



NATIONAL TRANSPORTATION SAFETY BOARD
Investigative Hearing

Washington Metropolitan Area Transit Authority Metrorail train 302 that encountered heavy smoke in the tunnel between the L'Enfant Plaza Station and the Potomac River Bridge on January 12, 2015

| | |
|----------------|----------|
| GROUP | H |
| EXHIBIT | |
| 24 | |

Agency / Organization

Washington Metropolitan Area Transit Authority

Title

1983 Ventilation Studies

**May 1983 Raymond (KE) Inc. Assessment of Metrorail Ventilation System
Report No. 83-017-R-MD**

This study consisted of seven different tasks with seven different scopes. The portion of the rail system studied varies with each task.

Task 1 Review of System Documentation

Covers the completed designs for the underground system as of the time of the study. This would exclude the Mid-E line from Gallery Place to Fort Totten, the Outer B Line from Forest Glen to Glenmont, the outer E Line from Fort Totten to Greenbelt, the Largo extension from Addison Road station, New York Avenue Station, and the Dulles Extension.

Task 2 Performance Testing

Tests were conducted in selected subway portions of the Metrorail system to measure the performance of the ventilation system. The subway areas selected for testing were judged to be representative of ventilation configurations system wide. The tests were conducted to provide both an understanding of the subway air flow characteristics and data for calibration of a ventilation computer model for the Metrorail system.

The performance tests were conducted at the following locations:

- Test No. 1 - Capitol South Fan Shafts FD5 to FD6
- Test No. 2 - Benning Road Fan Shafts FG2 to FG4
- Test No. 3 - Court House Fan Shafts FK1 to FK3
- Test No. 4 - DuPont Circle Fan Shafts FA4 to FA5
- Test No. 5 - Woodley Park Fan Shaft FA6
- Test No. 6 - Rosslyn Fan Shaft FC5
- Test No. 7 - Judiciary Square Fan Shaft FB2
- Test No. 8 - DuPont Circle Fan Shaft FA1 to FA7
- Test No. 9 - Foggy Bottom Fan Shaft FC2 to FC5
- Test No. 10 - Metro Center Fan Shaft FA2 to FB2
Fan Shaft FC2 to FD2
- Test No. 11 - McPherson Square Fan Shaft FA1 to FA3
Fan Shaft FC1 to FC4

A ventilation system model was developed for the Subway Environment Simulation (SES) program. This model extended from Virginia Square to Farragut West stations and included most of the typical conditions of the system. The model also included several tunnel sections that are difficult to ventilate. The results of computer simulations using this model can be used to predict the effect of ventilation procedures at similar areas in other parts of the Metrorail system. Tests 3, 6, and 9 above were used to calibrate the model.

H-24 Ventilation Studies – Parts of the System Examined

Task 3 Operational Scenarios

Covers the operating system at the time of the study:

| | | | |
|---|----------------|----|------------------|
| A | Metro Center | To | Van Ness |
| B | Gallery Place | To | Silver Spring |
| C | McPherson | To | National Airport |
| D | McPherson | To | New Carrollton |
| G | Stadium Armory | To | Addison Road |
| K | Rosslyn | To | Ballston |

This task also covers the following segments which were under construction at the time.

| | | | |
|---|----------|----|----------------|
| A | Van Ness | To | Medical Center |
|---|----------|----|----------------|

Task 4 Information Display – Not location specific

Task 5 Reliability and Maintainability

Covers the operating system at the time of the study:

| | | | |
|---|----------------|----|------------------|
| A | Metro Center | To | Van Ness |
| B | Gallery Place | To | Silver Spring |
| C | McPherson | To | National Airport |
| D | McPherson | To | New Carrollton |
| G | Stadium Armory | To | Addison Road |
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Task 6 System Signage

The analyses and conclusions in this task were based upon a review of the signage and site conditions of the operating system and the system under construction at the time of the report. Additionally, a conscious effort was made to view the WMATA system in its entirety so that any recommendation or concepts developed would be applicable to existing underground, grade and aerial sections and future sections.

