

2009 Rail Safety Statistics Report

An analysis of safety data reported by state safety oversight agencies and rail transit agencies for the years 2003 – 2008.

Prepared by the Office of Safety and Security

Numbers at a glance

In calendar year 2008, the rail transit industry provided over 18.5 billion passenger miles, a 5% increase from 2007 service numbers. Growth in ridership at the rail transit agencies in the Federal Transit Administration's (FTA) State Safety Oversight Program far outpaces other modes of transportation. In spite of this high level of passenger service, rail transit remains among the safest modes of transportation in the United States.

Yet accidents do occur on rail transit systems and their impacts are tragic. During calendar year 2008, 992 accidents occurred that met FTA accident reporting thresholds. These accidents resulted in 37 fatalities and 677 injuries (excluding suicide and trespasser fatalities). By standardizing safety data, 2008 numbers can be compared to the averages of the previous five years. An examination of this data provided the following results:

- The accident rate increased 61%.
- The fatality rate increased 5%.
- The injury rate increased 25%.



Acknowledgements

We would not have been able to undertake this effort without the involvement of many individuals, whom we thank for their support. The timeliness in the reporting of data by the state oversight agencies and rail transit properties to the Federal Transit Administration (FTA) was absolutely critical. Individuals at each organization dedicated time, energy, and thoughtfulness to the effort, and we are grateful for their contributions. Within FTA's Office of Safety and Security, we were fortunate to work with individuals who shared their expertise and supported our data collection and analysis, including Mr. Levern McElveen, Safety Team Leader and Mr. Timothy Braxton, Data Specialist. We especially thank Ms. Susan E. Schruth, Associate Administrator for Program Management, Mr. Sean Libberton, Deputy Associate Administrator for Program Management, and Mr. Michael Flanigon, Director, Office of Safety and Security for their leadership, insights and support.

In addition, we benefited from the sharing of resources from a number of stakeholders during the development of this report, the American Public Transportation Association, the Federal Highway Administration, the Federal Motor Carrier Safety Administration, the Federal Railroad Administration, the National Transit Institute, the National Transportation Safety Board, the Transit Cooperative Research Program, and the Transportation Safety Institute.

The Man-Machine Systems Assessment and Boyd, Caton & Grant team members who conducted the research and developed the framework and findings in this report were Chiquita Horton, Annabelle Boyd, Jim Caton, Bill Hultsch, Andy Lofton, Jason Sergent and Anne Singleton. We are especially appreciative of the organizations and individuals that helped us in our effort to better serve the rail transportation riding public and employees.

Executive Summary

This *Rail Safety Statistics Report* focuses attention on safety issues in the public rail transportation industry and supports FTA's (Federal Transit Administration) mission through the identification of safety priorities and attendant strategies to address industry concerns.

FTA's safety program for rail transit continues to be increasingly guided by the evaluation of industry data, trends in safety indicators, and the results of on-site assessments, audits and reviews. FTA attempts to direct both its safety oversight and technical assistance efforts toward those areas involving the highest risks for rail transit agencies. FTA also uses the evaluation of industry data to determine the effectiveness of its own programs and to identify where improvements can be made.

This *Rail Safety Statistics Report* uses information collected by FTA from the National Transit Database (NTD) and the SSO Program between calendar years 2003 and 2008. As applicable, this report also uses data supplied by the National Highway Traffic Safety Administration (NHTSA), the Federal Railroad Administration (FRA), the National Transportation Safety Board (NTSB), and the National Safety Council (NSC).

Key data reported: 2003 - 2008

- **14** passenger fatalities
 - Six fatalities were medically-related
 - Five fatalities were due to imprudent customer actions
 - Three fatalities were due to slips and falls

- **19** worker fatalities
 - 10 fatalities were Right-of-Way workers struck by trains
 - One fatality was an Operator killed in a train-to-train collision
 - Three fatalities were medically-related
 - Five fatalities were accidents at work sites

- **72** patron fatalities

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- 10 fatalities were the result of collisions between individuals on platforms and trains (leaning too far forward or train surfing)
- 62 fatalities were the result of individual accidents in rail transit stations and mezzanines, on stairs and escalators, and in parking garages and other transit-controlled property

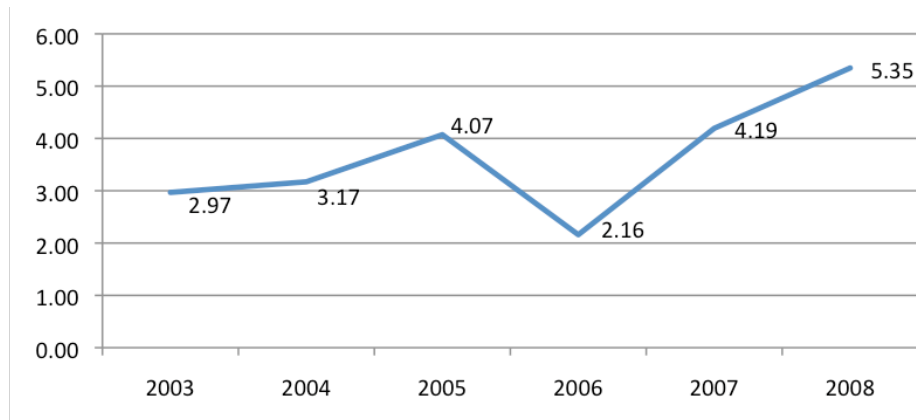
- **382** public fatalities
 - 180 were suicides or suspected suicides
 - 116 were trespasser-related
 - 39 were pedestrians involved in collisions
 - 34 were occupants of automobiles involved in collisions with trains
 - 13 were other single person accidents

- **1665** injuries to passengers
 - 385 from non-rail grade crossing collisions
 - 525 from rail grade crossing (RGX) collisions
 - 337 from derailments
 - 272 from fires
 - 146 other injuries

- **0** passengers onboard trains were killed in derailments or collisions

Key Trends

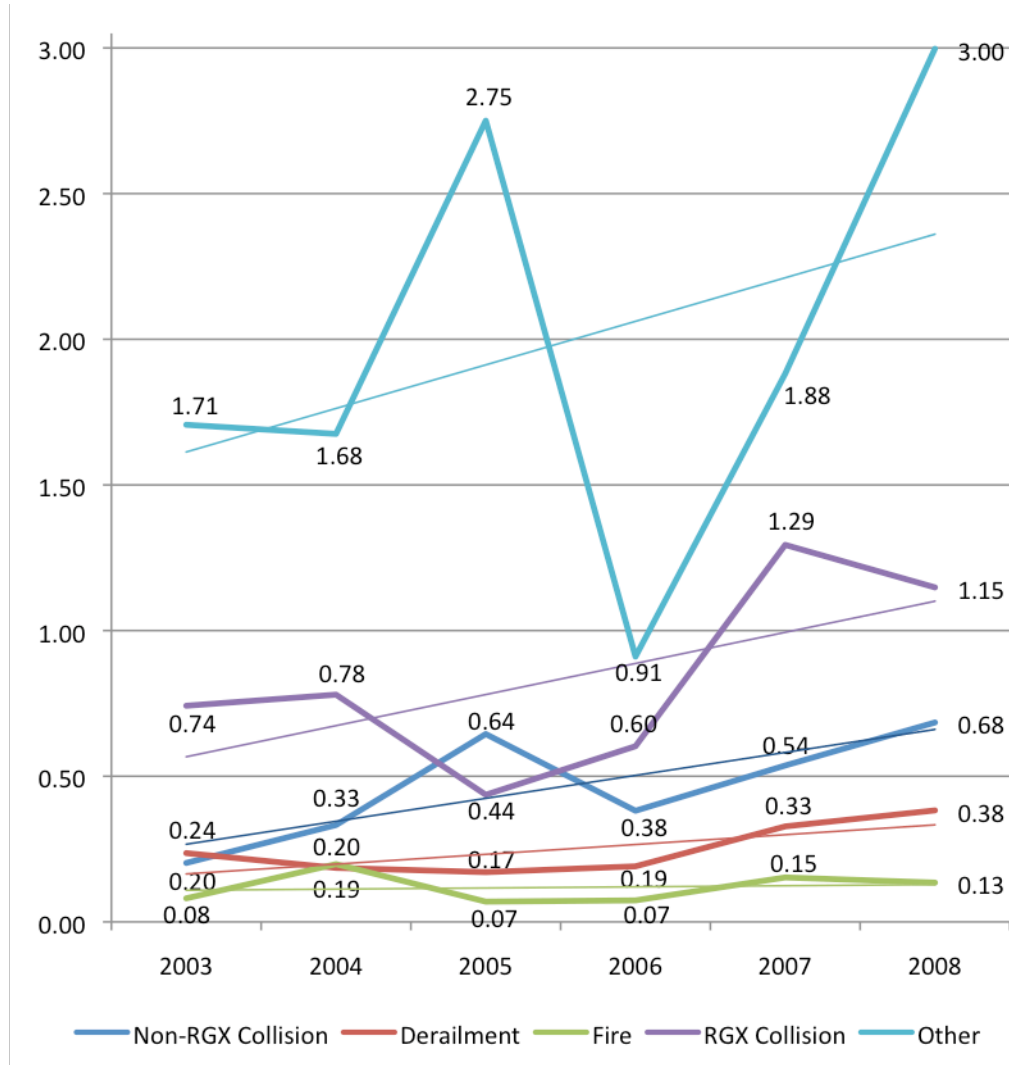
Rail Transit Accident Rates (per 100,000,000 passenger miles)



- The rail transit accident rate has increased by 80% over the last six years.
- In 2008, the industry experienced 5.35 accidents per 100 million passenger miles.

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Rail Transit Accident Rates by Accident Type (per 100,000,000 passenger miles)



- Other accidents include suicide and trespassing-related fatalities; homicides; non-fire-related evacuations; and other fatality or multiple-injury accidents that are not considered Collisions, Derailments, or Fires.
- The accident rates for each of the five accident categories have increased over the past six years (depicted by the rising trend lines in the graph above).
- The non-RGX Collision rate has increased by 238% over the last six years.
- The “Other” accident rate has increased by 76% over the six-year period.
- The accident rate for Fires has increased by 67% from its 2003 level.
- The Derailment accident rate increased by 62% through the six-year period.
- The RGX Collision accident rate increased by 55% from 2003.

Background

The mission of the Federal Transit Administration's (FTA) Office of Safety and Security is to provide leadership and vision in the development and management of programs and initiatives to continuously improve the safety of passengers, employees, emergency responders, and all others who come into contact with the public transportation system. This *Rail Safety Statistics Report* focuses attention on safety issues in the public rail transportation industry and supports FTA's mission through the identification of safety priorities and attendant strategies to address industry concerns.

FTA's safety program for rail transit continues to be increasingly guided by the evaluation of industry data, trends in safety indicators, and the results of on-site assessments, audits and reviews. FTA attempts to direct both its safety oversight and technical assistance efforts toward those areas involving the highest risks for rail transit agencies. FTA also uses the evaluation of industry data to determine the effectiveness of its own programs and to identify where improvements can be made.

The 2009 *Rail Safety Statistics Report* has been prepared by FTA to assess the safety of the rail transit industry and the performance of FTA's State Safety Oversight (SSO) program in providing an added degree of confidence that the minimum safety program requirements specified in FTA's SSO rule, 49 CFR Part 659, are being implemented.

