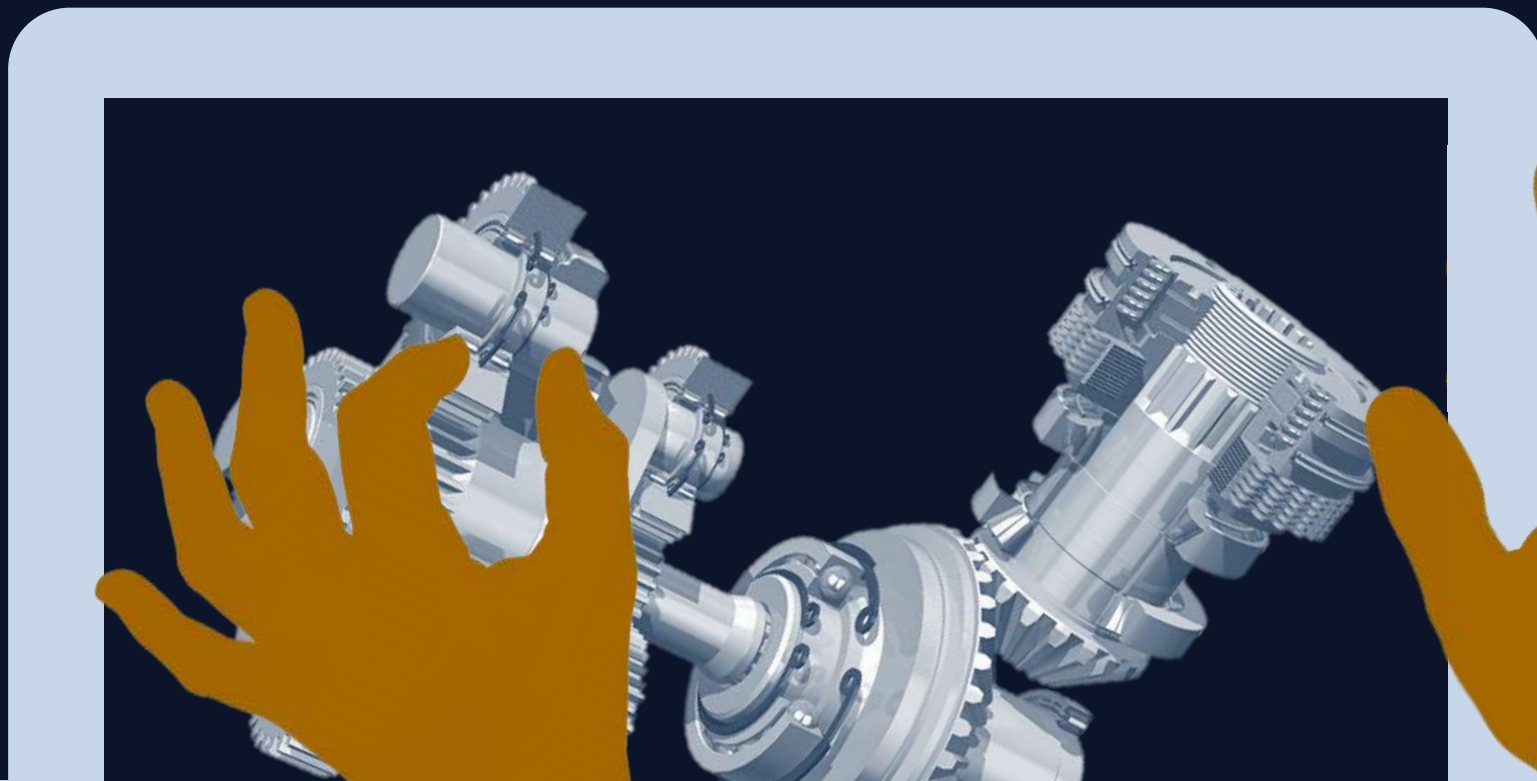# CAD ON MOBILE DEVICES:

IS IT READY? DO WE NEED IT?

LIFECYCLE INSIGHTS

# CAD ON MOBILE DEVICES: IS IT READY? DO WE NEED IT?

Ever since the first mobile devices emerged, those are questions that have been weighing on the minds of many an engineer. The concept of making CAD more accessible and interactive has long been appealing. Yet, it has always seemed like a far-off reality.

In recent years, however, some engineering organizations have been experimenting with CAD on mobile devices in one particular form. Findings from Lifecycle Insight's *2013 3D Collaboration and Interoperability Study* showed that 13% of respondents had been using smartphones to view engineering documentation. Furthermore, Lifecycle Insight's *2014 Model-Based Enterprise Study* showed that 20% of respondents had used mobile apps on tablets to view drawings and 3D models. These have been initial steps towards fully leveraging mobile devices in product development and show that these applications are feasible and valid.

While these engineering organizations have been experimenting with viewing and interrogating engineering models and documents, the power of mobile devices has been steadily increasing. Their processors have become more powerful. Their disk space and memory have expanded. Their graphics processing has grown. It's enough to ask that question again, albeit more seriously this time: Is full 3D CAD design on mobile devices ready?