Task 7 Assessment of Level of Safety

Covers the completed designs for the underground system as of the time of the study. See Task 1.

August 1985 De Leuw, Cather Tunnel Smoke Control Study Phase 1

Sections considered in this study include portions of the B Route, from the portal north of Silver Spring Station (Sta. 480+30) to the planned portal at the Glenmont Yard (1230+60); underground portions of the E Route between Prince Georges Plaza and College Park Stations, (Sta 509+15 to 576+00); and the F Route from L'Enfant Plaza Station to Anacostia Station (Sta. 52+66 to 204+18).

August 31, 1987 Revised September 16, 1987 PBQD Metro Emergency Ventilation System – Review of Previous Studies

This is a review of previous reports. Note, this report references seven prior reports which are Items 1 through 7 on Attachment 1. WMATA does not have the reports identified in items 2 and 4 through 7 of the References to this report (Attachment 1 of this response).

April 1988 PBQD Ventilation Analysis Phase I

The overall objective of the study was to develop ventilation strategies to expand the existing ventilation system capabilities for smoke control and develop groundwork for their site testing at both a single track and double track location considered to be prototypical of the system. As such, this study lays the groundwork for modeling that would be used to analyze the existing operating system, portions of the system under construction, and portions of the system currently in design or planning. For all intents and purposes this is the entire underground system.

Specific sections examined were:

Red Line

B Route from the portal north of Silver Spring Station to the portal between Glenmont Station and the Glenmont yard

A Route from Farragut North to Gallery Place

Orange Line

C Route from Farragut West to Metro Center

D Route from Metro Center to Federal Triangle

Connection between the Red and Orange Lines

July 1991 PB/TEMA Tunnel Ventilation Project Phase II - Results of Prototype Development and Test Program

F Line At 7th and I Streets SW Fan Shaft Between L'Enfant Plaza Station and Waterfront

C Line At N.Y. Avenue Fan Shaft Between McPherson Square and Metro Center

B Line at Blueridge Avenue Fan Shaft Between Wheaton and Glenmont

H-24 Ventilation Studies – Parts of the System Examined

January 1998 De Leuw, Cather & Co. Outer B Route Tunnel Ventilation Analysis

Wheaton Station to Glenmont Station

March 10, 1998 WMATA Outer B Route CFD Simulation, Emergency Ventilation and Smoke Control Analysis

Wheaton Station to Glenmont Station

July 2006 WMATA Ballston MU Station Exiting

Ballston-MU Station

This is an exiting study, not a ventilation study.

October 6 2011 Dulles Transit Partners Tunnel Ventilation Smoke Management Report

Tysons Tunnel

H-24 Attachment 1

REFERENCES

1. Raymond Kaiser Engineers, "Assessment of Metrorail Ventilation System", Volume I and Appendix, Contract No. Y91012, Report No. 83-017-R-MD, May, 1983.
2. Raymond Kaiser Engineers, "Metrorail Ventilation System Improvements and Vehicle Fire Hardening", Contract No. X91012, December, 1983.
3. DeLeuw, Cather and Company, "Tunnel Smoke Control Study Phase 1", August, 1985.
4. Washington Metropolitan Area Transit Authority, "Report on Ventilation, Fire Protection, and Emergency Egress System on the Metrorail System", No date.
5. DeLeuw, Cather and Company, "Subway Environmental Simulation Program and Subway Environmental Design Handbook Validation through Field Testing", UMPTA-DC-06-0267-86-1 thru 4, February, 1983.
6. DeLeuw, Cather and Company, "Air Conditioning for Passenger Stations", June, 1968.
7. Boeing Aerospace Company, Engineering Technology, "WMATA Metrorail System Analysis, Volume 1", March, 1983.
8. Washington Metropolitan Area Transit Authority, "Metrorail System Maps", October, 1984.
9. NFPA 130, "Standard for Fixed Guideway Transit Systems."
10. Associated Engineers, Subway Environmental Design Handbook, Volume 1 Principles and Applications, U. S. Department of Transportation, Washington, DC, 1975.