



**NTSB** National Transportation Safety Board

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*Office of Railroad, Pipeline &  
Hazardous Materials Investigations*

# Survival Factors

Crashworthiness

# Crashworthiness Issues

- Carbody telescoping.
- Minimum crashworthiness standards for transit railcars.

# Vehicle Dynamics

- Train 703
  - non-revenue
  - 6 railcars / 1000 series
  - 3.72 % grade
  - > 2,200 ft
  - estimated 36 mph

# Vehicle Dynamics

- Train 105
  - revenue
  - 6 railcars / 4000 series
  - train operator and about 70 passengers
  - stopped / servicing platform
  - train operator escaped / warned passengers

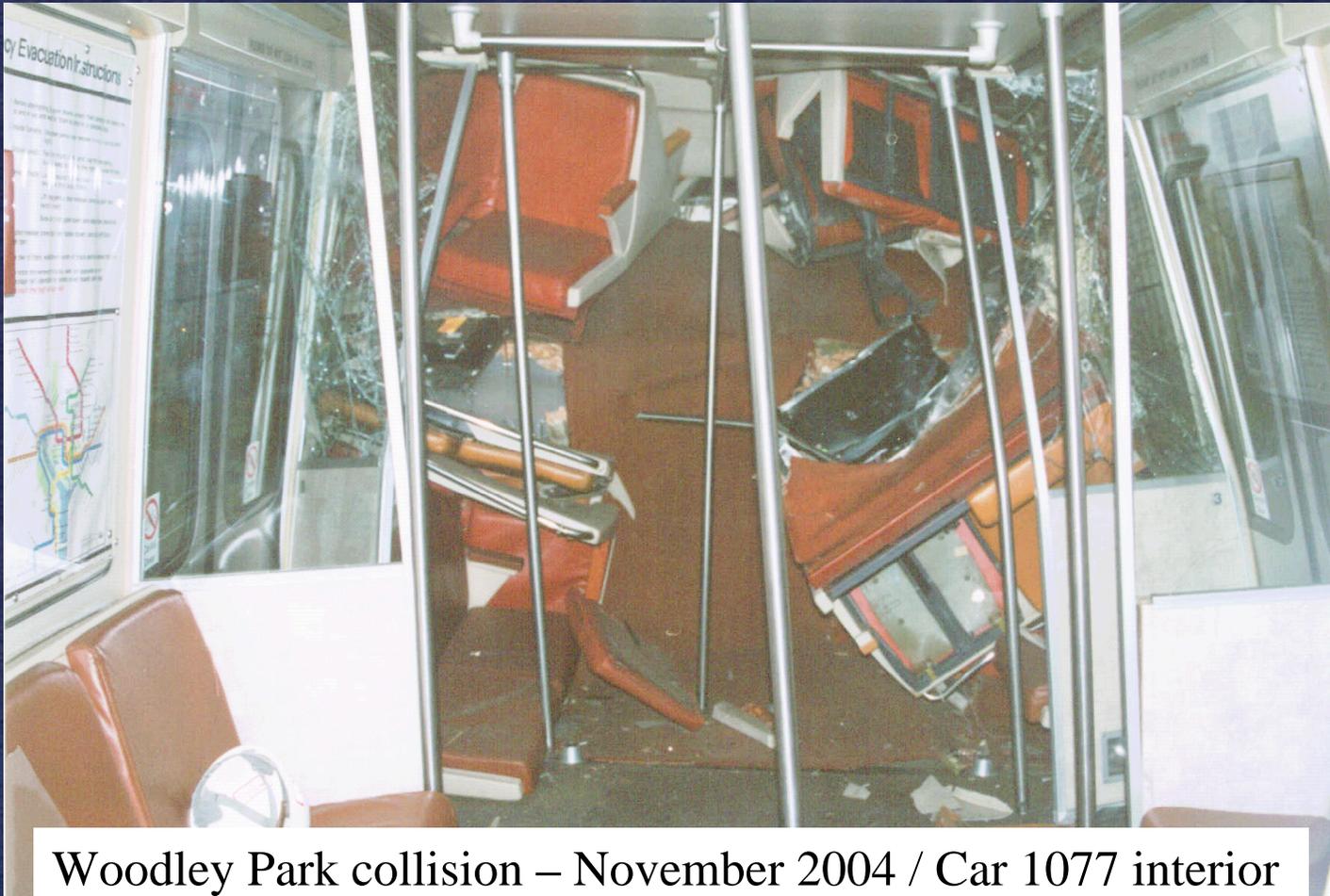
# Vehicle Dynamics

- Collision
    - Train 703 / last railcar
    - Train 105 / first railcar
  - longitudinal override about 20 ft
  - loss of about 34 linear feet of occupant survival space
- (almost half the length of passenger compartment)

# Vehicle Dynamics

- Train 703 / last railcar
  - collision posts survived essentially intact
  - carbody underframe structure adjacent to collision posts failed
- Train 105 / first railcar
  - carbody structure withstood collision

