

**J. Greg Sanchez, P.E.**

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**PROFESSION:** Mechanical Engineer

**FIELD OF EXPERTISE:** Fire Life Safety, Fire Protection, Commissioning, System Integration, HVAC, Tunnel Ventilation, Pump Systems, Chemical and Biological Dispersion, Computational Thermo and Fluid Dynamics (CFD), Fire Dynamics, Evacuation, Sound and Vibrations, Game Theory, Operations Research, Risk Analysis

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#### **EDUCATION AND PROFESSIONAL QUALIFICATIONS SUMMARY**

***MS Mechanical Engineering / Thermal Science Option***, Polytechnic University, Brooklyn, NY (MS Project: Computational Fluid Dynamics modeling of heat transfer over a backward-facing step)

***BS Mechanical Engineering / Business Minor***, Polytechnic University, Brooklyn, NY, (BS Project: Computational vibration modeling of backlash dynamic)

Strong management, leadership, networking, writing and presentation skills

Professional Engineer registered in the State of New York: License #077060

Expert user and interpreter of NFPA130 and 502

APTA Technical Ventilation Forum, **Vice Chair** 2013-2016

ASHRAE Technical Committee 5.1 Fans, **Chair** 2012-2014

ASHRAE Technical Committee 5.9 Enclosed Vehicular Facilities, **Chair** 2012-2014

ASHRAE Technical Committee 5.6 Fire and Smoke Control

AMCA 210 Technical Committee on Fan Lab Performance Testing

Past British Hydraulics Research Group, International Technical Advisory Committee Member

Past Graz University of Technology International Conference on Tunnel Safety and Ventilation Technical Committee Member

Foreign Languages: Native Spanish (speaking and writing)

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#### **KEY EXPERIENCE**

Mr. Sanchez is an internationally recognized expert in the tunnel ventilation industry with over 29 years of progressive multi-national engineering experience in developing scope of work, contract bid documents, specifications, ventilation concepts, strategies, preliminary and final engineering, performance testing of equipment (dampers, actuators, silencers, motors, fans, pumps), commissioning, and construction support for rail and road tunnel ventilation systems, stations, and other systems requiring HVAC, normal conditions and fire-life safety ventilation systems. Tasks included leading and managing engineering groups, and conducting design for infrastructure projects worldwide including: USA, UK, Hong Kong, Australia, Thailand, China, Italy, Portugal, Canada, Singapore, Argentina, Venezuela, and Dubai.

He is an expert with NFPA 130 and 502, NEMA and ASHRAE Standards. His experience includes computational fluid dynamics (CFD), fire dynamics modeling; egress; fire suppression systems use for data centers, signal relay rooms; and sprinkler systems for occupied spaces. He has co-authored many technical papers and has co-chaired technical sessions in international conferences.

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#### **PROFESSIONAL HISTORY**

1999 to date Capital Program Management, New York City Transit, New York  
**Principal Mechanical Engineer.**

Manager of the mechanical engineering group that supports NYCT's tunnel line equipment, ventilation, and fire life safety, pumps and substation programs. He directs and supervises NYCT's technical staff and consultant's, in the preparation and delivery of engineering scopes, design criteria, studies, reports, contract drawings, and contract specs and management of staffing, budgeting and scheduling to support NYCT's multi-billion dollar capital program. He has also served in the capacity of interviewer and selector of consultants for NYCT projects.

He managed design, and supported construction projects for mechanical pump systems, tunnel ventilation systems, station HVAC, ventilation for maintenance shops, and bus depots, including sound treatment of tunnel ventilation systems, seeking new technologies, approving new equipment and vendors, developing drawings, specifications, testing and accepting equipment at the factory acceptance test, commissioning and system integration for NYCT. He oversees consultants who conduct designs for pumps, tunnel and station ventilation, ventilation for the buses facilities, train maintenance shops, tunnel and station ventilation works for the multimillion dollar expansion program in NYCT including 2<sup>nd</sup> Ave Subway, 7<sup>th</sup> West Extension, Transit Center. He oversaw the multimillion dollar East Side Access in the intermediate stage. He designed the fire protection, smoke management systems and ventilation system for the new South Ferry Terminal Station and the new Cortland Street Station under the new World Trade Center, Corona Yard and East New York train maintenance shops, Bus Depots, 207<sup>th</sup> Street Shop, and communication rooms. He has established a new 5MW design train fire heat release rate for all NYCT capital projects.

