

Seeing the way to enhanced productivity and safety

Leveraging technology in the construction industry

Lean manufacturing principles are a significant reason for consistent productivity gains in the manufacturing sector, and today many contractors are using new technologies to follow suit. But for much of the construction industry, additional opportunities to look closer and see leaner opportunities are within easy reach.

Over the last 20 years, labor-productivity growth in the construction sector has averaged only 1% per year compared with growth of 3.6% per year in the manufacturing sector. Technology that promotes lean principles can help close that gap. Contractors need to be aware that some of the technology is new and untested. Simple video-based technologies, however, are plentiful and affordable.

We offer here a quick guide on where and how contractors can see their way to greater productivity and safety and reduced waste.

Where the problems are

These productivity sore points will be all too familiar to most in our industry.

Unused employee creativity
failing to engage or listen to employees

Accidents
harmful waste to employees, property and the public

Unnecessary movement
of workers and equipment

Unnecessary transport
75% of construction operational costs are directly tied to material/equipment movement and handling

Waiting
workers and equipment are idle

Congestion
excessive effort or slowed activity due to overcrowded and congested work areas

Defects and rework
not understanding customer needs or taking shortcuts to save time

Ineffective/insufficient processing
workers who take unneeded or inefficient steps to complete their work



First key to solving these problems

To address many of the productivity sore points on this list, the best contractors have a process to identify and manage the contributing factors that reduce productivity and safety, and increase waste. For example, the people at Toyota have a phrase for this process, *genchi genbutsu*, which emphasizes going to the actual place to observe and understand. Toyota also uses a learning exercise called “standing in the circle,” in which young engineers are asked to stand in one place to observe work for six to eight hours. Experts say that this approach produces significantly better insights into labor productivity waste, unsafe work methods and quality issues than the more common practice of instantaneous evaluations of a work area – with possibly a quick photo of the surface issue. In the manufacturing sector, the core engineering process of analyzing and observing work methods has helped contribute to a 3.6% annual labor productivity increase over the last 20 years.

But who has six to eight hours to stand in a circle and observe? Here’s an obvious area where technology can step in.

In manufacturing environments, videotaping complex work methods and tasks is commonplace. In fact, it’s one of the leading ways to analyze labor work methods, material flow, equipment utilization, debris removal and other areas where non-productive effort can be spent. Industrial engineers, whose primary work is to study and improve productivity, quality and safety use video extensively.

Right now the most frequent use of digital photography on construction projects is for site security. We suggest looking for other ways to put this technology to work on your projects.

Smaller, faster, better

Digital photography has come a long way over the past 10 years. With the advent of action camera photography, cameras are smaller, lighter and faster, offering higher resolution, time-lapse capabilities, and higher frame rates to improve slow motion analysis. Cameras are more durable and weatherproof and have more automatic and remote operation features. And thanks to drone technology, they can fly. Best of all, their cost has plummeted making this technology easily affordable.



Here are some examples of how digital photography can help you increase productivity and safety on your projects.

Examples using Digital Photography on Construction Projects

Superintendents with hard-hat video mounts can record their end-of-day project walk.



These clips (with audio) can be reviewed with team members the next day to visualize and discuss issues.



Drones can be used to periodically analyze public and worker traffic flow to/from the project entrance.



By studying worker movement patterns, superintendents can improve access to the project entrance, eliminate “goat paths” that workers create, and reduce the potential for trip-and-fall accidents.



Here are some other ways to use video technology to reduce labor and material waste and improve worker safety.

Project material delivery points

Material delivery to the project is a prime area for waste. Real-time or time-lapse video can help you see it. When materials come in, we often rush to get the delivery unloaded and end up moving items several times before they get to the area where they will be used. Once spotted, these inefficiencies are often simple to correct. Methods for rigging and placing materials can also be studied to reduce productivity waste and accidents.

