Transit's Safety Challenges

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ABSTRACT

Everyone knows that automobile travel is dangerous. This naturally leads to the assumption that public transit ought to be encouraged as a means of improving travel safety. However, the issue is more complex than this simple assumption allows. In some respects, introducing more transit vehicles into the mix of urban transportation options will increase the risk.

Much of the energy put into transit has been the struggle to obtain more resources in order to implement more transit options. The focus has been on trying to provide the type of service that might attract drivers out of their cars and onto transit vehicles. The idea has been that this would lead to reductions in traffic congestion and improved air quality. Overlooked in this quest for reduced traffic congestion has been the potential impact on public safety. The data gleaned from published sources indicate that there are serious safety issues surrounding the operation of transit in our cities. It is long past time that these issues be more forthrightly addressed by those seeking to expand the role of public transit in the urban setting.

INTRODUCTION

Everyone knows that automobile travel is dangerous. This naturally leads to the assumption that public transit ought to be encouraged as a means of improving travel safety. However, the issue is more complex than this simple assumption allows. In some respects, introducing more transit vehicles into the mix of urban transportation options will increase the risk.

FATALITY RATES PER VEHICLE MILE

The transit modes that share the roadways with cars and trucks also share the risk of collisions with these vehicles and with pedestrians. Fatality Rates by Vehicle Type (see Table 1: 2000 Fatality Rates by Vehicle Type) were compiled from the National Highway Traffic Safety Administration's *Traffic Safety Facts 2000* [1], the Federal Highway Administration's *Highway Statistics 2000* [2] and the American Public Transportation Association's *2002 Public Transportation Fact Book* [3]. These statistics reveal some interesting data.

Unsurprisingly, travel by motorcycle is the most dangerous way a person can choose to go. The motorcycle's occupant fatality rate of 272.9 per billion vehicle miles of travel is far higher than for any other mode. However, occupants are not the only persons put at risk in urban transportation. Vehicles collide with other vehicles or with pedestrians—putting non-occupants at risk. When we look at the non-occupant fatality rates we find that motorcycles pose relatively little risk for non-occupants. With a non-occupant fatality rate of 7.4 per billion vehicle miles, motorcycles are less dangerous than any other vehicle except the automobile (4.4 non-occupant fatalities per billion vehicle miles).

Public transit vehicles, in contrast, impose higher risks on non-occupants. Buses, with a non-occupant fatality rate of 33.3 per billion vehicle miles represent a risk four times as large as motorcycles and seven times as large as automobiles. In fact, buses are more dangerous to non-occupants than the much feared semi-truck (20.4 fatalities per billion vehicle miles).

Risky as buses are for non-occupants, light rail trains are far more dangerous. Light rail's non-occupant fatality rate of 322 per billion vehicle miles of travel is almost ten times that of the next most dangerous vehicles—transit buses. Consequently, the surge in new light rail systems in cities across America has likely created an elevated level of risk for urban travellers.

Of course, Table 1 deals with only one year's worth of data. Crashes and fatalities fluctuate from year to year. The question naturally arises as to whether the data for transit buses and light rail for the year 2000 are aberrant. In an effort to address this concern, Table 2: 10 Year Trends in Fatality Rates presents data drawn from the Federal Transit Administration's *Safety Management Information Statistics (SAMIS) 1999 Annual Report* [5], the American Public Transportation Association's *2002 Public Transportation Fact Book* [3] and the Federal Highway Administration's *Highway Statistics* [2]. In this table, the modes of urban passenger travel are compared. We find that while there is substantial fluctuation for the transit modes, the year 2000 figures for bus and light rail are close to the ten-year averages. Both of these street-based transit modes have ten-year average per vehicle-mile fatality rates higher than automobiles. Buses at 55 fatalities per billion vehicle-miles are five times as dangerous as automobiles (11 fatalities per billion vehicle-miles). Light rail's fatality rate of 355 per vehicle-mile is thirty times higher than that for automobiles.