This *Rail Safety Statistics Report* uses information collected by FTA from the National Transit Database (NTD) and the SSO Program between calendar years 2003 and 2008. As applicable, this *Rail Safety Statistics Report* also uses data supplied by the National Highway Traffic Safety Administration (NHTSA), the Federal Railroad Administration (FRA), the National Transportation Safety Board (NTSB), and the National Safety Council (NSC).

Scope of Report

The *Rail Safety Statistics Report* documents FTA's analysis of the safety performance of the rail transit industry since 2003, providing a six-year trend analysis and comparison data for 2003 through 2008 and provides information and analysis of industry compliance with 49 CFR Part 659 Rail Fixed Guideway Systems (RFGS), State Safety Oversight Rule.

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The scope of data presented in this *Rail Safety Statistics Report* is for rail fixed guideway systems as defined in 49 CFR Part 659.5. Therefore, FTA does not present safety data for commuter rail properties as defined by the Federal Railroad Administration (FRA). However, in 2007, FTA and FRA collaborated to develop the *Commuter Rail Safety Study*, which presents an analysis of commuter rail safety data obtained through coordinated efforts with FRA.

***Rail Fixed Guideway System
(49 CFR Part 659.5)***

“Any light, heavy, or rapid rail system, monorail, inclined plane, funicular, trolley, or automated guideway that:

- (1) Is not regulated by the Federal Railroad Administration; and
- (2) Is included in FTA's calculation of fixed guideway route miles or receives funding under FTA's formula program for urbanized areas (49 U.S.C. 5336); or
- (3) Has submitted documentation to FTA indicating its intent to be included in FTA's calculation of fixed guideway route miles to receive funding under FTA's formula program for urbanized areas (49 U.S.C. 5336)”

Data Sources

To develop its *Rail Safety Statistics Report*, FTA reviewed available industry safety data to identify the most common causes of rail transit accidents and assess their severity as well as the rail transit agency's level of influence to prevent the accident. Critical to the analysis was the need to compile the most consistent and comprehensive data set. This year's analysis included an evaluation of data collected through both the SSO Program and the NTD Program for the period 2003 to 2008.

***SSO Accident Reporting Thresholds
(49 CFR Part 659.33)***

- (1) A fatality at the scene; or where an individual is confirmed dead within thirty (30) days of a rail transit-related incident;
- (2) Injuries requiring immediate medical attention away from the scene for two or more individuals;
- (3) Property damage to rail transit vehicles, non-rail transit vehicles, other rail transit property or facilities and non-transit property that equals or exceeds \$25,000;
- (4) An evacuation due to life safety reasons;
- (5) A collision at a grade crossing;
- (6) A main-line derailment;
- (7) A collision with an individual on a rail right of way; or
- (8) A collision between a rail transit vehicle and a second rail transit vehicle, or a rail transit non-revenue vehicle.

Subtle changes in NTD accident reporting thresholds and the revision of 49 CFR Part 659 accident thresholds in 2006 impacted 2007 reporting year data. 49 CFR Part 659 revisions better aligned the thresholds for the two programs. However, the subtle change in NTD's threshold for rail grade crossing accidents (establishment of a minimum \$7,500 to be met in order to be reportable) necessitated the use of SSO Program data for the 2006, 2007, and 2008 reporting years. By using NTD data for reporting years 2003-2005 and the SSO Program data for reporting years 2006, 2007, and 2008, FTA achieved the most consistent data set possible.

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FTA evaluated each accident reported through both programs to identify any anomalies, discrepancies, or variances that necessitated follow-up with state oversight agencies for validation. FTA believes that the current 2003-2008 data set in this report is its most accurate record of rail transit safety data to date. It should be noted that data from the NTD prior to 2003 did not include sufficient causal information and therefore was removed from current analyses.

In addition to the alignment of reporting thresholds, FTA also established consistent probable cause categories. When a probable cause was not provided, FTA examined the description of each accident, followed up with the state oversight agency and assigned the appropriate causal category. FTA understands that accidents may often have contributing factors and, on occasion, multiple causes; however, for purposes of analysis, FTA attributed the most likely probable cause based on the information provided by the rail transit agency and state oversight agency.

In addition to the available safety data, FTA reviewed ridership data for rail transit agencies between January 1, 2003, and December 31, 2008.

Report Methodology

The SSO Rail Accident Database includes information for all accidents meeting the thresholds established in 49 CFR 659.33. However, an event that meets one of these thresholds may not be particularly severe. For example, a reportable rail grade crossing (RGX) collision or an evacuation may have resulted in zero injuries and minimal property damage. While collection of this information is critical from a safety data standpoint, such events have a lower severity level due to minimal resulting impacts (fatalities, injuries, and property damage).

For both reporting and analysis, FTA groups incidents meeting 49 CFR Part 659 thresholds into five (5) categories:

- Collisions: Includes train-to-train, train-to-vehicle, train-to-object, and train-to-person collisions. Does not include rail grade crossing collisions, or collisions that occur as part of suicides or trespasser-related accidents.
- Rail Grade Crossing (RGX) Collisions: Includes collisions with transit vehicle, person, automobile, or other vehicle at a rail grade crossing.
- Derailments: Includes all mainline derailments.

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- Fires: Includes fires that cause at least \$25,000 in property damage or cause an evacuation of a vehicle or a station for life safety reasons.
- Other: Includes suicide and trespassing-related fatalities; homicides; non-fire-related evacuations, and other fatality or multiple-injury accidents that are not considered Collisions, Derailments, or Fires.

In addition, FTA analysis breaks down injuries and fatalities by four person types:

- Passenger: Individual on-board a rail transit vehicle or boarding or alighting a rail transit vehicle.
- Patron: Individual waiting for or leaving rail transit at stations, in mezzanines, on stairs, escalators, or elevators, in parking lots and other transit-controlled property.
- Worker: Rail transit agency employee or contractor.
- Public: All others who come into contact with the rail transit system, including pedestrians, automobile drivers, trespassers, and suicides.

Using these distinctions, FTA is able to determine the specific injury and fatality risk to each person type for any accident type. Additionally, FTA collects probable cause information from the SSO agencies for each accident. Causes are derived from the following sources:

- Equipment failure: Includes the unanticipated failure of a piece of equipment, such as a defective cable, signal, or relay.
- Transit workforce behavior: Includes the failure of rail transit personnel to comply with rules, procedures, and policies (i.e., signals, speed restrictions, door opening/closing) or by human factors issues affecting rail transit personnel (inattentiveness, fatigue, etc.). Also includes failures resulting from the poor state of repair of an element of the transit system, such a poor track conditions, poorly trued wheels, poorly maintained switch points, or deteriorating structures for which speed or other restrictions have not been placed or enforced.
- Customer behavior: Includes poor decision-making on the part of a passenger or patron in the station or while boarding/alighting a train (i.e., carelessness, inattention, drunkenness, train surfing, climbing into the right-of-way to retrieve a lost item, leaning into the path of an on-coming train, etc.).

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- Public behavior: Includes a variety of unsafe behaviors from those with whom the rail transit interacts, such as trespassers, suicidal individuals, the drivers or automobiles, and pedestrians.

The table below illustrates how the probable cause information collected from the SSO agencies in the Annual Reporting Template is aggregated into the source causes used by FTA in its analysis.

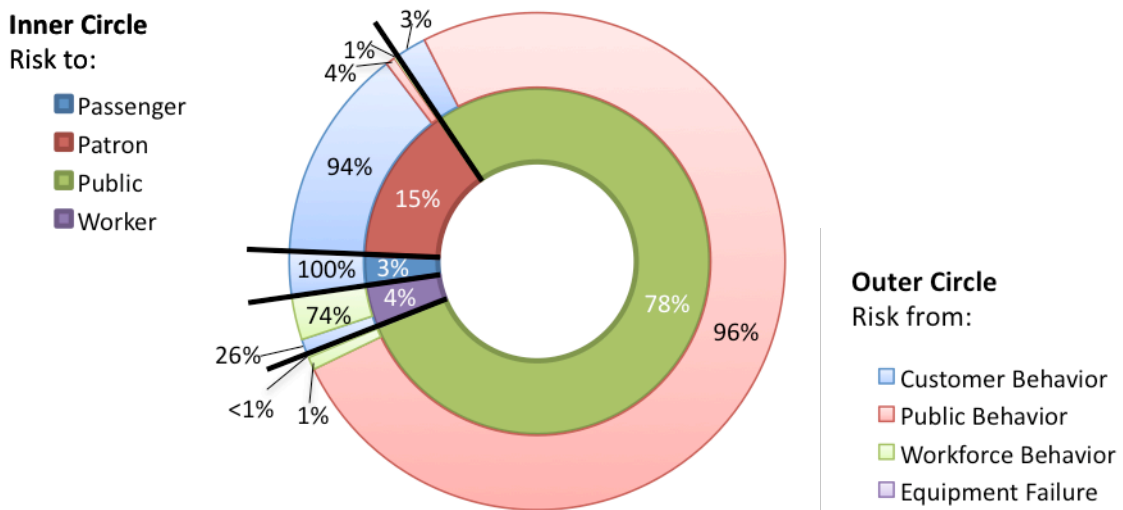
Probable Cause from SSO Annual Reporting Templates	Description	FTA Source Category
Equipment Failure	System component failure	Equipment Failure
Poor Maintenance	System not properly maintained	Transit workforce behavior
Employee Error	Operating Rule Violation/Human Factor	Transit workforce behavior
Slips and Falls	Slips and falls in station or vehicle	Customer behavior
Imprudent Customer Actions	Inappropriate patron or passenger behavior on vehicles or in stations	Customer behavior
Medically Related	Illness, heart-attacks	Customer behavior
Action of Motorist	Auto driver at fault	Public behavior
Pedestrian Actions	Pedestrian at fault	Public behavior
Trespasser	Trespasser action	Public behavior
Suicide	Suicides and suicide attempts	Public behavior
Other	Acts of Nature/ Unknown	Public behavior

In all of its analysis, FTA utilizes passenger miles to standardize impact data and provide injury and fatality rates. The resulting rates present the number of occurrences per 100 million passenger miles. For example, in 2007 the SSO community reported a fatality rate (excluding suicides and trespassing events) of 0.25. In other words, one individual was killed for every 400 million passenger miles of service provided in 2007.

For the first time, FTA’s summary also includes risk analyses that utilize “risk doughnuts” to depict who is affected by safety risk (risk to) and who caused the risk (risk from). In each risk doughnut, the inner ring displays the risk to by dividing the ring into four segments, one for each person type established by FTA (passenger, patron, worker, and public). The size of each segment is proportional to the risk for that person type. The outer ring depicts the risk from each causal group for each of the segments defined in

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the inner ring (equipment failure, transit workforce behavior, customer behavior, and public behavior). The result is a chart that shows what percentage of a specific event was incurred by each person type and the proportion of causes for that event by person type. See the sample “risk doughnut” below. As an example, to read the “risk doughnut” to determine the risks of this sample event to workers, first locate the purple segment on the inner ring. This segment shows that workers comprise 4 percent of the people affected by the sample event. To determine the causal groups responsible for the worker events, look to the outer ring corresponding to the purple segment of the inner ring. Note that 74 percent of the sample worker events were caused by transit workforce behavior, while the remaining 26 percent were caused by the actions of customers. This process can be repeated to determine the risk to the other people types from FTA’s source cause categories.