1998 - 1999 Kaiser Engineers (currently AECOM and former Earth Tech), California/New York  
**Principal Ventilation Engineer**  
Managed detailed ventilation design with Platform Screen Doors of the Hong Kong Mass Transit Railway TKE Tunnel Ventilation Contract. Member of the NYCT Fire Life Safety and Risk Assessment Team.

1989 - 1998 Parsons Brinckerhoff Quade & Douglas, Inc., New York  
**Lead Mechanical/CFD Engineer**  
Managed detailed design of ventilation systems for tunnels and subway mass transit systems worldwide.

1987 - 1989 Soros Associates, New York  
**Staff Engineer**  
Responsible for computational analysis of port operations research and finite element analysis of peer structures for various worldwide projects.

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#### LIST OF KEY PROJECTS

**New York City Transit, New York:** Principal Mechanical Engineer responsible for fire protection, fire life safety, and ventilation system design for tunnels, stations, facility buildings, train maintenance shops, communication rooms, etc. Among the different aspects are:

**Smoke Managements** – designed smoke management systems for stations, tunnels, back of house space, bus depots, maintenance shops, and control rooms. It included specification of fire rating separation, smoke and fire dampers.

**Fire Dynamics and Fire Modeling** – modeled fire to predict smoke patterns for train fires in stations and tunnels, computer equipment in communication rooms, relay rooms, relay rooms, and large public spaces. Also conducted detailed fire modeling to determine the current 5MW train fire heat release rate for all station and tunnel fire emergency conditions

**Evacuation modeling** – assessed people egress from stations and occupied spaces to assessed means of egress and emergency exiting capacity requirements.

**Risk analysis** – has conducted risk analysis to assess economic impact on project means of construction.

**HVAC** – designed HVAC systems for stations, back of house spaces, revenue facilities, control rooms.

**Ventilation** – designed ventilation systems for fire emergency and comfort for stations, tunnels, yards facilities and interconnections.

**Stand pipes** – Dry stand pipe systems for stations and tunnels.

**Pump rooms** – Submersible, pneumatic pump systems for stations and tunnels.

**Metro Los Teques, Venezuela:** Designed station and tunnel fire life safety ventilation system for a 6-station metro extension.

**Kadikoy/Kartal Metro, Istanbul, Turkey:** Designed station and tunnel fire life safety ventilation system for a 25-km, 16-station metro line.

**Subterráneos de Buenos Aires (Subte), Buenos Aires, Argentina:** reviewed and advised SUBTE on means of mechanical and natural ventilation for the new system expansion to meet NFPA 130 and ASHRAE requirements.

**East Side Access, New York:** Reviewed and established the proper criteria for fire events after evaluating train materials.

**Terminal Station Caracas - Rutas Cortas, Venezuela:** Designed station air conditioning and emergency ventilation for the station, and emergency conditions for the tunnels Mayas and La Rinconada.

**Utility Tunnel Powergrid Cable Tunnel, Doha:** Designed fire-life safety ventilation system for new city utility network tunnels under very hot environment.

**Dubai Light Rail, Dubai, Red and Green Lines, United Arab Emirates:** Designed the tunnel ventilation system for the first two subway lines in Dubai (Red and Green Lines) for comfort and emergency of this single-bored, two-way train operations. The system called for preserving the tunnel and station environment using conditioned air to control the tunnel and station temperatures.