Last year the Transportation Research Board published study of light rail transit crashes for a selected sample of cities [4]. The data in this study indicated that light rail trains appeared to be dangerous additions to urban traffic streams. The statistics based on data as of 1996 showed that with only one exception, crashes per vehicle-mile of travel were reported as far higher for light rail transit than they are for motor vehicles (see Table 3: Crashes/100 Million Vehicle Miles of Travel). Data for the nine light rail systems in U.S. cities featured in the report showed an average crash rate of 1,125 per 100 million vehicle miles of travel. This is four times higher than the 276 crashes per 100 million vehicle miles for motor vehicles.

A key factor in the high crash rates for light rail seemed to be motorist and pedestrian unfamiliarity with the new light rail operations. A lengthy listing of motorist and pedestrian errors was cited by the authors to account for the high crash rates [4]. This implies that the crash and fatality rates ought to decline over time, as other roadway users become more familiar with the presence of light rail trains in the traffic stream. While this may become true in the future, it does not appear to be true yet. A graph of the light rail fatality rates since 1991 [5, 3] reveals no pattern of decline (See Figure 1: Light Rail Fatalities/billion vm). In fact, the fatality rate for the latest year (417) is higher than the average for the ten-year period (355). Consequently, there is no tangible evidence of a reduced risk due to increasing familiarity with these new light rail systems.

On a per vehicle-mile of travel basis, the data indicate that public transit vehicles pose a significant hazard to the travelling public. Advocates of expanded transit systems will need to devote more attention and effort to mitigating the hazards of operating transit vehicles on the roadways.

FATALITY RATES PER PERSON-MILE

Transit advocates may criticize the per vehicle-mile measure of fatality rates on the grounds that transit vehicles can carry more persons and, as such, can produce lower per person-mile fatality rates. There is some merit to this argument. While it would be most prudent for pedestrians and occupants of other vehicles to be wary of the per vehicle-mile risks posed by transit vehicles with which they share the streets, it may be reasonable for public authorities to be most concerned with the aggregate outcomes. Since transit vehicles can carry larger numbers of people, the risk they inflict on non-occupants may be offset by the superior safety they can offer to passengers. In crashes, size matters. Being inside a large bus or an even larger train offers substantial protection in the event of collisions with other vehicles or objects.

Dividing the fatalities by the person-miles of travel dramatically improves the safety picture for public transit (see Table 2: 10 Year Trends in Fatality Rates). In this regard, we discover that transit buses do have a lower ten-year average fatality rate per person-mile than do automobiles (6 per billion person-miles vs. 10 for automobiles). Light rail, however, has a higher per person-mile fatality rate than automobiles (14 per billion person-miles).

For buses, the ten-year average fatality rate of less than six persons per billion passenger-miles compares favorably with urban automobiles' fatality rate of ten per billion person-miles of travel. Commuter and heavy rail transit also generate lower fatality rates per person-mile of travel in the urban traffic environment than automobiles do. Light rail, though, even with the greater capacity of the vehicles, still generates a higher overall fatality rate—occupants and non-occupants included—than automobiles do. Neither is there a discernible downward trend in light rail fatalities per passenger mile over the ten-year period (see Figure 2: Light Rail Fatalities/billion pm). In fact, the fatality rate for the latest year (16) is higher than the average for the ten-year period (14).

THE LIGHT RAIL DILEMMA

The high risks of light rail ought to be a cause for concern and pause in the quest to place more of these trains onto city streets. The hope of transit advocates is that light rail would attract more riders and, thereby, make a positive contribution to urban traffic safety. Light rail could improve its safety performance compared to the automobile if it could increase its load factor. A 50% increase in light rail ridership with no change in vehicle miles of travel would be enough to overcome light rail's per person-mile safety deficit vs. the automobile. Given the low elasticity of demand for transit service, though, it seems unlikely that a 50% increase in ridership could be achieved without increasing vehicle miles of travel. The relatively slow speeds of light rail (due to the necessity for frequent stops, light rail averages only 15 mph [3]) make it difficult for this mode to draw people out of automobiles and onto the light rail trains.