Rail Transit Safety Performance

The following section presents safety data for accidents reported between 2003 and 2008. The data presented include actual accident counts and impact totals, as well as these numbers standardized by 100,000,000 passenger miles.

Rail transit accidents: 2003 – 2008

Accident Type	2003	2004	2005	2006	2007	2008
Collision (non-RGX)	30	53	102	62	95	127
Derailment	35	29	27	31	58	71
Fire	12	31	11	12	27	25
Other	110	121	69	98	229	213
RGX Collision	253	262	435	148	333	556
Total	440	496	644	351	742	992

- Total accidents per year have increased significantly from 2003:
 - On average, the number of collisions (non RGX) has more than tripled since 2003.
 - On average, the number of RGX collisions has doubled since 2003.
 - The number of mainline derailments also increased.
- The largest increases occurred in RGX collisions and in other accidents, which include suicides and trespasser-related events.
- Increases in collisions, RGX collisions, derailments, and other accidents far outpaced the increase in passenger miles of service between 2003 and 2008:
 - During this period, the rail transit industry experienced growth not seen since the beginning of the 1900s.
 - Rail transit passenger miles increased 25 percent from 14,825,976,904 in 2003 to 18,550,977,528 in 2008. At some agencies, unlinked passenger trips increased by 40 percent.
 - Nevertheless, even with this period of sustained growth, the increase in 49 CFR Part 659 incidents reported in the rail transit industry exceeds normalized trending by an order of magnitude.

Rail transit accident causes: 2003 – 2008

Probable cause information is provided for each accident included in FTA’s SSO Rail Accident Database.

Tables 2 through 5 present the probable causes of the 3,665 accidents reported to FTA’s SSO Rail Accident Database between 2003 and 2008.

Table 2 – Accidents Caused by Equipment Failure: 2003 – 2008							
Accident Type	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	0	2	8	1	1	1	13
RGX Collision	2	0	0	0	1	1	4
Derailment	11	3	4	6	36	20	80
Fire	9	23	5	6	22	19	84
Other	1	7	1	8	22	20	59
Total	23	35	18	21	82	61	240

- Over the last six years, equipment failure has led to an increasing number of accidents. This is observed in increasing derailments, fires, and other incidents caused by equipment failures.

Table 3 – Accidents Caused by Customer Behavior: 2003 – 2008							
Accident Type	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	9	2	7	0	2	7	27
RGX Collision	0	0	0	0	0	3	3
Other	49	48	35	23	74	58	287
Total	58	50	42	23	76	68	317

- Customer behavior caused the highest levels of other accidents in 2007 and 2008, 74 and 58 accidents, respectively.

Table 4 – Accidents Caused by Public Behavior: 2003 – 2008							
Accident Type	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	12	24	42	40	26	66	210
RGX Collision	234	244	426	140	319	513	1876
Derailment	0	0	0	0	1	0	1
Other	57	60	32	51	115	123	438
Total	303	328	500	231	461	702	2525

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- In 2008 public behavior caused its highest level of non-RGX collisions, RGX collisions, and other accidents over the six-year analysis period.

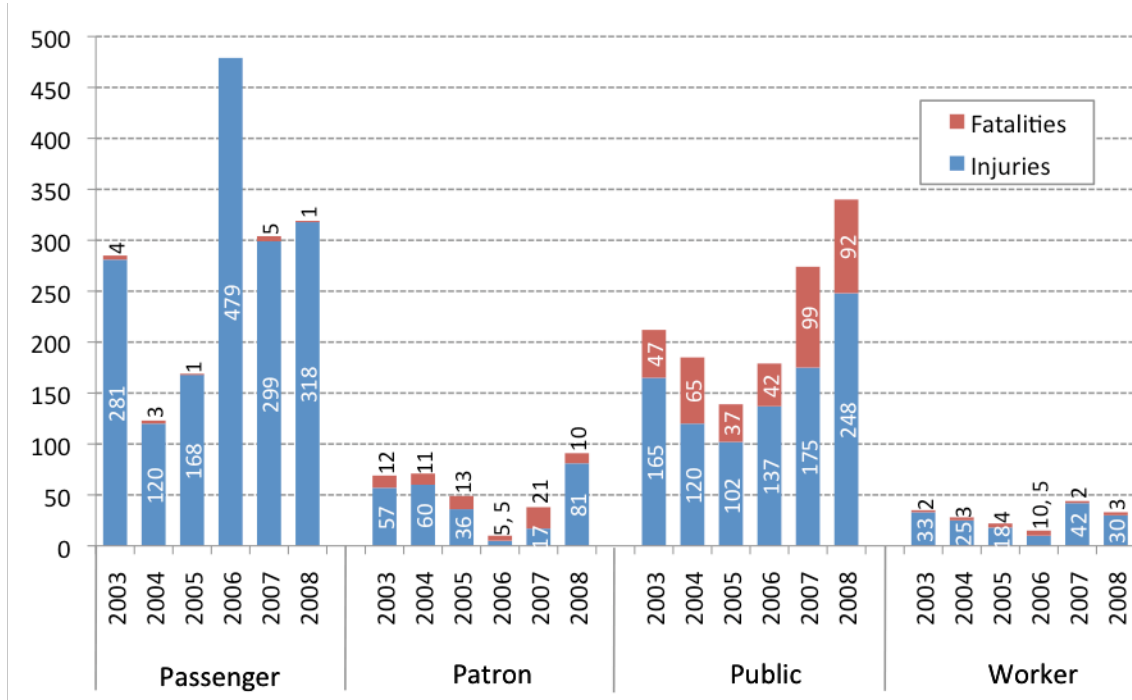
Table 5 – Accidents Caused by Workforce Behavior: 2003 – 2008

Accident Type	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	9	24	45	21	66	53	218
RGX Collision	17	18	9	8	13	39	104
Derailment	24	26	23	25	21	51	170
Fire	3	8	6	6	5	6	34
Other	3	7	1	16	18	12	57
Total	56	83	84	76	123	161	583

- 2008 data represents the highest levels of derailments and RGX collisions cause by workforce behavior.

Fatalities and injuries: 2003 – 2008

Figure 1 – Fatalities and injuries by person type: 2003 - 2008



- As shown in Figure 1, 783 individuals were injured or killed in reportable accidents in 2008.
 - This included 106 fatalities – one passenger, 10 patrons, 92 members of the public, and 3 workers.
 - Of the 92 public deaths, 40 were suicides and 29 were trespassing-related.
- Between 2003 and 2008, passengers experienced low occurrences of fatality.
- Also, during this period, 19 rail transit workers were killed.

Fatalities by accident type: 2003 – 2008

Accident Type	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	4	3	13	5	8	6	39
Derailment	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0
Other	52	69	38	40	109	90	398
RGX Collision	9	10	4	7	10	10	50
Total	65	82	55	52	127	106	487

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- Over the six years between 2003 and 2008, 487 people were killed in accidents taking place on rail transit-controlled property.
 - As indicated in Table 7 below, 296 (or 61%) of these fatalities are the result of suicides and trespasser-related accidents.
- Between 2003 and 2008, 89 total fatalities were attributable to collisions (39 to collisions (non-RGX) and 50 to RGX collisions).
- Between 2003 and 2008, there were no fatalities attributable to derailments or fires.

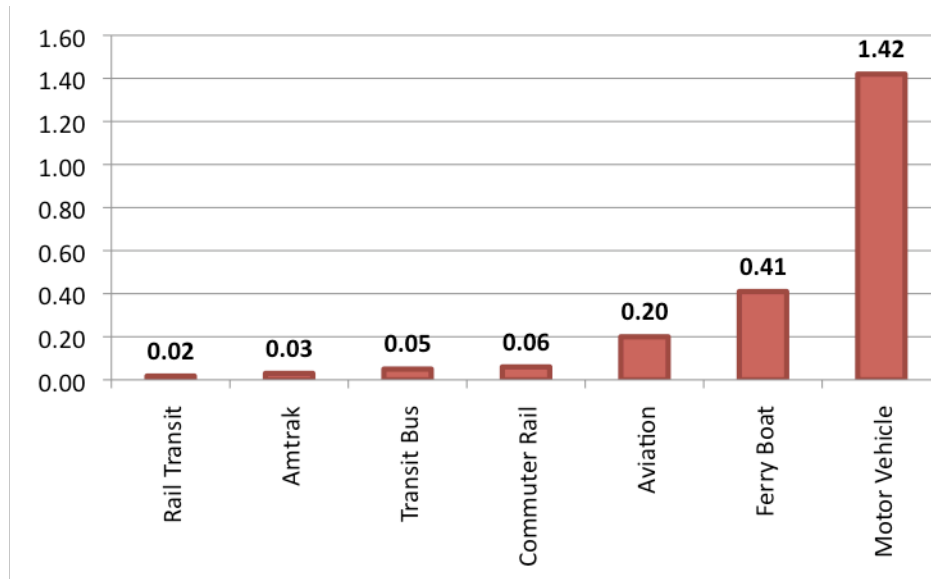
Table 7 - Suicide and Trespassing Fatalities: 2003 - 2008

Fatality Type	2003	2004	2005	2006	2007	2008	Total
Suicides	17	26	13	24	60	40	180
Trespassing	21	28	9	7	22	29	116
Total	38	54	22	31	82	69	296

Intermodal comparison

With its low occurrence of passenger fatalities, rail transit modes (heavy rail and light rail) rank among the safest modes of transportation. The following graph presents passenger fatality rates per 100,000,000 passenger miles for common transportation modes.

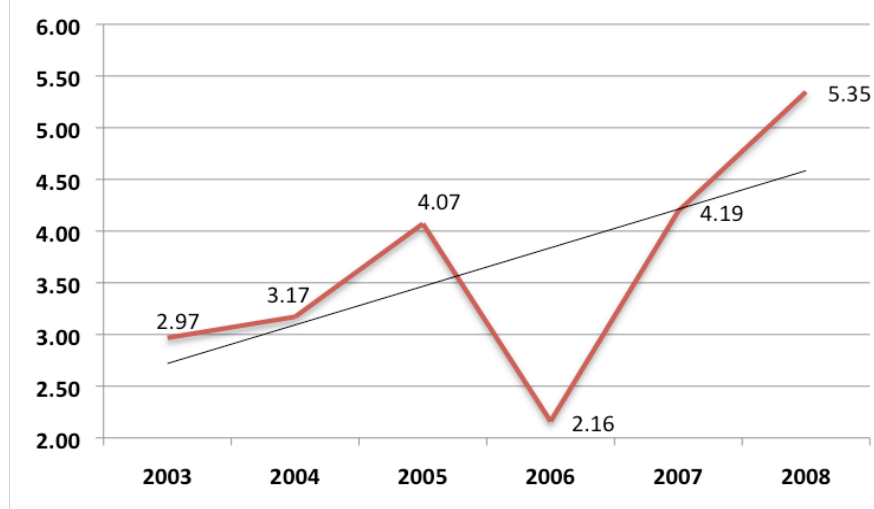
Figure 2 – Passenger fatality rates (per 100,000,000 passenger miles)



Accident Rate – Overall accident trend

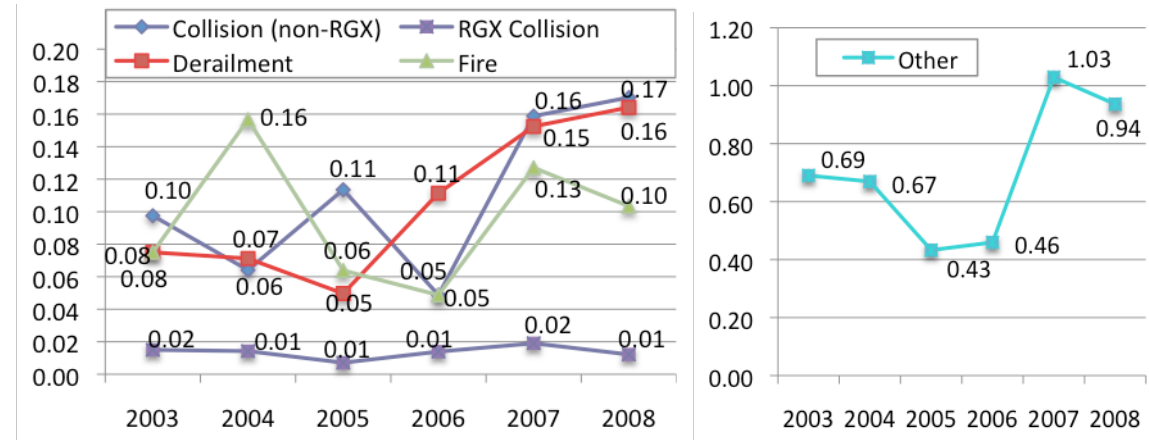
Rail transit modes have experienced an increasing accident rate over the last six years. Accident rates were established by standardizing total accidents by 100,000,000 passenger miles.

