	34,847	20,250	506
Between 8 - 9	-	-	23,696	13,770	344
Between 9 - 10	-	-	8,828	5,130	128
Total miles/yr	12,582	10,962	285,961	174,960	4,227
% miles	3%	2%	59%	36%	1%

Risk Measures (1-Mile Minimum Pick-up)

5-10 year Olds	Rates/100 million miles	
	Fatalities	Injuries
School Bus	0.10	13
Other Bus	0.01	12
PV (driver 19 and older)	0.27	77
Walking	13.61	726
Bicycling	21.16	2,625
PV (driver 18 and younger)	15.22	2,549

} National averages

	Walking	Bicycling	School Bus	Driver 19 or +	Driver 18 or -
Injuries/yr	0.09	0.29	0.04	0.13	0.11
% of Injuries	14%	44%	6%	20%	16%
Fatalities/yr	0.0017	0.0023	0.0003	0.0005	0.0006
% of Fatalities	32%	43%	5%	9%	12%
	0.659	Total injuries per year			
	0.0054	Total fatalities per year			