It would seem that the most promising means of improving light rail's safety performance would be to emulate the other rail transit modes and strive for more grade separation. The fewer intersections of rail and road there are, the fewer the opportunities for crashes between trains and motor vehicles. Of course, grade separations add cost to light rail systems. Saving these costs is a large part of the motivation for choosing to place light rail onto city streets. However, the safety deficiencies of this strategy raise serious questions about whether the public good is adequately served by placing more light rail vehicles on city streets. If the expense of grade separations for light rail trains is too daunting, perhaps cities should place their reliance on bus transit since it does have a safety advantage over automobiles in the person-miles of travel comparison.

TRANSIT CRIME

Traffic crashes are not the only safety issue of concern in public transportation. Crime is also a matter that must be considered in evaluating decisions to implement transit systems. Many cities have been or are seeking to add light rail lines to their transit mix. One of the arguments used for replacing bus service with light rail service is the perceived potential for light rail stations to attract real estate development. This may well be true, but it is not an unmixed blessing. Light rail also appears to attract an unusually high number of criminals.

Of all the transit modes, light rail has the worst crime rate (see Table 4: 2000 Public Transit Serious Crime Statistics). Light rail's violent crimes against persons (i.e., murder, rape, robbery and assault) rate of 313 per billion passenger miles of travel is almost 50% higher than heavy rail (219 per billion passenger-miles) and more than three times higher than the rate for bus transit (94 per billion passenger-miles). Light rail's crimes against property (larceny, theft, burglary and arson) rate of 839 per billion passenger miles of travel is 25% higher than heavy rail (667 per billion passenger-miles) and six times higher than the rate for bus transit (136 per billion passenger-miles). Consequently, it looks like a decision to replace bus transit with light rail transit is very likely a decision that will bring more crime to an area.

CONCLUSION

Much of the energy put into transit has been the struggle to obtain more resources in order to implement more transit options. The focus has been on trying to provide the type of service that might attract drivers out of their cars and onto transit vehicles. The idea has been that this would lead to reductions in traffic congestion and improved air quality. Overlooked in this quest for reduced traffic congestion has been the potential impact on public safety. The data gleaned from published sources indicate that there are serious safety issues surrounding the operation of transit in our cities. It is long past time that these issues be more forthrightly addressed by those seeking to expand the role of public transit, especially that of light rail, in the urban setting.

REFERENCES

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Table 1: 2000 Fatality Rates by Vehicle Type

Vehicle Type	*Fatal Crashes*	*Occupant Fatalities*	*Non-Occupant fatalities*	*Vehicle Miles (millions)*	*Occupant Fatalities/ Billion VMT*	*Non-Occupant Fatalities/ Billion VMT*	*Total Fatalities/ Billion VMT*
Automobiles	27,496	20,492	7,004	1,602,914	12.8	4.4	17.2
Large Trucks	4,930	741	4,189	205,791	3.6	20.4	24.0
Light Rail	22	5	17	53	94.7	322.0	416.7
Light Trucks	20,295	11,418	8,877	924,018	12.4	9.6	22.0
Motorcycles	2,940	2,862	78	10,489	272.9	7.4	280.3
Transit Buses	96	19	77	2,315	8.2	33.3	41.5

Sources: Tables 36 and 74 in *Traffic Safety Facts 2000,* Table VM-1 in *Highway Statistics 2000* (FHWA), Tables 42 and 71 in *2002 Public Transportation Fact Book* (American Public Transit Association).