Figure 3 – Accident rates (per 100,000,000 passenger miles)



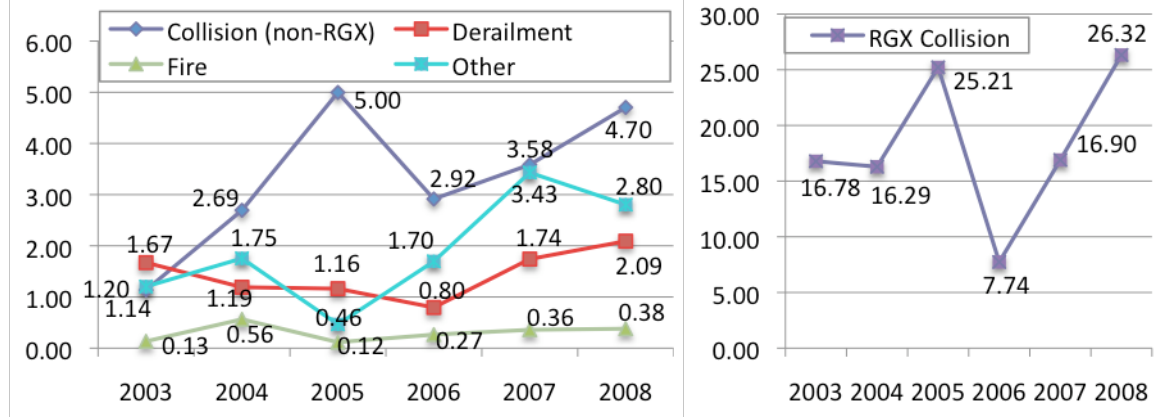
- The above graph and trendline show an increasing accident rate over the past six years.
- While 2006 showed a significant drop in accident rate, the rates for 2007 and 2008 continued a rising trend.

Figure 4 – Heavy Rail Accident Rates



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Figure 5 – Light Rail Accident Rates



- Heavy rail accident rates for collisions and derailments increased in 2008. Given the potential for catastrophic events, these trends are of considerable concern.
- Light rail accident rates for collisions, RGX collisions, derailments, and fires increased in 2008.

Risk Profiles

Risk profile – fatalities

The following analysis presents safety data from 2003 to 2008 and depicts who is affected by fatality risk (risk to) and who is responsible for causing it (risk from).

Figure 6 – Fatality risk profile (including suicide and trespassing fatalities)

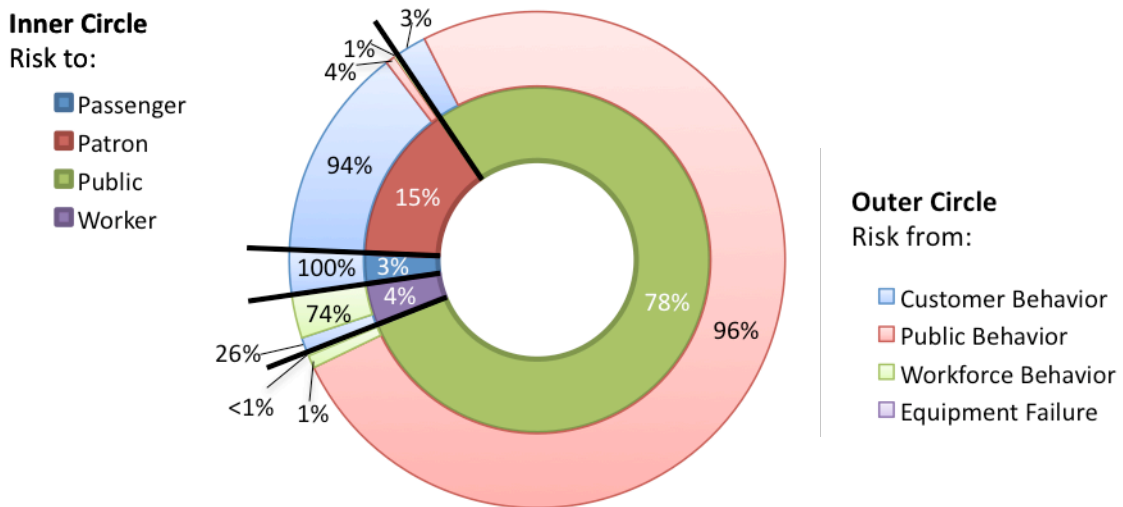
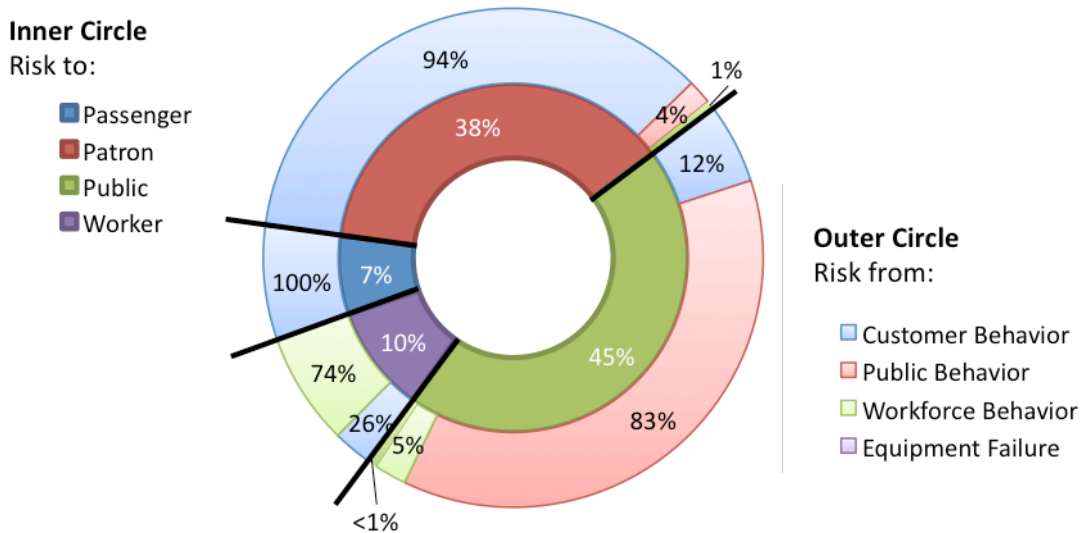


Figure 7 – Fatality risk profile (excluding suicide and trespassing fatalities)

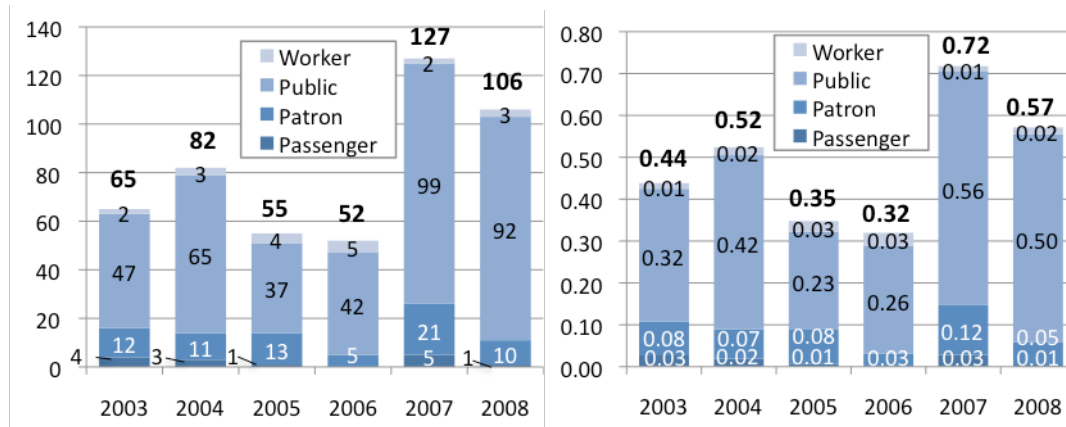


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- As shown in Figures 6 and 7, 78% of rail transit fatality risk is to the (non-riding) public. *When excluding suicides and trespassing fatalities, the risk to the public is 45%.*
 - 96% of this risk is caused by public behavior – *83% when excluding suicides and trespassing fatalities.*
- As shown in Figures 6 and 7, 3% of fatality risk is to passengers, *7% when excluding suicides and trespassing.*
 - 100% of this risk is attributed to slips and falls, imprudent customer actions, and medical issues.
- Figures 6 and 7 indicate that 15% of fatality risk is to patrons (individuals waiting for or leaving transit), *38% when excluding suicides and trespassers.*
 - 94% of risk to patrons is caused by their own actions.
- Finally, Figures 6 and 7 show a 4% fatality risk to workers, *10% excluding suicides and trespassing fatalities.*
 - The majority of this risk (74%) is caused by workforce behavior and the remainder (26%) is caused by customer behavior.

Analysis of Fatalities

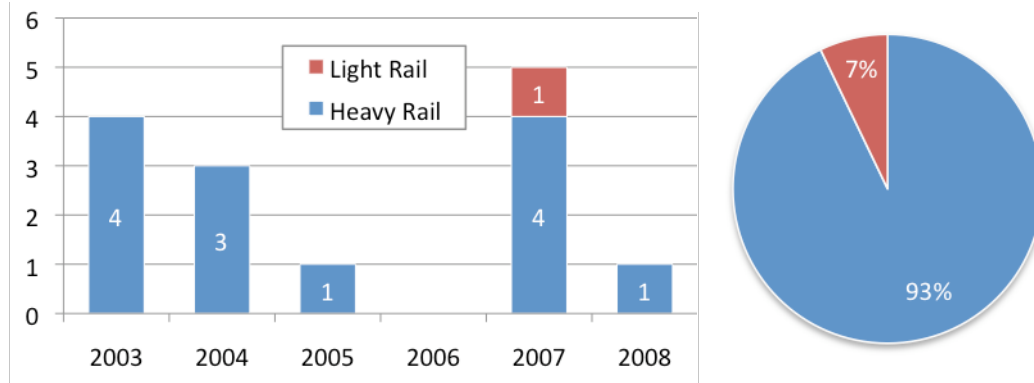
Figure 8 – Fatalities and rates by person type



- Passenger, patron, and public fatalities decreased in 2008.
- Worker fatalities increased in 2008.
- Less than 1% of 2008 fatalities were passengers.
- 9% of 2008 fatalities were patron deaths.
- 87% of 2008 fatalities were public deaths.
- Of the 92 public fatalities, 40 were suicides and 29 were trespassing-related.

