areas of expertise

mechanical design
tunnel fixed & temporary ventilation
tunnel systems
road & rail vehicle emissions
smoke control
fire suppression
mechanical & natural ventilation
code compliance
hazardous goods drainage
noise
human comfort studies
tunnel drainage

electrical design
lighting (specializing in road tunnels)
high voltage power distribution
emergency power supplies
electromagnetic coupling
SCADA design
electrical inspections
whole life costs
communications & control
signage

flow simulation
computational fluid dynamics
aerodynamics analysis
thermodynamic analysis
wind engineering
assessment of gust effects
fire modeling
heat release rate assessment
smoke movement studies
chemical, biological & radiological releases
pollutant dispersion & environmental flows
natural ventilation design
ventilation inlet/outlet positioning

response management
emergency response procedures
egress modeling
emergency services liaison
fire fighting
operator training
security & operational optimization
threat and vulnerability analysis

pedestrian movement
pedestrian flow analysis
queue time, ingress & egress analysis
evacuation analysis
development of safety & evacuation plans
facilities optimization

code compliance
code assessment
code development
prescriptive & performance based design
ADA compliance
national & international standards

Cover: Vermont/Beverly Station, Lower Platform Area, Los Angeles, CA.
Hatch Mott MacDonald

Hatch Mott MacDonald is a leading North American consulting engineering firm with worldwide experience and a lineage stretching back over a century. Proud of our role in major ventures across North America, we provide comprehensive engineering services in the areas of air, rail, transit, water, wastewater, environmental, and utility markets.

Life-Safety and Security has been a key element of Hatch Mott MacDonald’s work since our founder’s involvement in the development of London’s underground road and rail system more than 100 years ago. Our commitment to safety in design continues today, and has led us to develop and apply the most advanced analytical tools to assess risk and formulate innovative approaches to design.

The design of safer transit environments has led us to explore both ventilation and operation at a highly advanced level. HMM has developed and validated three-dimensional simulation tools for smoke, chemical, and biological pollutant dispersion, as well as complementary visualization tools which enable clear understanding of design concepts, and options for both normal and emergency operation.

Response management and emergency planning are enhanced by HMM’s use of pedestrian-movement and evacuation analyses. In addition to our design work, we have developed one of the world’s leading pedestrian-modeling programs, STEPS (Simulation of Transient Evacuation and Pedestrian movementS). Integrated with smoke models, STEPS provides one of the most complete solutions to testing and verifying operational procedures and emergency response training.
At the forefront of transit environment system design, Hatch Mott MacDonald’s cutting-edge skills successfully address the various issues associated with the design of systems for today’s modern rail and road networks. Our international reputation is built upon extensive experience, both in the design of new systems, and in the refurbishment and regeneration of existing systems.

Recent incidents in European tunnels, namely the 1999 Mont Blanc Tunnel fire and the 1996 Channel Tunnel fire, cast a critical eye on the safety of underground structures. In addition, the attacks of September 11, 2001 added an even deeper element of concern. Remaining at the forefront of tunnel ventilation, operation, and control, HMM maintains a serious and active interest in these issues worldwide, and continuously participates in and monitors advances in technology and methodology.

We have an established reputation in environmentally-sensitive design to minimize adverse effects inside the tunnel and within the tunnel vicinity, including noise attenuation measures and integration of ventilation facilities with architectural features. This includes designing and implementing facilities for the safe collection and disposal of hazardous spills, analyzing levels of carbon monoxide and other pollutants in the tunnel environment, designing ventilation systems to maintain high air quality, undertaking simulations of exhaust emissions dispersion from tunnel portals, and finally, designing measures to alter the dispersion pattern.

HMM actively contributes to improving the state-of-the-art in transit environment systems. The firm serves on the World Road Association (PIARC) committees and working groups on tunnel ventilation and smoke control.
ventilation and fire life-safety
Our design group is experienced in all aspects of ventilation design, from concept design to procurement, system delivery, and commissioning. The group has a strong background in analytical problem solving, as well as the skills to develop constructible, safe, and cost-effective designs. We also have an in-depth understanding of the needs of the end-user, and welcome the opportunity to better equip the facility operator or the emergency responder to do his or her job.

electrical
Hatch Mott MacDonald offers electrical design services for new and existing railroad, metro, automated people mover, and road tunnel installations. Our engineers have design experience in electrical services including power supplies, high and low voltage design, switch gear, uninterruptible power supplies, stand-by generators, and grounding and electromagnetic compatibility designs.

lighting
Hatch Mott MacDonald also offers lighting design services for normal operation, emergency operation, and way-finding situations. We have specialist experience in road tunnel lighting design services in accordance with the Illuminating Engineering Society of North America (IESNA) RP-22-05, utilizing in-house dedicated lighting design software. In addition, HMM’s engineers have extensive experience in the inspection and refurbishment of existing lighting installations.

communications and controls
Our staff has comprehensive experience in the design of communications and control systems to ensure the mechanical and electrical (M&E) systems operate in a cohesive and integrated manner. Such systems design include Supervisory Control and Data Acquisition (SCADA), traffic management, Closed-Circuit Television (CCTV), radio communications, emergency telephone systems, access control, and Operational Safety Procedures.
Hatch Mott MacDonald’s Computational Fluid Dynamics (CFD) group develops and applies 3D simulation models to predict flow behavior. By understanding the underlying dynamics of flow situations, HMM is able to develop better designs, study the influence of design options, and assess risk and cost-benefits of particular systems or actions with fewer uncertainties or assumptions.