Table 2: 10 Year Trends in Fatality Rates											
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**Totals**
Bus											
Fatalities	88	99	83	108	82	101	109	109	102	101	982
Vehicle Miles(Ms)	1,661	1,688	1,690	1,702	1,702	1,687	1,719	1,779	1,835	2,315	17,778
Passenger Miles(Ms)	17,145	16,613	16,342	16,107	16,148	16,004	16,696	17,113	17,743	21,241	171,152
Fatalities/B vm	53	59	49	63	48	60	63	61	56	44	55
Fatalities/B pm	5	6	5	7	5	6	7	6	6	5	6
Light Rail											
Fatalities	13	9	15	13	15	6	3	23	17	22	114
Vehicle Miles(Ms)	27	28	27	34	34	37	41	43	48	53	321
Passenger Miles(Ms)	648	686	689	824	859	955	1,024	1,115	1,190	1,356	7,990
Fatalities/B vm	481	321	556	382	441	162	73	535	354	417	355
Fatalities/B pm	20	13	22	16	17	6	3	21	14	16	14
Heavy Rail											
Fatalities	103	91	83	85	79	74	77	54	84	39	730
Vehicle Miles(Ms)	522	520	518	522	537	543	558	566	578	595	4,863
Passenger Miles(Ms)	10,421	10,613	10,130	10,521	10,559	11,530	12,056	12,284	12,902	13,844	101,016
Fatalities/B vm	197	175	160	163	147	136	138	95	145	66	150
Fatalities/B pm	10	9	8	8	7	6	6	4	7	3	7
Commuter Rail											
Fatalities	93	74	98	112	92	72	79	94	95	65	809
Vehicle Miles(Ms)	188	188	206	210	217	203	216	242	249	271	1,921
Passenger Miles(Ms)	6,094	5,992	6,211	7,202	7,581	7,148	7,000	8,138	8,158	9,402	63,526
Fatalities/B vm	495	394	476	533	424	355	366	388	382	240	421
Fatalities/B pm	15	12	16	16	12	10	11	12	12	7	13
Urban Motor Vehicle Travel											
Fatalities	17,049	16,486	16,915	16,983	17,811	17,742	17,078	16,023	15,816	15,695	167,598
Vehicle Miles(Bs)	1,288	1,359	1,294	1,450	1,489	1,522	1,560	1,592	1,628	1,665	14,847
Passenger Miles(Bs)	1,417	1,495	1,424	1,595	1,638	1,674	1,716	1,751	1,790	1,831	16,332
Fatalities/B vm	13	12	13	12	12	12	11	10	10	9	11
Fatalities/B pm	12	11	12	11	11	11	10	9	9	9	10
Vm = vehicle miles; pm = passenger miles; M = million; B = billion											
Sources: Federal Transit Administration, *Safety Management Information Statistics (SAMIS) 1999 Annual Report;* American Public Transportation Association, *2002 Public Transportation Fact Book; and* Federal Highway Administration, *Highway Statistics*											

Table 3: Crashes/100 Million Vehicle Miles of Travel	
LRT System	*Rate*
Baltimore	1,351
Dallas	1,514
Denver	6,471
Los Angeles	1,222
Portland	1,356
Sacramento	1,144
St. Louis	20
San Diego	676
San Jose	1,349
Average	1,125
U.S. Highway System	276

Light rail crash rates are from *Light Rail Service: Pedestrian and Vehicular Safety, TCRP Report 69*. The highway data is obtained from *Highway Statistics 1996* (FHWA) and *1996 Traffic Crashes, Injuries, and Fatalities* (NHTSA).

Table 4: 2000 Public Transit Serious Crime Statistics						
	Murder/Rape/ Robbery/Assault		Larceny/Theft/ Burglary/Arson		Combined	
	Total	Rate*	Total	Rate*	Total	Rate*
Bus	2,003	94	2883	136	4,886	230
Commuter Rail	206	22	2703	287	2,909	309
Demand Response	20	24	31	37	51	61
Heavy Rail	3,037	219	9239	667	12,276	887
Light Rail	425	313	1138	839	1,563	1153

*per billion passenger miles

Source: *2002 Public Transportation Fact Book* (American Public Transportation Association), Tables 30 & 76.