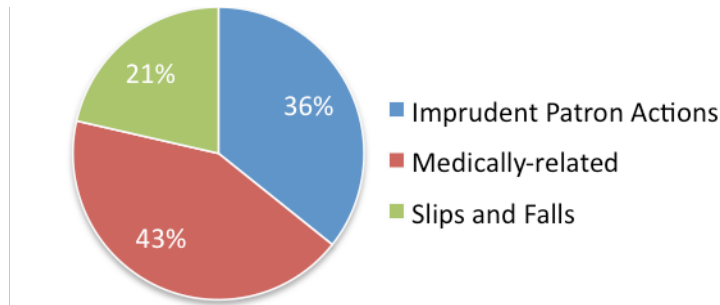
Passenger fatalities

Figure 9 – Passenger fatalities by mode and year



- All passenger fatalities were due to “other” individual accidents.
- 93% of all passenger fatalities occurred on heavy rail service (13 deaths).
- One light rail passenger died in 2007 in a slip-and-fall incident.

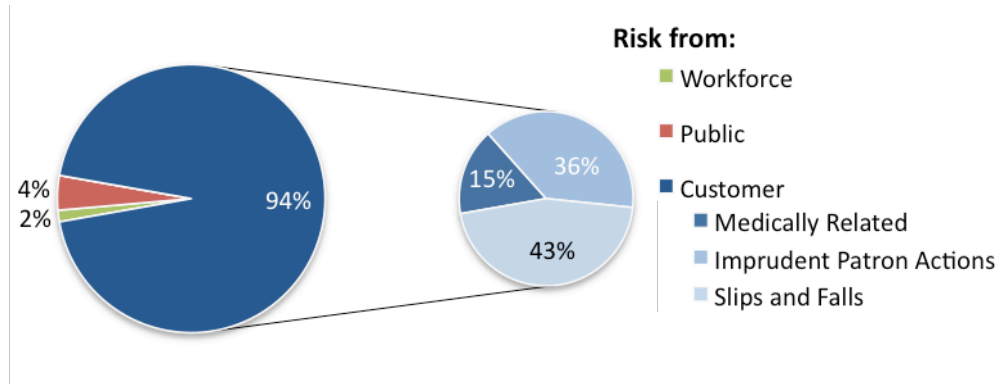
Figure 10 – Passenger fatalities by probable cause: 2003 - 2008



- A total of 14 passengers were killed between 2003 and 2008.
- All fatalities were caused by risk from customer behavior.
- Medically-related events accounted for six fatalities.
- Imprudent patron actions caused five fatalities.
- Slips and falls accounted for three fatalities.
- All passenger fatalities were on heavy rail service except for one light rail passenger slip and fall.

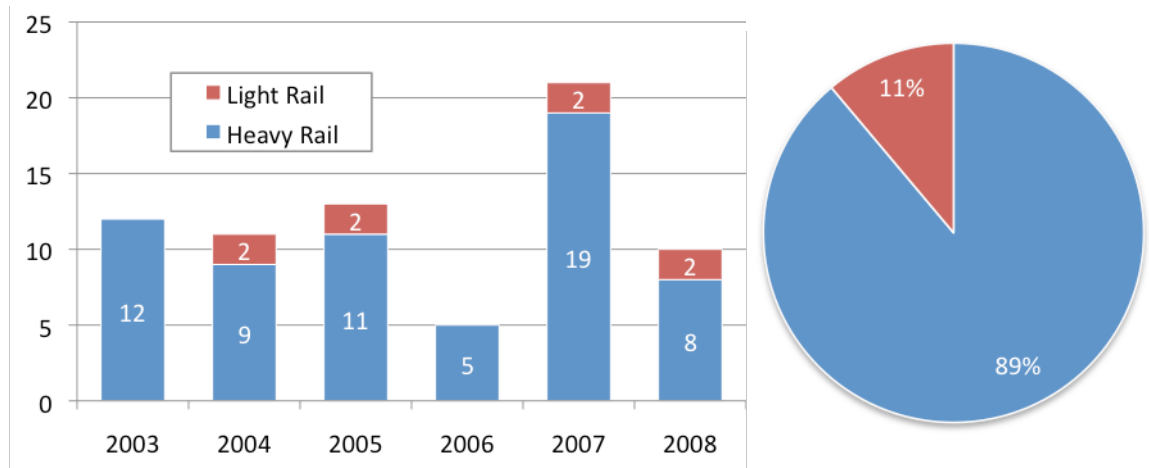
Patron fatalities

Figure 11 – Patron fatality risk: 2003 – 2008



- There were 72 patron fatalities between 2003 and 2008.
- One patron fatality was a pedestrian collision due to inattentiveness (workforce behavior).
- Three fatalities were caused by pedestrian actions (public behavior).
- Customers caused the remaining 94% of all patron fatalities.
 - 11 patron fatalities were medically related.
 - 26 were due to imprudent patron actions.
 - 31 were slips and falls.

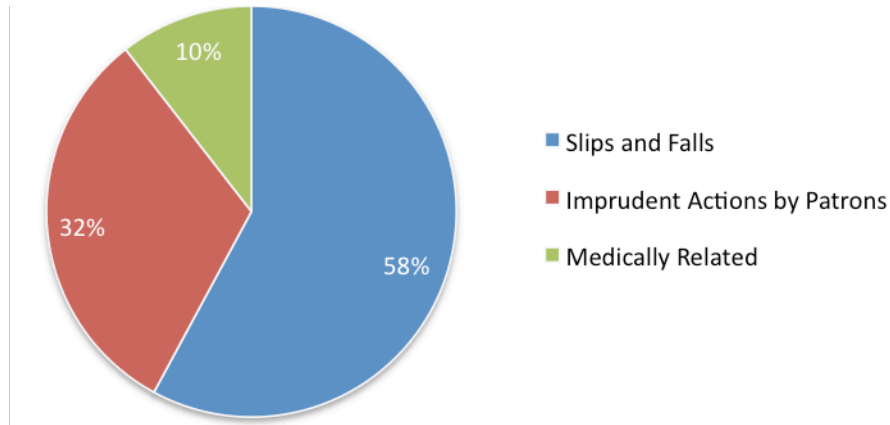
Figure 12 – Patron fatalities by mode: 2003 - 2008



- 89% of patron fatalities were related to heavy rail service.
- Heavy rail systems experienced eight patron fatalities in 2008, down from 19 in 2007.

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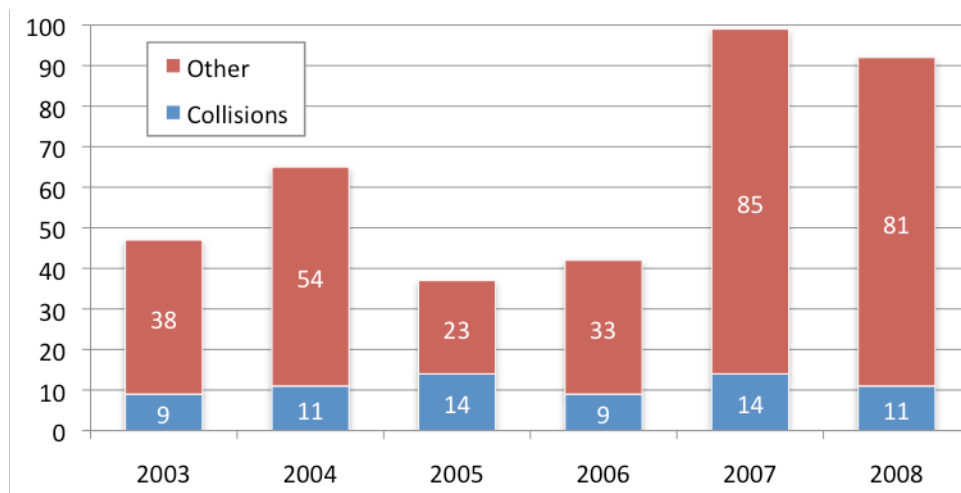
Figure 13 – Heavy rail patron fatalities: 2007



- All patron fatalities in 2007 were “other” individual accidents.
- Slips and falls caused 58% of heavy rail patron fatalities in 2007, including falls in the station and falls from the platform to the track bed.
- 32% of heavy rail patron fatalities were caused by imprudent patron actions, such as patron disputes and jumps to the track bed.
- 10% of the heavy rail patron fatalities were medically related.

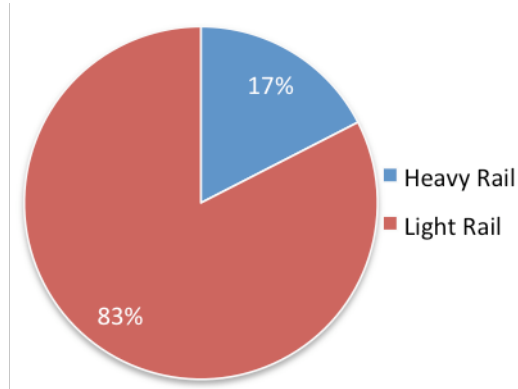
Public fatalities

Figure 14 – Public fatalities by accident type: 2003 - 2008



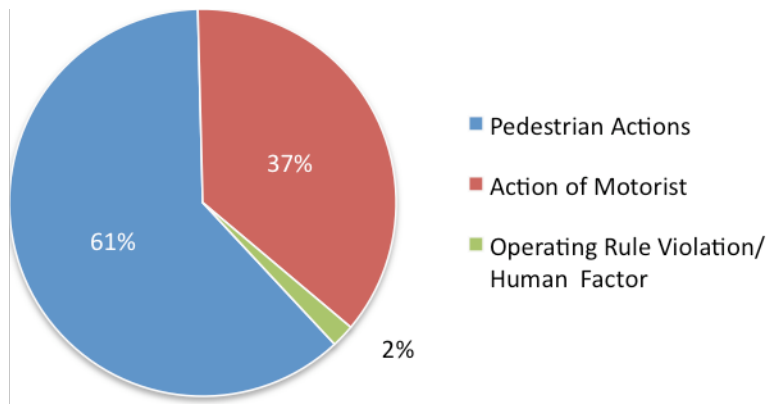
- 82% of the 382 public fatalities resulted from “other” individual events, including 180 suicides, 115 trespassing fatalities, eight deaths caused by imprudent patron actions, five due to actions of motorists, two due to pedestrian actions, one fatal slip and fall, one due to equipment failure, and one due to a medical issue.
- 18% of the public fatalities resulted from collisions.

Figure 15 – Public fatalities by mode, excluding suicides and trespassing: 2003 - 2008



- Heavy rail service reported 17% of public fatalities (excluding suicides and trespassing fatalities), including nine fatalities from collisions with vehicles or pedestrians, five fatalities caused by imprudent patron actions, and one slip-and-fall death.
- Light rail experienced 83% of non-suicide and non-trespassing public fatalities. 66 of these fatalities resulted from collisions and five were “other” individual accidents.