**Marina Line of LTA, Singapore:** Designed ventilation system for single shaft ventilation concept for the new Marina Line in Singapore.

**Circle Line of LTA, Singapore:** Designed ventilation system for 5 underground station and tunnels for the circle line (CCL) in Singapore.

**Powergrid Cable Tunnel, Singapore:** Designed ventilation system for the 1.9 km cable tunnel.

**Argonne National LAB, Chicago:** Ventilation specialist in charge of modeling scenarios and studying ventilation systems and responses to mitigate potential terrorist attacks for various subway systems.

**MTRC, Tseung Kwan O Extension (TKE), Hong Kong:** Designed the environmental control system to meet normal, congested, and emergency modes of operations. The system involved the use of platform screen doors, tunnel impulse fans, tunnel cooling dumpings and tunnel ventilation fans. The design included the evaluation of the pressure transients on the platform screen doors, station infiltration / exfiltration rates through the platform screen doors in the new stations and the station cooling loads in the old station as a function of the operation projections. Reviewed system safety issues related to the environmental control system design.

**New York City Transit, New York:** Member of the team that evaluated the risk associated with the different events and fire hazards in the largest mass transit system in the world, the NYCT. Reviewed system fire data to determine the probability of numerous causes to become a smoke hazard. Performed fault and event tree analyses to determine of the risk in all the under ground tunnel sections 311 in total. Part of the scope included a to perform RAM analysis for the fan plants and a cost/benefit analysis to guide NYCT to prioritize the capital projects.

**LA Metro Red Line:** Lead team to design tunnel ventilation design for normal, congested, and emergency conditions.

**Metrovias, Buenos Aires, Argentina:** assessed ventilation effectiveness of the Buenos Aires Metro.

**Miami International Airport Lower Vehicle Drive:** designed ventilation system to meet EPA's CO concentration criteria in the lower vehicle drive.

**MARTA:** assessed ventilation requirements for fire conditions under natural ventilation for a tunnel section north of the Sandy Springs Station.

**Jubilee Line Extension, London, U.K.:** responsible for the design of the tunnel ventilation system for normal, emergency and congested conditions. It also included pressure transient analysis.

**Pasadena Blue Line, Los Angeles:** responsible for fire and smoke management for the Memorial Park Station.

**New York City Transit Authority, New York:** System-Wide Ventilation Strategy Study: Responsible for 20% of the study. This included physically inspecting the stations and incorporating survey team inspection reports of the complex tunnels, existing fan plants and miles of sidewalk ventilation shafts.

**Boston Central Artery, Memorial Tunnel Fire Ventilation Test Program, West Virginia:** participated in the Phase I of the project. Performed analysis and prepared design estimates for the ventilation requirements for longitudinal, semi-transverse, and fully transverse systems during emergency conditions including 20, 50 and 100 MW tunnel fires in the Memorial Tunnel.

**Massachusetts Bay Transportation Authority, Boston:** designed emergency ventilation system for the Blue Line Subway Line.

**English Channel Tunnel Project, UK:** proof engineering for tunnel ventilation and fire/life safety..

**Metropolitan Atlanta Rapid Transit Authority, Georgia:** designed ventilation systems during emergency conditions for a 56.2- and 92.6-million British thermal unit (MBtu) per hour train fire.

**Washington Metropolitan Area Transit Authority Tunnel Ventilation Test Program Phase II, Washington, DC:** participated in the field full scale tunnel ventilation experiments to evaluate the performance of alternative ventilation systems (barriers and jet fans).

**Los Angeles Metro Rail Project, California:** responsible for the system-wide ventilation requirements during emergency conditions for the metropolitan Los Angeles subway system.

**Cumberland Gap Tunnel, Kentucky:** responsible for preliminary design of the tunnel ventilation system using semi-transverse system and jet fans

**Sydney Harbour Tunnel, Australia:** designed emergency ventilation system for this vehicular tunnel.

**Roc Harbour Housing Project, New Jersey:** responsible for air quality analysis using CALINE 3 and MOBILE 3 air dispersion and vehicle emissions computer programs in order to determine CO concentrations at the project site for the "build" and "no-build" alternatives.