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Figure 1: Light Rail Fatalities/billion vm

Figure 2: Light Rail Fatalities/billion pm

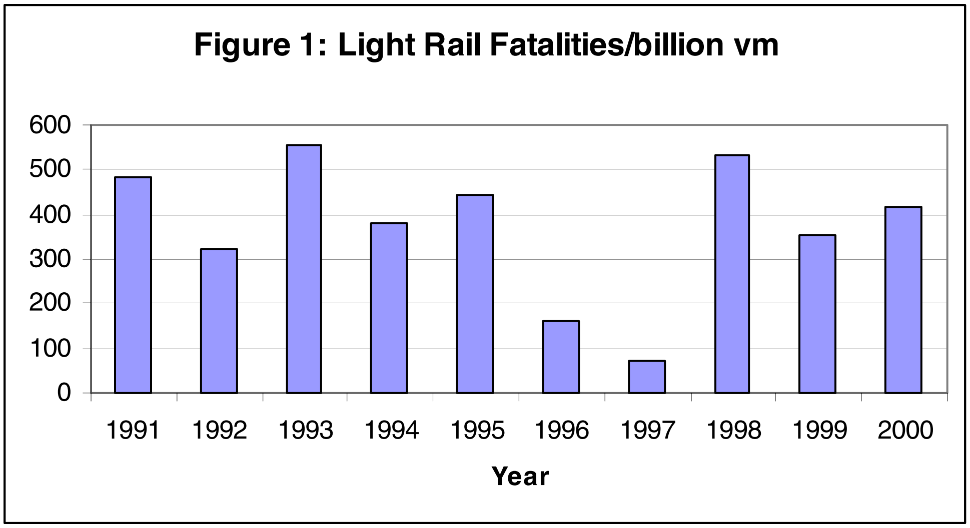
Figure 1: Light Rail Fatalities/billion vm
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400
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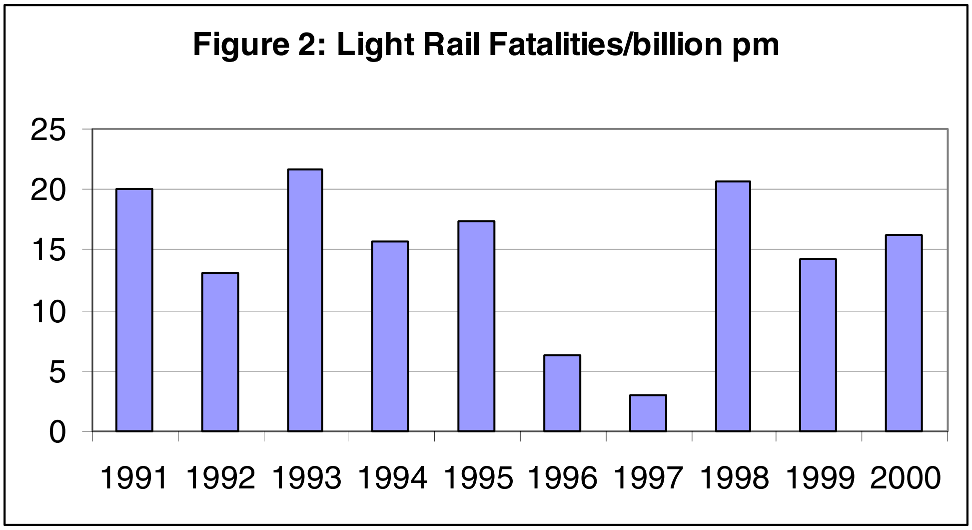
Figure 2: Light Rail Fatalities/billion pm
25
20
15
10
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1991 1992 1993 1994 1995 1996 1997 1998 1999 2000