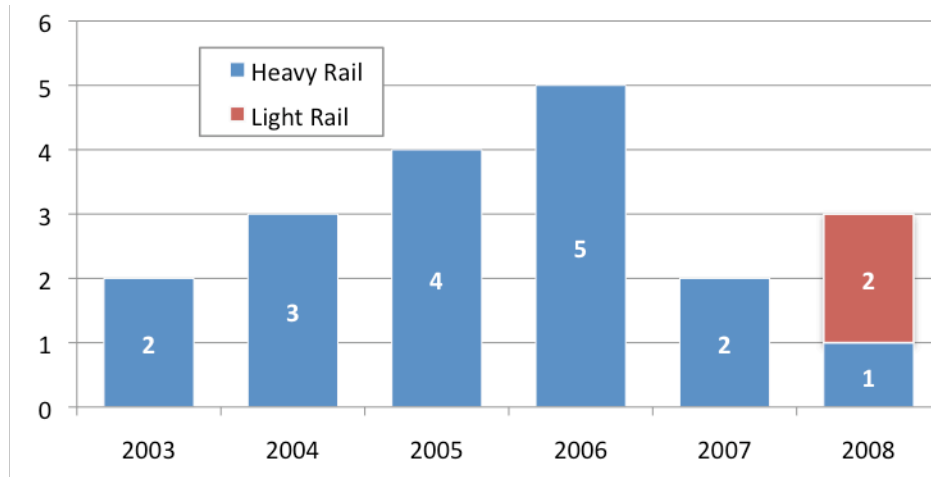
Figure 16 – Public fatality risk from light rail collisions: 2003 – 2008



- Operating rule violations/ human factors caused three public fatalities.
- Pedestrian actions caused 61% of light rail collision public fatalities.
- Motorist actions caused 37% of the selected fatalities.

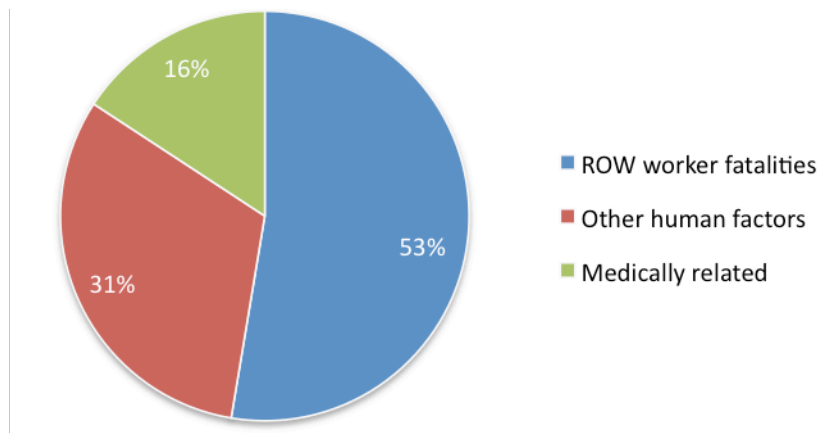
Worker fatalities

Figure 17 – Worker fatalities: 2003 – 2008



- Of the 19 worker fatalities, 17 were reported for heavy rail service and two for light rail service.
- Over half of all worker fatalities were Right-of-Way worker incidents (10 fatalities).

Figure 18 – Worker fatalities by cause: 2003 – 2008



- 10 Right-of-Way workers were killed over the six-year period (struck by trains).
- Six fatalities were caused by other factors such as one operating rule violation that resulted in a fatal train to train collision, and five other single-person accidents (such as slips and falls).
- Medical issues caused three worker fatalities.

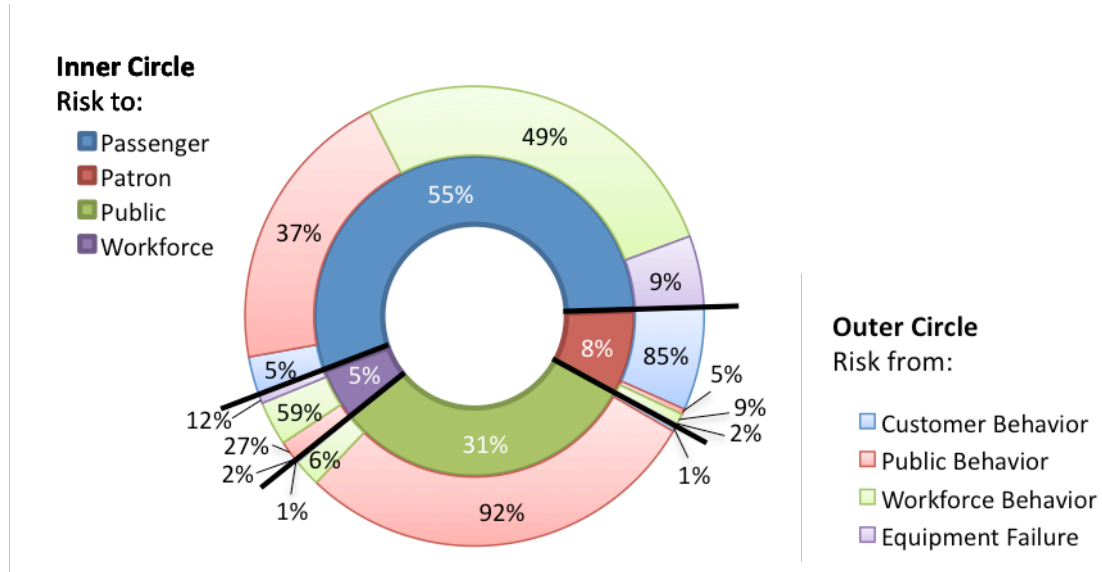
Risk profiles – injuries

Table 8 presents the number of injuries by accident type for the period 2003 to 2008.

Accident Type	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	43	61	50	133	136	235	658
Derailment	9	4	3	279	26	30	351
Fire	199	18	7	57	2	11	294
Other	89	91	47	63	99	176	565
RGX Collision	196	151	217	99	270	225	1158
Total	65	82	55	52	127	106	3,026

The following analysis presents safety data from 2003 to 2008 and depicts who is affected by injury risk (risk to) and who is responsible for causing it (risk from).

Figure 19 – Injury Risk Profile



- Figure 19 shows that 55% of injury risk is to passengers. This group includes transit customers aboard trains. 49% of these injuries were caused by workforce behavior, such as operating rule violations and other human factors. 37% of these injuries were caused by public behavior, such as careless auto drivers.
- Figure 19 also indicates that 31% of injury risk is to the public. 92% of public injuries are caused by public behavior. Workforce behavior causes 6% of public

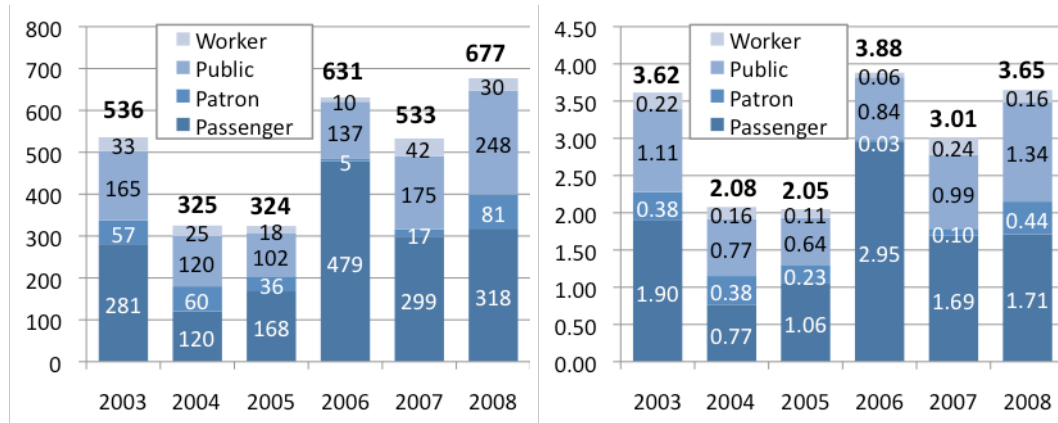
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injuries. Other public injuries are caused by customer behavior (imprudent patron actions) and equipment failure.

- Figure 19 shows 8% of injury risk is to patrons. The majority of these injuries (85%) are caused by customer behavior (slips and falls, imprudent patron actions, medical conditions). 9% of patron injuries were caused by workforce behavior (such as poor maintenance).
- Finally, Figure 19 depicts 5% of injury risk to workers. 59% of worker injury risk is caused by workforce behavior. The public causes 27% of worker injuries and equipment failure causes 12%.

Analysis of injuries

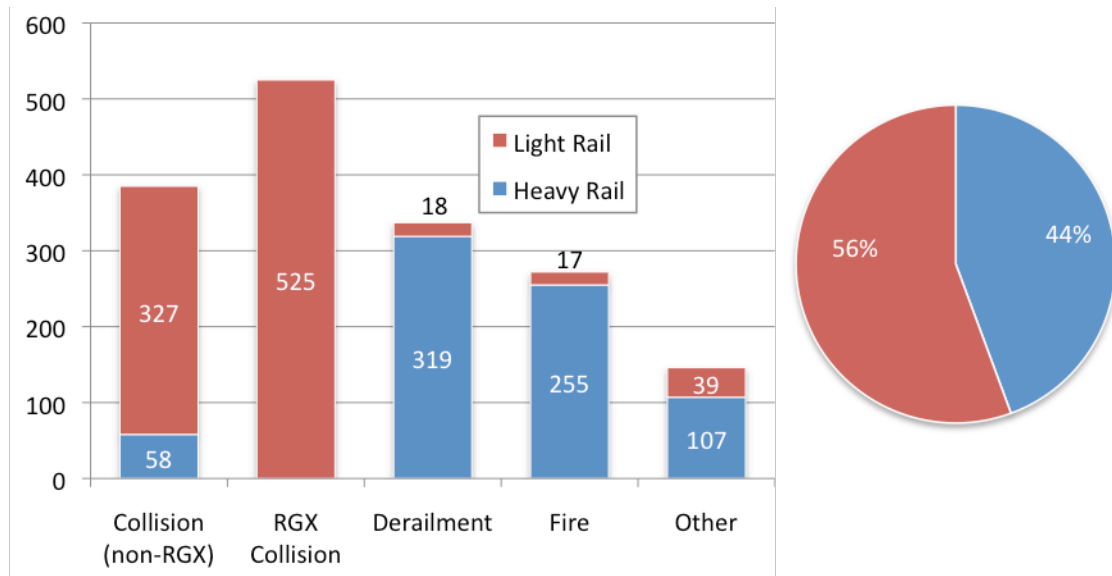
Figure 20 – Injuries and rates by person type



- Passenger, patron, and public injuries increased in 2008.
- Worker injuries decreased in 2008.
- 47% of 2008 injuries were passenger injuries.
- 12% of 2008 injuries were injuries to patrons.
- 37% of 2008 injuries were public injuries.
- 4% of 2008 injuries were injuries to workers.

