Terrain Expertise and the New Urban Environment: U.S. Army Engineers and the Modern City

By Colonel Robert G. Dixon

Army engineers have historically claimed the title of terrain experts, with expertise in civil and mechanical engineering matters translating to distinct advantages for commanders. Providing on-the-spot expertise regarding fortifications, lines of communication, obstacle integration and reduction, and the effects that terrain in various atmospheric conditions have on operations made engineers an invaluable asset for maneuver commanders. The changing nature of the operational environment, however, challenges the ability of the Corps of Engineers to provide this expertise. Global urbanization practically guarantees that U.S. land forces will be conducting operations in large, urban areas—an environment where the Army in general and the Corps of Engineers specifically are largely unprepared to operate. Further, the lack of training, doctrine, and equipment for urban operations in huge, modern cities will certainly leave engineer leaders on the ground with little hope of providing maneuver commanders with the expertise or engineering advantages they have come to expect.

Current Army doctrine for urban operations spells out many of the expectations for engineers. Some are highly technical, such as—

- Analyzing buildings and other infrastructure for structural integrity.
- Evaluating, assessing, and restoring utilities.
- Advising civilian construction about civil survivability shelter.
- Providing specialized breaching and reconnaissance capability.

U.S. Army National Guard photo by Captain William Carraway

Combat engineers from the 810th Engineer Company, Georgia Army National Guard, inspect a simulated collapsed building site.

- Understanding and assessing the construction capabilities of nongovernmental organizations and other unified action partners.

Other expectations are more practical, such as—

- Clearing obstacles.
- Providing mobility support for mounted and dismounted maneuver.
- Reinforcing existing infrastructure, such as bridges or rooftops, that may be required by the maneuver force.
- Providing countermobility, survivability, and general engineering support to friendly and civilian populations.
- Supporting civilian evacuation planning and execution.
- Constructing lines of communication.
- Maintaining or restoring infrastructure such as roads and highways, over-the-shore facilities, ports, railroads, airports and heliports, fixed bridges, electric power facilities, petroleum pipelines and storage facilities, and water facilities.
- Serving as the primary interface with indigenous engineers, public works employees, fire departments, and city managers.

The wide variety of expectations outlined in Army urban doctrine suggests that the development of Army engineer leaders requires at least some knowledge of how modern cities operate. A robust understanding of modern sanitation, power, communications, subterranean navigation, the science of buildings, and vertical logistics is essential. This kind of expertise takes time and focus to develop. Yet engineer doctrine and development are not currently focused on the environment; instead they are focused almost exclusively on the activities of friendly forces, such as the construction of base camps and roads for construction units, counter improvised explosive device operations, and mobility support. Aside from forward engineer support teams–main, which have fewer than 40 Soldiers and civilians, and forward engineer support teams–advance, with fewer than 10 personnel, there are few engineers developing expertise in modern city science with the intent of developing terrain expertise.

The challenges and opportunities of the modern city require intense study. Exploiting the engineering and scientific aspects of modern cities can improve the effects that combat engineers can provide for maneuver commanders. For example, tactical, cyber-enabled engineers can control airflow in skyscrapers or change traffic patterns for surface or subsurface transportation. Engineers with knowledge of modern port and rail systems can enable or improve the flow of forces and sustainment without the lag time often seen when awaiting indigenous worker capabilities. An engineer with knowledge of the natural gas or steam networks of a city can help a maneuver commander avoid costly damage to these systems, which will be critical in postconflict operations. Engineers helping a staff understand zoning and street patterns in urban areas will help commanders and staff gain insights into the cultural and social fabric that exists in the city. Engineers with a robust understanding of modern building science can help commanders identify weaknesses in target buildings, advise aviators on urban aerodynamics and building sway, and help identify the resistance of modern antiearthquake and blast protection materials to weapons. Current doctrine, for example, suggests that engineers can create "mouse hole" breaches in building walls or ceilings to enable dismounted mobility—horizontally between rooms or buildings or vertically between floors. In many modern cities, however, construction materials resist the explosive and cutting tools normally used (much to the frustration of urban search-and-rescue units).

Educating Army engineers in these areas won't happen overnight. Urban engineering is a specialty that requires significant investment, and there are already robust learning requirements levied on Army engineers. The Army relies on four basic arenas for developing leaders: professional military education; civilian education; individual development; and experiential learning on the job, which includes broadening assignments.

Photo by Sergeant Terence Ewings

Engineers from the 178th Engineer Company apply wooden bracing and linked chains to a pillar supporting a collapsed parking garage during a field training exercise.

Photo by Staff Sergeant Steven C. Eaton

Soldiers dump snow cleared from a narrow Massachusetts road.

The strategy for educating engineer leaders on modern urban environments necessarily starts at the U.S. Army Engineer School and with civilian education. The Corps of Engineers has taken a great step forward by increasing requirements for science, technology, engineering, and mathematics (STEM) education for many key leadership positions. This educational background will help set the foundation for advanced learning on the urban environment. However, professional military education concentrates very little on the modern urban environment, instead focusing much of the training and education for junior leaders on traditional engineer roles in offense, defense, and stability operations. With limited time and resources, it is unlikely that the Engineer School can provide more than basic knowledge in these areas. Additional learning requirements for the modern urban environment means that something in the current curriculum must be removed. While reviewing and eliminating outdated or unnecessary portions of the professional military education curriculum is always beneficial, it is doubtful that anything close to urban expertise can be developed in the classroom, regardless of how much time is dedicated to it.

Individual development and broadening assignments have the most potential for expanding engineer leader expertise in the modern urban environment. Individuals can enroll in online education (often free of cost) that will help them understand the challenges of modern urban operations. For example, the Massachusetts Institute of Technology offers free online graduate and undergraduate courses on topics such as disaster relief in megacities, food security, freshwater distribution, and the differences between First World and Third World cities. Other schools and the relevant topics available include The Ohio State University, which offers classes in exploiting networks, sensors, and mobile technologies; and Harvard University, which offers studies in urban water supplies, future cities, the next generation of infrastructure, metrics for "smart" cities, and social physics, among others. Engineer leaders should invest the time to learn about changes in the environment and require those they mentor to do so as well. This is something that can be implemented immediately at no cost to the Army.

Finally, the Corps of Engineers should assign leaders to positions in which they can learn about the modern urban environment through personal experience. Engineers assigned to work in public works or emergency response offices in major cities in the United States and abroad would garner a level of knowledge equivalent to a Training With Industry assignment that no current assignment provides. Working alongside emergency response professionals and city planners and engineers would expose Army engineer leaders to the systems that keep modern cities operating and the challenges of keeping those systems operational. Engineers serving in overseas cities would develop relationships that would be beneficial if the Army were called to conduct operations there. If coordinated with the Army's regionally aligned forces, engineers with city-specific knowledge and relationships could be an invaluable asset to maneuver commanders operating in and around those cities.

The Corps of Engineers has provided terrain experts to the Army since its inception. During that time, the terrain and infrastructure faced by the Army have changed and the Corps of Engineers has changed with them. But the world is becoming increasingly urban, and the urban environment is becoming increasingly sophisticated. If the Corps of Engineers is to retain the title of terrain expert, we must update our doctrine and equipment for urban operations and invest in the development of engineer leaders who have expertise in the modern urban environment.

For more information on the Army and large urban areas, see *Megacities and the United States Army: Preparing for a Complex and Uncertain Future* at <http://usarmy.vo.llnwd.net/e2/c /downloads/351235.pdf>.

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