**Oil Terminal, Saudi Arabia:** conducted computerized operations research analysis for an 80-million-ton-per-year oil terminal. The study consisted of a traffic analysis for the port, evaluation of the farm storage, berth utilization, and service time for various fleet compositions.

**Bulk Terminal, Canada:** performed operations research analysis for this Canadian facility. An evaluation of berth capacity, farm storage and review of several schemes. Work force requirements for the best performance of the port were also studied.

**Sines Multipurpose Terminal, Portugal:** conducted operations research analysis. The project's task was to review the material handling system, thereby providing information regarding the storage capacity, train-vessel time in port, and machine utilization.

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PAPERS/PUBLICATIONS AND PRESENTATIONS

- “Non-Stoichiometric Fire Modeling Predictions with Applications to Train Fires in Tunnels”**, International Congress on Fire Computer Modeling, University of Cantabria, Santander, Spain, October 2012.
- “NYCT R-142 Train Design Fire Scenario Characteristics”**, ASHRAE Winter meeting, Chicago, IL January 2012.
- “Establishing the Train Fire Heat Release Rate for the New York City Transit R-142 Trains”**, BRH Group 14<sup>th</sup> International Symposium on Aerodynamics and Ventilation of Tunnels, Dundee, Scotland, May 2011.
- “Assessing the Impact Fire Heat Release Rate has on Infrastructure Design and Constructability of Rail and Road Tunnel Ventilations Systems”**, ASHRAE Winter meeting, Las Vegas, NV, February 2011.
- “Thermal Radiation in Enclosed Glazed Public Pavilions and its impact in the Design”**, ASHRAE Summer Annual Meeting, Albuquerque, NM, June 2010.
- “Fundamentals for the Development and Application of a Design Train Fire Scenario”**, 13<sup>th</sup> International Symposium on the Aerodynamics and Ventilation of Vehicular Tunnels, BHRG, New Brunswick, NJ, May 2009.
- “Emergency Ventilation Fan Performance Characteristics – from Theoretical to Shop Test, and Installation”**, APTA Rail Conference, San Francisco, CA, June 2008.
- “Predicting Fire Growth and Smoke Conditions in Tunnels and Metros – An Advanced Fire Model”**, 4<sup>th</sup> International Conference in Tunnel Safety and Ventilation, Graz, Austria, April 2008.
- “Assessment of Fire Heat Release Rate for Train Fires”**, ASHRAE Transactions NY-08-023, Volume 114, Part1, presented at winter annual ASHRAE meeting, New York, NY, January 2008.
- “Integrating Station Smoke and Fire Analysis with Station Evacuation to Assess Egress Conditions in Stations”**, APTA Rail Conference, Toronto, Canada, June 2007.
- “Predicting Flashover and Tenability Conditions in Train Fires – A CFD Approach”**, ASHRAE Transactions CH-06-3-4, Volume 112, Part1, presented at winter annual ASHRAE meeting, Chicago, IL, January 2006.
- “Emergency Conditions Requirements for Modern Air-Conditioned Stations in the New York City Subway”**, presented at the 5<sup>th</sup> International Safety Conference in Rail and Road Tunnels, Tunnel Management International, Marseille, France, October 2003.
- “Optimization of Station Air-Conditioning Systems for Mass Transit Systems”**, BHR Group International Conference, Luzerne, Switzerland, July 2003.
- “Evaluation of Alternative Tunnel Ventilation Shaft Configurations for Mass Transit Systems – Single Mid-Tunnel, Dual Station-End, and Single Station-End”**, co-authored with YY Kwok, Rapid Transit Conference, Singapore, April 2003.
- “Rules of Thumb for Emergency Tunnel Ventilation Systems”**, co-authored with YY Kwok, Second International Conference, Long Road and Rail Tunnels, Tunnel Management International, Hong Kong, May 2002.
- “Dispersion Modeling of Pollutants in Long Tunnels”**, co-authored with YY Kwok, Second International Conference, Long Road and Rail Tunnels, Tunnel Management International, Hong Kong, May 2002.
- “Computer Modeling Techniques and Analysis Used in Design of Tunnel Ventilation Fan Plants for the New York City Subway”**, co-authored with Don Willemann, IEEE/ASME Joint Rail Conference, Washington, DC, April 2002.
- “Upgrading the Emergency Ventilation Capabilities at the New York City Transit Authority to Improve Safety”**, co-authored with Robert W. Montfort, Tunnel Management International magazine, November 2001.
- “A Holistic Approach to Controlling Backlayering During a Tunnel Fire”**, to be included in the Proceedings of the Third International Conference on Tunnel Fires, Gaithersburg, Maryland, 9-11 October 2001.
- “Development of Tunnel Ventilation Systems Based on and to Support a Fire Risk Assessment Analysis”**, co-authored with Leo Lee, to be included in the Proceedings of the Third International Conference on Tunnel Fires, Gaithersburg, Maryland, 9-11 October 2001.
- “Diffusion of Fumes into Ambient from Ventilation Gratings”**, ASHRAE Summer Meeting, Cincinnati, Ohio, 23-27 June 2001.
- “(U) Biological Threat in Subways: Importance of Background Biomass”**, co-authored with A.L. Birenzvice, L.R. Cole, S. Filer, and A.J. Policastro, 69<sup>th</sup> Military Operations Research Society Symposium, U.S. Naval Academy, Annapolis, Maryland, 12-14 June 2001, classified paper.
- “Emergency Ventilation Issues at New York City Transit”**, co-authored with Robert W. Montfort, APTA Rail Transit Conference, Boston, Massachusetts, 10-14 June 2001.