Because of their fundamental nature, CFD methods are used when standard correlations or design methods are inadequate, or when operating conditions are beyond those for which experimental data exist. Using CFD methods allows these interactions to be considered in addition to the engineering details.
Hatch Mott MacDonald's comprehensive experience with CFD began with the development and application of the first general-purpose CFD codes in the early 1980s, including 3D models for smoke movement analysis. Our commitment to quality and reliability in CFD application has led us to undertake many validation studies and contribute to international programs on verification.

We remain actively involved in the most advanced applications of CFD for engineering analysis, validation, and visualization through computer animation and virtual reality. Developed in-house, powerful interactive visualization techniques are used in conjunction with more traditional methods to gain deeper physical insights from the CFD simulations.

The successful application of CFD requires specialist expertise in building accurate geometric models and appropriately representing the physics of the problem. Hatch Mott MacDonald's specialists have applied its simulation expertise to buildings and transit systems worldwide.
Hatch Mott MacDonald’s capabilities in tunneling and tunnel ventilation are complementary. HMM uses one-dimensional aerodynamic and thermodynamic programs for the design of road tunnel and metro system ventilation plants. Coordination of tunnel design and tunnel ventilation results in a cost-effective overall design which optimizes safety and system performance. Our international reputation in tunnel ventilation is based not only on the refurbishment and regeneration of existing tunnels but also on new projects.

Hatch Mott MacDonald has maintained a leading position in the use of computer simulation for the design of ventilation systems, developing and utilizing state-of-the-art software tools. As the capability of simulating more complex systems increases, we have created innovative visualization techniques to assist in the understanding of the model geometry, its boundary conditions, and the resulting parameters, which ultimately reveal the design behavior.
To complement our ventilation design skills, Hatch Mott MacDonald has developed the STEPS program (Simulation of Transient Evacuation and Pedestrian movementS) to simulate the movement of people under both normal and emergency conditions. Office blocks, sports stadiums, shopping malls, and underground stations are all examples of areas where there is a need to ensure uncomplicated transitions in normal operation and rapid evacuation in the event of an emergency. Optimization of people flow through simulation can provide a more agreeable environment and more effective fire safety design in large and crowded places.

Human behavior is simulated through the representation of complex characteristics from travel speed and destination to the amount of system familiarity and level of patience. A key feature of STEPS is its ability to predict evacuation, and such models can accommodate a “shut-down” of evacuation routes due to smoke contamination, the effects of emergency services moving against the evacuation flow, and initiation of evacuation at different times from different areas of the environment.

In addition to providing a very clear and informative visualization of the people movements in both normal and emergency conditions, STEPS provides flow rates, level of service data, and paths of selected people, as input to virtual reality models.

Left: Pedestrian Movement Analysis, Penn Station, New York, NY.
how Hatch Mott MacDonald makes the difference

Hatch Mott MacDonald is committed to achieving design solutions with the highest levels of safety and security. We adopt a systems-approach, considering the entirety of passive and active technical equipment, operator response, and human behavior in our quest for quality in safety design and management. We explore the limits of our designs through the most advanced simulation modeling techniques. We capture the knowledge gained from our work through computer animation and Virtual Reality – ensuring understanding by specialist and non-specialist alike, and preserving the designer’s intention for future system users. This is how Hatch Mott MacDonald makes the difference.
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<tr>
<th>State</th>
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<th>Phone Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>Phoenix</td>
<td>130 North 48th St (Suite 220) Phoenix, AZ 85004</td>
<td>480.463.2106 / 480.275.4560</td>
</tr>
<tr>
<td>California</td>
<td>Los Angeles</td>
<td>16222 Ventura Blvd (Suite 901) Los Angeles, CA 90067</td>
<td>310.865.0000 / 310.865.7169</td>
</tr>
<tr>
<td>Florida</td>
<td>Sunrise</td>
<td>2100 South Westlake St Sunrise, FL 33326</td>
<td>954.379.4999 / 954.807.9066</td>
</tr>
<tr>
<td>New York</td>
<td>Suffolk</td>
<td>670 Main St (Suite 700) New York, NY 11701</td>
<td>516.393.2313 / 516.393.2312</td>
</tr>
<tr>
<td>Ohio</td>
<td>Cleveland</td>
<td>3001 E 12th Street (Suite 300) Cleveland, OH 44103</td>
<td>216.276.3015 / 216.276.3016</td>
</tr>
<tr>
<td>Oregon</td>
<td>Portland</td>
<td>408 NW 7th Ave (Suite 100) Portland, OR 97209</td>
<td>503.224.3700 / 503.224.3702</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>Pittsburgh</td>
<td>Gateway Vue Place 4000 W Carson St Pittsburgh, PA 15235</td>
<td>412.497.2000 / 412.497.2000</td>
</tr>
<tr>
<td>Texas</td>
<td>Houston</td>
<td>2000 Cullen Parkway (Suite 201) Houston, TX 77006</td>
<td>713.759.0300 / 713.759.0303</td>
</tr>
<tr>
<td>Utah</td>
<td>Provo</td>
<td>1909 South Minuteman Dr (Suite 200) Provo, UT 84602</td>
<td>801.375.8702 / 801.375.8700</td>
</tr>
<tr>
<td>Virginia</td>
<td>Dulles</td>
<td>2500 Baldwin Circle (Suite 200) Dulles, VA 22107</td>
<td>703.894.3000 / 703.894.3000</td>
</tr>
<tr>
<td>Washington</td>
<td>Seattle</td>
<td>345 Madison St (Suite 100) Seattle, WA 98134</td>
<td>206.296.2299 / 206.296.2299</td>
</tr>
<tr>
<td>West Virginia</td>
<td>Morgantown</td>
<td>2501 Cranberry Square Morgantown, WV 26508</td>
<td>304.252.4000 / 304.252.4000</td>
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