Passenger injuries

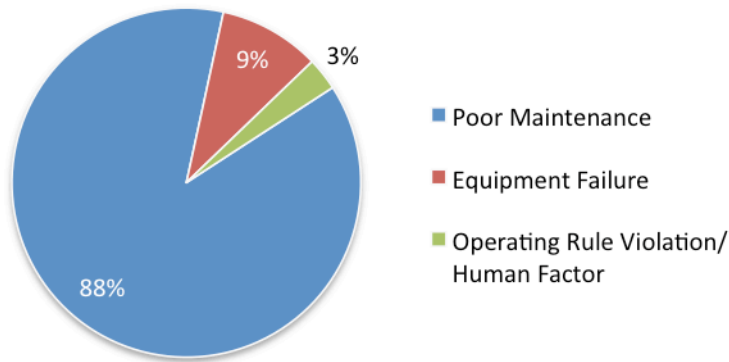
Figure 21 – Passenger injuries by mode: 2003 - 2008



- There were 1,665 passenger injuries over the six-year period. 56% of these injuries were reported for light rail service and 44% for heavy rail.
- Of the 926 light rail passenger injuries reported, 57% resulted from rail grade crossing collisions, and 35% from non-rail grade crossing collisions. Light rail non-rail grade crossing collisions include streetcar collisions with autos that occur between intersections. Streetcar collisions occurring at intersections are considered rail grade crossing collisions.
- 4% of light rail passenger injuries resulted from “other” accidents, caused by slips and falls and imprudent patron actions.
- Of the 739 heavy rail injuries reported, 43% resulted from derailments, 35% from fires, 14% from “other” accidents, and 8% from collisions.

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Figure 22 – Heavy rail passenger injuries from derailments: 2006 - 2008

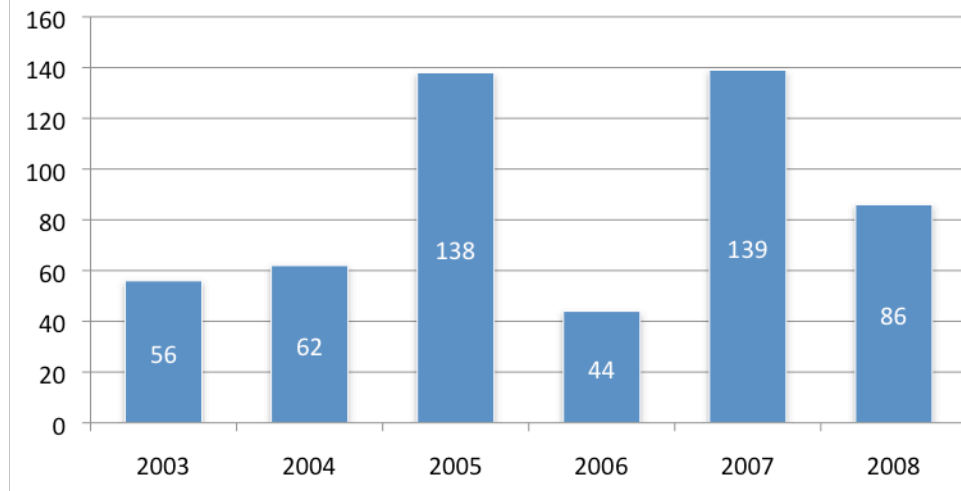


Year	2006	2007	2008
Derailment Injuries	275	23	17

- Between 2006 and 2008, heavy rail service experienced 315 passenger injuries resulting from derailments.
- 261 of these derailment injuries occurred in two Chicago Transit Authority (CTA) derailments caused by poor maintenance: one 257-injury derailment and a 4-injury derailment.
- 29 of these derailment injuries were caused by equipment failure, including a 23-injury Washington Metropolitan Area Transit Authority (WMATA) derailment, a 5-injury CTA derailment, and a single-injury New York City Transit (NYCT) derailment.
- Nine derailment injuries were caused by transit agency human factors, including a 14-injury CTA derailment, an 8-injury Miami-Dade Transit (MDT) derailment, a single-injury CTA derailment, and a single-injury Massachusetts Bay Transportation Authority (MBTA) derailment.

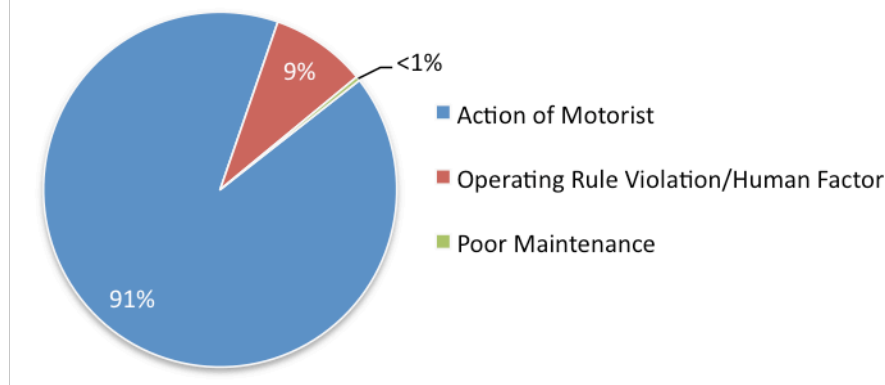
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Figure 23 – Light rail grade crossing collision passenger injuries: 2003 – 2008



- 86 passenger injuries resulted from rail grade crossing collisions in 2008, slightly lower than the previous five-year average of 87.8.

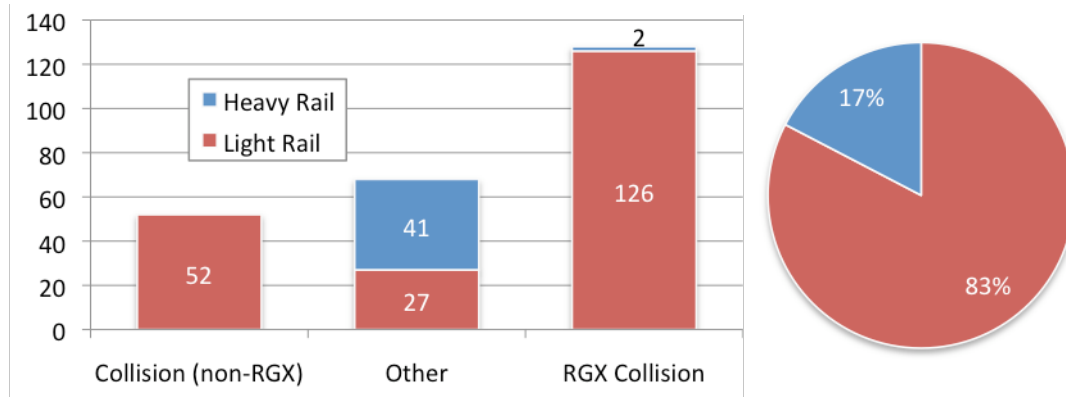
Figure 24 – Light rail grade crossing passenger injuries by cause: 2003 - 2008



- Automobile drivers caused 91% of light rail grade crossing passenger injuries.
- Workforce behavior caused 9% of light rail grade crossing passenger injuries in over the six-year period, including operating rule violations (48 injuries) and poor maintenance (two injuries).

Public injuries

Figure 25 – Public injuries by mode: 2008



- 17% of all public injuries in 2008 were related to heavy rail service (43 injuries).
- Causes of the 43 heavy rail public injuries include motorists (21), trespassers (11), suicide attempts (9), slips and falls (1), and imprudent patron actions (1).
- RGX collisions caused 61% of all light rail public injuries in 2008.
- Causes of light rail RGX public injuries include motorist actions (95 injuries), pedestrians (22), operating rule violations (7), and imprudent patron actions (2).

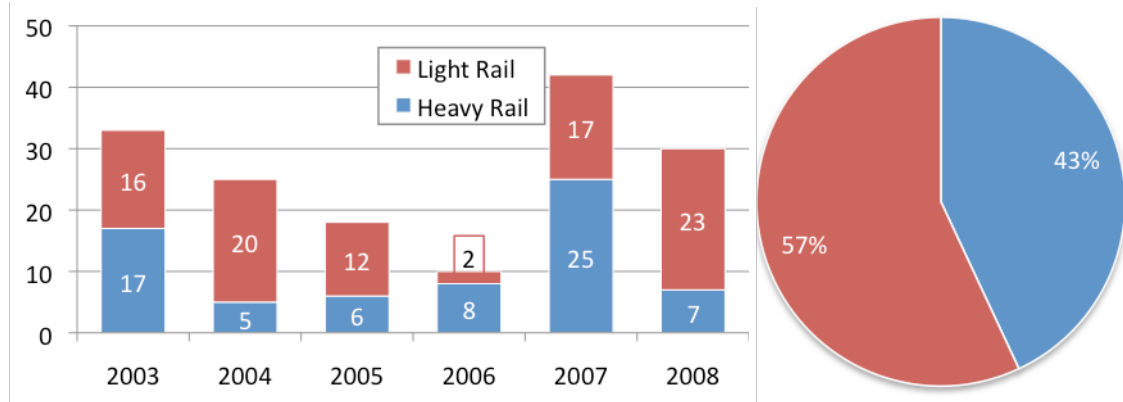
Figure 26 – Light rail RGX injury risk to the public: 2003 - 2008



- Public behavior caused 95% of public injuries resulting from light rail RGX collisions over the six-year period.
 - Motorist actions caused 493 public injuries.
 - Pedestrains caused 54 public injuries.
- 5% of public injuries from RGX collisions were caused by operating rule violations (workforce behavior).

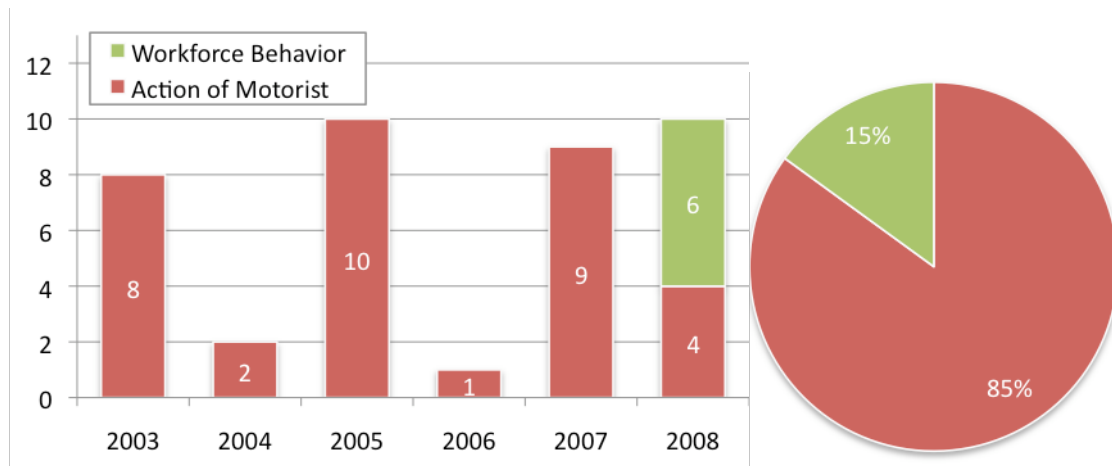
Worker injuries

Figure 27 – Worker injuries by mode: 2003 - 2008



- 57% of all worker injuries are reported by light rail service.
- In 2008, 22 light rail worker injuries resulted from collisions, and one from a derailment.
- The seven heavy rail worker injuries in 2008 resulted from a fire caused by equipment failure that injured a worker and a passenger, and the remaining six worker injuries resulted from “other” reportable workplace accidents.
- Of the seven 2008 heavy rail worker injuries, four were caused by workforce behavior, two by passenger behavior and one by equipment failure.