***“Upgrading the Emergency Ventilation Capabilities at the New York City Transit Authority to Improve Safety”***, co-authored with Robert W. Montfort, Proceedings of the Fourth International Conference on Safety in Road and Rail Tunnels, Madrid, Spain, 2-6 April 2001.

***“Managing Chemical/Biological Releases in the Subway Environment,”*** co-authored with Larry R. Coke and Anthony J. Policastro, Tunnel Management International magazine, April 2001.

***“A Model for the Dispersion of Contaminants in the Subway”***, co-authored with L.R. Coke, and A.J. Policastro, Proceedings of the 10<sup>th</sup> International Symposium on Aerodynamics and Ventilation of Vehicle Tunnels, Boston, USA, 1-3 November 2000.

***“Comparison of Strategies in Managing Chemical/Biological Releases in the Subway Environment”***, co-authored with L.R. Coke, F.L. Wasmer, and A.J. Policastro, Proceedings of the ITC Third International Conference on Tunnel Management 2000, Sydney, Australia, 4-6 October 2000.

***“Aerodynamic Characteristics for the Design of Platform Screen Doors,”*** co-authored with Leo Lee, British Hydraulics Research Group Aerodynamics and Ventilation of Vehicular Tunnels Conference, Boston, MA, November 2000.

***“Alternative Means for Smoke Control of Mass Transit Railway Tunnel,”*** co-authored with Leo Lee, ITC First International Conference, Tunnel and Underground Station fires, Hong Kong, China, 3-4 May 2000.

***“Design and Implementation Considerations for Emergency Ventilation Fan Plants,”*** co-authored with Leo Lee, ITC First International Conference, Tunnel and Underground Station fires, Hong Kong, China, 3-4 May 2000.

***“Seminar on Reliability Engineering Concepts in Today’s Mass Transit Systems with Emergency Fan Dampers Applications,”*** Seminar on Emergency Fan Dampers sponsored by the ASHRAE TC 5.9 committee, ASHARE 2000 Winter Annual Meeting, Dallas, Texas, February 2000.