Material movement

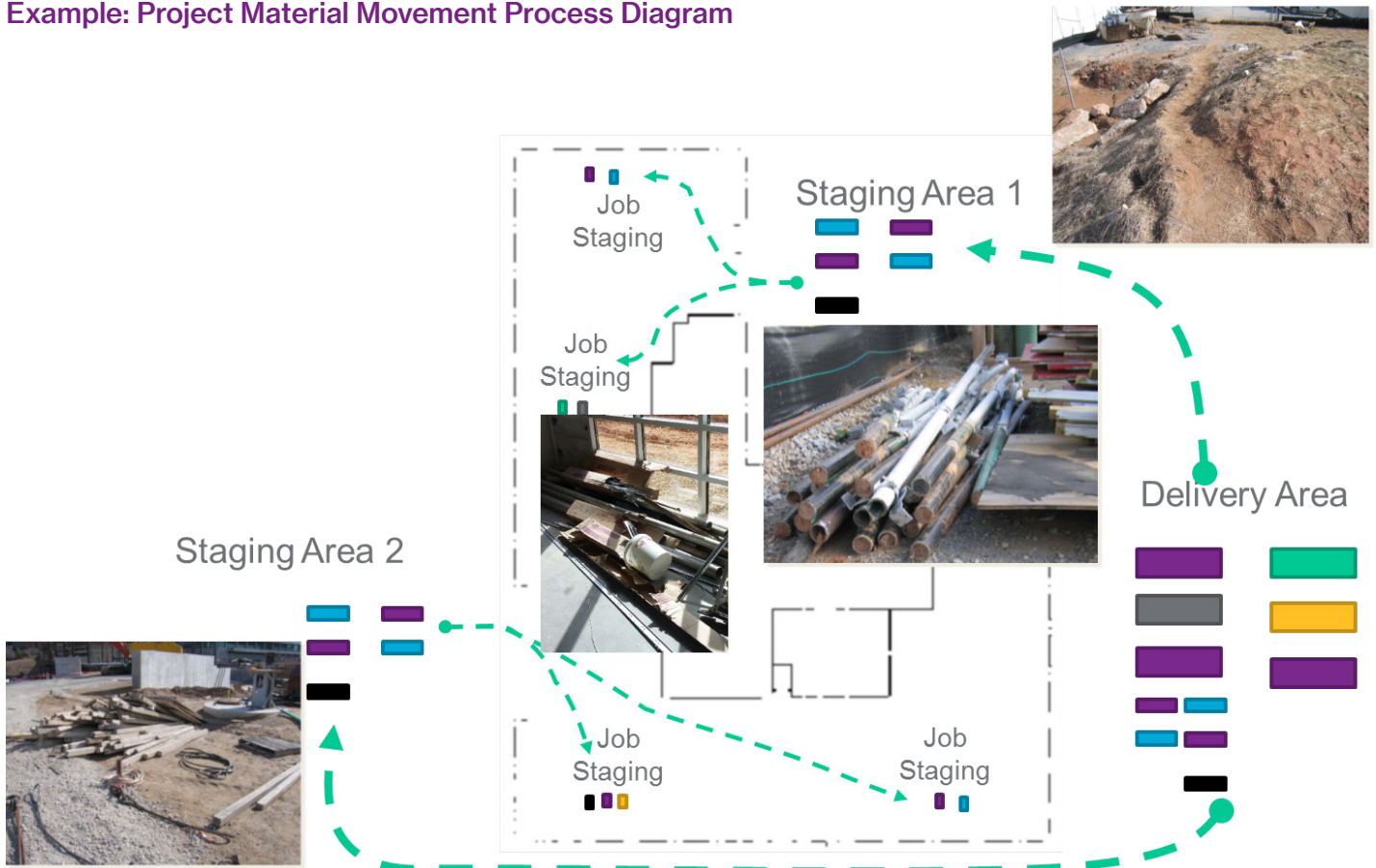
Materials are constantly moving on an active construction project. Long after delivery, waste is caused by unnecessary movement and transport, waiting, excessive effort or slowed activity due to overcrowded and congested work areas. The potential for worker injuries increases the more materials are handled. A recent nationwide study by two major construction insurance carriers showed the average cost for a manual handling-overexertion injury was \$24,460. Since these injuries are cumulative in nature, the savings generated by preventing the contributing risk factors can be cumulative as well.

The key to reducing waste in material movement is understanding these factors:

- Where stored
- When stored
- How stored
- How moved
- Paths for workers
- Material handling equipment
- Staffing level needed
- Handles and carrying aids
- Housekeeping and organization
- Project access
- Access to work areas

Process diagrams are used extensively in manufacturing. The Project Material Movement Process Diagram shown here demonstrates the value this planning tool can bring to project productivity and safety. However, to fine tune and identify productivity opportunities, video analysis of delivery, staging, work areas, and work methods is superior.

Example: Project Material Movement Process Diagram



Overcrowded and congested work areas

The second most common cause of waste on a construction project is overcrowded or congested work areas. Clutter and debris reduce productivity and increase safety risks. Workers may look busy when they are ineffectively and/or insufficiently processing their scheduled work. The same recent nationwide study by two major construction insurance carriers showed the average cost for a fall on a same-level injury was \$27,620. Video analysis can help reduce these costs as well as the lost productivity cost from the climbing over, climbing up, walking around, stepping through or going under that these obstructions or hazards may require.

Project access, access points, access paths

Access to a project from the parking lot, through the gate and throughout work areas can be a prime waste generator. Unless otherwise directed, workers will take the shortest distance between two points to get to the project gate. When they carry tools and equipment they increase the risks for muscle strain and same-level fall accidents. A strategically placed camera set on time-lapse for the entire day will help you see opportunities for reducing unnecessary congestion, movement, and transport.

People and technology

Construction is still a people business. When we build something we rely on the human element when it comes to doing the work and when it comes to making decisions that impact productivity, quality and safety. As long as people perform the work and make decisions about how things get done, there will be room for improvement.

There is a skilled labor shortage in construction. The inexperienced young people entering the construction environment today are “digital natives” meaning they grew up in a high technology environment. Many of them will embrace some of the concepts we have discussed to help them increase their understanding of the construction process, feel that they work for a company with purpose, and make an impact faster than previous generations.

Increasingly, construction is a technology business, too. With simple technology, we can make improvements by identifying non-productive and unsafe work habits and methods. We can do what the young engineers at Toyota do when they stand in a circle and observe work for a day. We may not have six or eight hours to spare, but we have access to technology that can help us see our way to a safer, more productive future.



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WTW-NA-2017-WTW30318

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