Figure 28 – Light rail worker RGX collision injuries by cause: 2003 - 2008



- There were 40 workers injured in light rail RGX collisions between 2003 and 2008.
- 85% of these injuries were caused by public behavior, specifically the actions of motorists.

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- 15% of these injuries were caused by workforce behavior (operating rule violations/human factors). These injuries were caused by a 2008 New Orleans Regional Transit Authority (NORTA) collision injuring 22 passengers and 4 workers, a 2008 San Francisco Municipal Railway (Muni) collision injuring one passenger and one worker, and a 2008 Memphis Area Transit Authority (MATA) collision injuring one worker.

Rail Transit Accidents

Heavy Rail	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	13	9	16	7	25	28	98
Derailment	10	10	7	16	24	27	94
Fire	10	22	9	7	20	17	85
Other	92	94	61	66	162	154	629
RGX Collision	2	2	1	2	3	2	12
Total	127	137	94	98	234	228	918

Light Rail	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	17	43	86	55	70	99	370
Derailment	25	19	20	15	34	44	157
Fire	2	9	2	5	7	8	33
RGX Collision	251	260	434	146	330	554	1975
Other	18	28	8	32	67	59	212
Total	313	359	550	253	508	764	2747

Total	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	30	52	102	62	95	127	468
Derailment	35	29	27	31	58	71	251
Fire	12	31	11	12	27	25	118
Other	110	122	69	98	229	213	841
RGX Collision	253	262	435	148	333	556	1987
Total	440	496	644	351	742	992	3665

Rail Transit Fatalities

Passenger	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	0	0	0	0	0	0	0	Collision (non-RGX)	0	0	0	0	0	0	0	Collision (non-RGX)	0	0	0	0	0	0	0
Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0
Other	4	3	1	0	5	1	14	Other	4	3	1	0	4	1	13	Other	0	0	0	0	1	0	1
RGX Collision	0	0	0	0	0	0	0	RGX Collision	0	0	0	0	0	0	0	RGX Collision	0	0	0	0	0	0	0
Total	4	3	1	0	5	1	14	Total	4	3	1	0	4	1	13	Total	0	0	0	0	1	0	1
Patron	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	4	0	2	0	0	2	8	Collision (non-RGX)	4	0	0	0	0	1	5	Collision (non-RGX)	0	0	2	0	0	1	3
Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0
Other	8	11	11	5	19	8	62	Other	8	9	11	5	19	7	59	Other	0	2	0	0	0	1	3
RGX Collision	0	0	0	0	2	0	2	RGX Collision	0	0	0	0	0	0	0	RGX Collision	0	0	0	0	2	0	2
Total	12	11	13	5	21	10	72	Total	12	9	11	5	19	8	64	Total	0	2	2	0	2	2	8
Public*	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	0	1	10	2	6	1	20	Collision (non-RGX)	0	0	1	0	1	0	2	Collision (non-RGX)	0	1	9	2	5	1	18
Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0
Other	38	54	23	33	85	81	314	Other	30	44	19	17	68	71	249	Other	8	10	4	16	17	10	65
RGX Collision	9	10	4	7	8	10	48	RGX Collision	1	0	0	0	2	0	3	RGX Collision	8	10	4	7	6	10	45
Total	47	65	37	42	99	92	382	Total	31	44	20	17	71	71	254	Total	16	21	17	25	28	21	128
Worker	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	0	2	1	3	2	3	11	Collision (non-RGX)	0	2	1	3	2	1	9	Collision (non-RGX)	0	0	0	0	0	2	2
Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0
Other	2	1	3	2	0	0	8	Other	2	1	3	2	0	0	8	Other	0	0	0	0	0	0	0
RGX Collision	0	0	0	0	0	0	0	RGX Collision	0	0	0	0	0	0	0	RGX Collision	0	0	0	0	0	0	0
Total	2	3	4	5	2	3	19	Total	2	3	4	5	2	1	17	Total	0	0	0	0	0	2	2
Total	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	4	3	13	5	8	6	39	Collision (non-RGX)	4	2	2	3	3	2	16	Collision (non-RGX)	0	1	11	2	5	4	23
Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0	Fire	0	0	0	0	0	0	0
Other	52	69	38	40	109	90	398	Other	44	57	34	24	91	79	329	Other	8	12	4	16	18	11	69
RGX Collision	9	10	4	7	10	10	50	RGX Collision	1	0	0	0	2	0	3	RGX Collision	8	10	4	7	8	10	47
Total	65	82	55	52	127	106	487	Total	49	59	36	27	96	81	348	Total	16	23	19	25	31	25	139

* includes suicides and trespassing fatalities

Rail Transit Injuries

Passenger	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	17	26	11	85	83	163	385	Collision (non-RGX)	11	21	1	0	19	6	58	Collision (non-RGX)	6	5	10	85	64	157	327
Derailment	3	1	3	275	26	29	337	Derailment	0	1	3	275	23	17	319	Derailment	3	0	0	0	3	12	18
Fire	187	17	5	53	2	8	272	Fire	187	9	5	53	0	1	255	Fire	0	8	0	0	2	7	17
Other	18	14	11	22	49	32	146	Other	12	8	8	15	38	26	107	Other	6	6	3	7	11	6	39
RGX Collision	56	62	138	44	139	86	525	RGX Collision	0	0	0	0	0	0	0	RGX Collision	56	62	138	44	139	86	525
Total	281	120	168	479	299	318	1665	Total	210	39	17	343	80	50	739	Total	71	81	151	136	219	268	926
Patron	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	5	2	10	0	2	7	26	Collision (non-RGX)	5	1	6	0	1	4	17	Collision (non-RGX)	0	1	4	0	1	3	9
Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0	Derailment	0	0	0	0	0	0	0
Fire	0	0	0	0	0	2	2	Fire	0	0	0	0	0	2	2	Fire	0	0	0	0	0	0	0
Other	52	58	25	5	15	71	226	Other	51	56	22	3	14	69	215	Other	1	2	3	2	1	2	11
RGX Collision	0	0	1	0	0	1	2	RGX Collision	0	0	0	0	0	0	0	RGX Collision	0	0	1	0	0	1	2
Total	57	60	36	5	17	81	256	Total	56	57	28	3	15	75	234	Total	1	3	8	2	2	6	22
Public*	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	13	20	23	47	23	52	178	Collision (non-RGX)	0	0	0	0	1	0	1	Collision (non-RGX)	13	20	23	47	22	52	177
Derailment	1	0	0	0	0	0	1	Derailment	0	0	0	0	0	0	0	Derailment	1	0	0	0	0	0	1
Fire	0	0	1	0	0	0	1	Fire	0	0	1	0	0	0	1	Fire	0	0	0	0	0	0	0
Other	19	13	10	36	30	68	176	Other	13	11	8	31	14	41	118	Other	6	2	2	5	16	27	58
RGX Collision	132	87	68	54	122	128	591	RGX Collision	1	2	2	1	0	2	8	RGX Collision	131	85	66	53	122	126	583
Total	165	120	102	137	175	248	947	Total	14	13	11	32	15	43	128	Total	151	107	91	105	160	205	819
Worker	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	8	13	6	1	28	13	69	Collision (non-RGX)	3	4	4	0	23	1	35	Collision (non-RGX)	5	9	2	1	5	12	34
Derailment	5	3	0	4	0	1	13	Derailment	2	0	0	4	0	0	6	Derailment	3	3	0	0	0	1	7
Fire	12	1	1	4	0	1	19	Fire	12	1	1	4	0	1	19	Fire	0	0	0	0	0	0	0
Other	0	6	1	0	5	5	17	Other	0	0	1	0	2	5	8	Other	0	6	0	0	3	0	9
RGX Collision	8	2	10	1	9	10	40	RGX Collision	0	0	0	0	0	0	0	RGX Collision	8	2	10	1	9	10	40
Total	33	25	18	10	42	30	158	Total	17	5	6	8	25	7	68	Total	16	20	12	2	17	23	90
Total	2003	2004	2005	2006	2007	2008	Total	HR	2003	2004	2005	2006	2007	2008	Total	LR	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	43	61	50	133	136	235	658	Collision (non-RGX)	19	26	11	0	44	11	111	Collision (non-RGX)	24	35	39	133	92	224	547
Derailment	9	4	3	279	26	30	351	Derailment	2	1	3	279	23	17	325	Derailment	7	3	0	0	3	13	26
Fire	199	18	7	57	2	11	294	Fire	199	10	7	57	0	4	277	Fire	0	8	0	0	2	7	17
Other	89	91	47	63	99	176	565	Other	76	75	39	49	68	141	448	Other	13	16	8	14	31	35	117
RGX Collision	196	151	217	99	270	225	1158	RGX Collision	1	2	2	1	0	2	8	RGX Collision	195	149	215	98	270	223	1150
Total	536	325	324	631	533	677	3026	Total	297	114	62	386	135	175	1169	Total	239	211	262	245	398	502	1857

* includes suicide attempts and trespassing injuries

Accident Causes

Equipment Failure

Accident Category	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	0	2	8	1	1	1	13
RGX Collision	2	0	0	0	1	1	4
Derailment	11	3	4	6	36	20	80
Fire	9	23	5	6	22	19	84
Other	1	7	1	8	22	20	59
Total	23	35	18	21	82	61	240

Poor Maintenance

Accident Category	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	3	7	0	0	0	6	16
RGX Collision	0	0	0	0	1	0	1
Derailment	8	13	7	11	4	12	55
Fire	3	6	6	6	5	5	31
Other	2	3	0	5	0	4	14
Total	16	29	13	22	10	27	117

Operating Rule Violation/Human Factor

Accident Category	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	6	17	45	21	66	47	202
RGX Collision	17	18	9	8	12	39	103
Derailment	16	13	16	14	17	39	115
Fire	0	2	0	0	0	1	3
Other	1	4	1	11	18	8	43
Total	40	54	71	54	113	134	466

Action of Motorist

Accident Category	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	0	0	0	27	2	35	64
Derailment	0	0	0	0	1	0	1
Other	0	0	0	1	1	6	8
RGX Collision	230	235	417	128	292	481	1783
Total	230	235	417	156	296	522	1856

Slips and Falls

Accident Category	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	9	2	7	0	2	3	23
Other	24	19	15	5	21	36	120
Total	33	21	22	5	23	39	143

Imprudent Actions

Accident Category	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	0	0	0	0	0	4	4
Other	18	21	15	18	48	20	140
RGX Collision	0	0	0	0	0	3	3
Total	18	21	15	18	48	27	147

Pedestrian

Accident Category	2003	2004	2005	2006	2007	2008	Total
Collision (non-RGX)	12	24	42	13	24	31	146
Other	2	0	0	0	13	7	22
RGX Collision	4	9	9	12	27	32	93
Total	18	33	51	25	64	70	261

Medically Related

Accident Category	2003	2004	2005	2006	2007	2008	Total
Other	7	8	5	0	5	2	27
Total	7	8	5	0	5	2	27

Suicides

Accident Category	2003	2004	2005	2006	2007	2008	Total
Other	20	26	17	34	71	51	219
Total	20	26	17	34	71	51	219

Other/Unknown

Accident Category	2003	2004	2005	2006	2007	2008	Total
Other	0	0	0	0	0	2	2
Total	0	0	0	0	0	2	2

Trespasser

Accident Category	2003	2004	2005	2006	2007	2008	Total
Other	35	34	15	16	30	57	187
Total	35	34	15	16	30	57	187