***“Seminar on CFD Modeling Benchmark for Mass Transit Systems,”*** Seminar on CFD sponsored by the ASHRAE TC 5.9 committee, ASHARE 2000 Winter Annual Meeting, Dallas, Texas, February 2000.

***“Underground Railway Air Quality and its Impact on Energy Consumption,”*** co-author with Leo Lee, Proceedings of the Symposium on Energy Engineering in the 21st Century, Hong Kong, China, 9-12 January 2000.

***“Railway Tunnel Air Quality Control and its Impact on Energy Consumption,”*** co-author with Leo Lee, Proceedings of the 3rd Asia Tunneling Summit, Hong Kong, China, 2-3 November 1999.

***“Modeling Chemical/Biological Dispersion in Subways”***, co-author with Policastro, A.J., Coke, L.R., Brown, D., Dunn, W., Presented at DOE Chemical/Biological Nonproliferation Program, Annual Meeting, Los Alamos National Laboratory, 22 July 1999.

***“Alternatives to Control Tunnel Temperatures in Hong Kong,”*** co-author with Leo Lee, Proceedings of the ITC International Conference on Tunnel Control and Instrumentation, Hong Kong, China, 8-9 February 1999.

***“CFD Modeling Techniques for Large Structures and Facilities,”*** co-editor of Proceedings of the Fluids Engineering Division, ASME FED Summer Annual Meeting 1996, Vol. 3, FED-Vol. 238, July 1996.

***“Using CFD for Ventilation Shaft Design for Fire Conditions,”*** Proceedings of the Technical Symposium on Computer Applications in Fire Protection Engineering, Worcester Polytechnic University, Worcester, MA, 20-21 June 1996.

***“Derivation and Application of the SES Critical Velocity Equations,”*** co-author with W.D. Kennedy and J.A. Gonzalez, ASHRAE Transactions: Research, paper 3983, pp. 40-44, 1996.

***“Application of a Two-Region Zonal Approach to Computations of Turbulent Convective Heat transfer,”*** co-author with D. Choudhury, Proceedings of the 1995 ASME International Congress in San Francisco, CA, Nov. 1995.

***“Solution to a Laminar Natural Convection Problem in a Squared Cavity with Temperature Dependent Viscosity,”*** Proceedings of the 1995 ASME International Congress in San Francisco, CA, Nov. 1995.

***“Application of an Unstructured Solution Adaptive CFD Solver to Fluid Flow and Heat Transfer Problems,”*** co-author with D. Choudhury and G. Spragle, Proceedings of the 1995 ASME NHTC in Portland, OR, August 1995.

***“Mixed Convection Heat Transfer Over a Backward Facing Step,”*** co-author with G.C. Vradis, Proceedings of the 1993 ASME Winter Annual Meeting, Benchmark Problems for Heat Transfer Codes, New Orleans, LA, December 1993.

***“Safety Issues in the Design of Inflatable Barriers for the Control of Smoke in the Washington Subway,”*** Co-author with W.D. Kennedy and M.L. Bayne, Proceedings of the 1st International Conference on the Safety in Roads and Rail Tunnels, Basel, Switzerland, November 1992.

***“Heat Transfer Over a Backward Facing Step: Solution to a Benchmark Problem,”*** co-author with G.C. Vradis and M.V. Otugen, Proceedings of the ASME Winter Annual Meeting, Benchmark Problems for Heat Transfer Codes, Anaheim, CA, December 1992.

***“The Use of Inflatable Barriers and Jet Fans for the Control of Smoke in the Washington Subway,”*** co-author with W.D. Kennedy and M.L. Bayne, Proceedings of the 7th International Symposium on Aerodynamics and Ventilation of Vehicle Tunnels.

***“A Study of Backlash Dynamics,”*** co-author with W. Blesser, Proceedings of the ASME Winter Annual Meeting, Boston, MA, December 1987.

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**REFERENCES** To be furnished upon request