# Carbody Telescoping



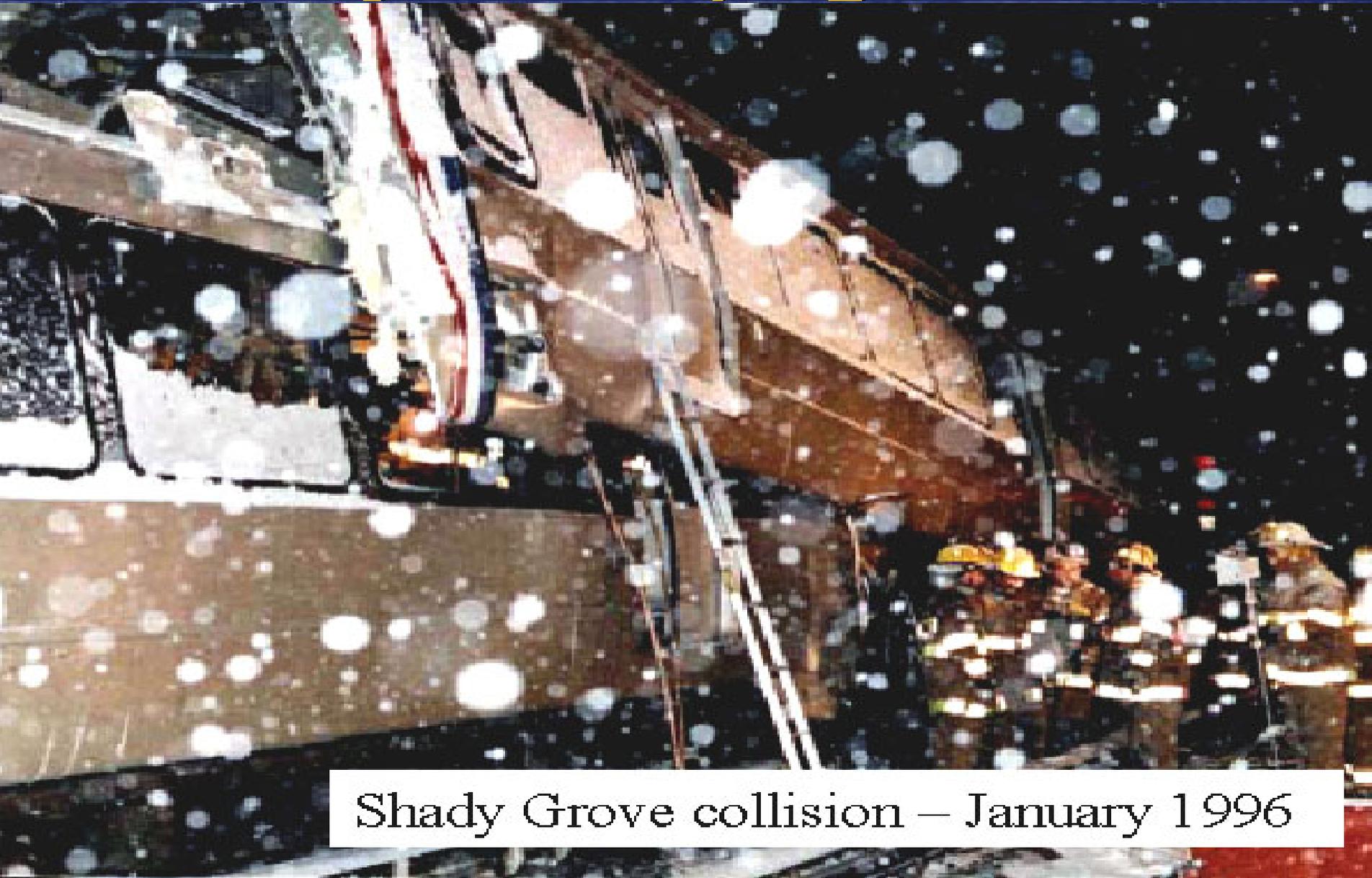
Woodley Park collision – November 2004 / Car 1077 interior

# Carbody Telescoping

Woodley Park collision – November 2004



# Carbody Telescoping



Shady Grove collision – January 1996

# Technical Specs Review

- Structural features / collision protection provisions
- Carbody design versions:
  - Rohr 1000 series
  - Breda 2000, 3000, 4000
  - CAF 5000
  - ALSTOM 6000

# Technical Specs Review

- Structural features / collision protection provisions
- Carbody design versions: resiliency:

- Rohr	1000 series	least
- Breda	2000, 3000, 4000	higher
- CAF	5000	next higher
- ALSTOM	6000	highest

# Carbody Telescoping

- Metrorail has made progress...

in the ability of a carbody end-structure to resist catastrophic telescoping.

Recommendation R-96-37:

Closed - Acceptable Action in May 2002.

# 1000 Series / Rohr Railcars

- Least relative degree of carbody end-structure resiliency
- About 31 % of fleet
- Targeted retirement in 2012

# Conclusion

- The failure of the carbody (underframe) end structure of the 1000-series Metrorail cars may make them susceptible to telescoping and potentially subject to a catastrophic compromise of the occupant survival space.

# Minimum Crashworthiness Standards for Transit Railcars

- FRA: crashworthiness standards for railroad / commuter passenger railcars.
- FTA: regulatory authority over transit operations, but no railcar crashworthiness provisions.

# Minimum Crashworthiness Standards for Transit Railcars

- Individual transit system operators:
  - prescribe own crashworthiness specifications
  - use specialized technical contractors
- No minimum structural crashworthiness standards for transit railcar equipment

# Conclusion

- The failure to have minimum crashworthiness standards for preventing telescoping of rail transit cars in collisions places an unnecessary risk on passengers and crew.



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