Answering that question is the purpose of this eBook. Here, you will find insight into how CAD on mobile devices can be applied in development. You will find details on how not only compute power, but also new interactions on mobile devices, affect performance and usability. Finally, you'll gain insight on how CAD running on mobile devices affects organizational and personal productivity.

So dig in. It's time we considered this question seriously.
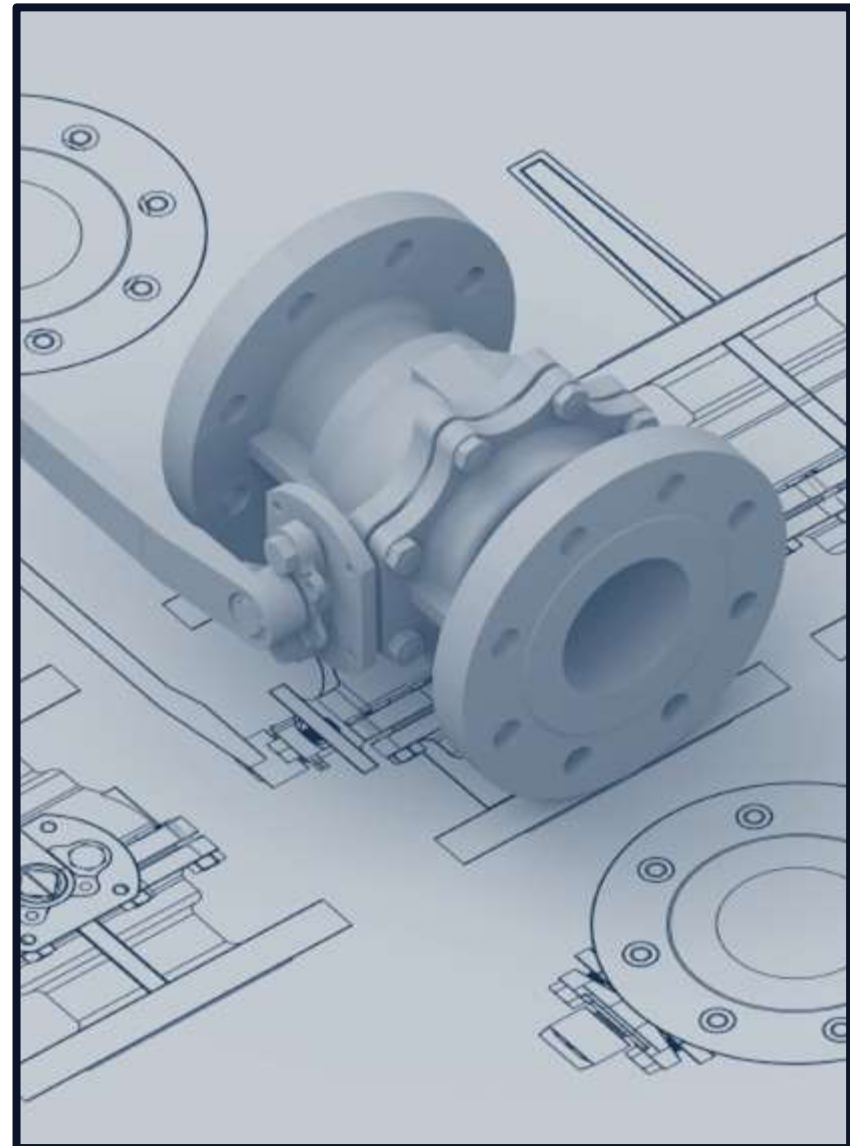
WHY DO ENGINEERS NEED CAD ON MOBILE DEVICES?

Why do engineers need the capability to run CAD applications on mobile devices? This section answers that question by looking at several scenarios that require design creation or modification on the go.

RESOLVING DESIGN ISSUES ON THE GO

Much like many other professions today, the desk is no longer the only place where work gets done. Engineers, especially in smaller companies, have a myriad of responsibilities that require them to run between conference rooms, investigate manufacturing issues and visit suppliers and customers in remote locations. Those responsibilities aren't just reviewing drawings and rotating 3D models. They require active modifications to designs. Consider the following scenarios.

- **On the shop floor:** The transition from 3D model to production is rarely a completely seamless one. NC programmers, machine operators and assembly personnel often have questions. But they also request small modifications and tweaks to designs in order to manufacture them more easily or at less cost. On the shop floor, engineers need the ability to mock up a change and resolve the issue, then and there.

- **In the procurement office:** Purchasing is always looking to cut costs. One means of doing that is exploring the feasibility of replacing specialty parts with commodity ones. Volume purchase discounts translate to hard cost savings. Engineers need the ability to explore the functional equivalency of different alternatives, allowing them to validate switching one part out for another.

- **At the customer's office:** Everyone has urgency in product development, particularly customers. Sales calls can quickly transform into design sessions, opening up the opportunity to gain immediate financial commitments. In these scenarios, engineers need the capability to perform conceptual and even detailed design work in front of prospective customers.

- **At the supplier's office:** Components received from strategic suppliers can have a profound impact on the success or failure of a product. Engineers need the capability to pull up a component design, review it in the context of their own product and suggest changes that ensure a seamless fit.


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In each of these scenarios, there are advantages to resolving design issues then and there. However, there are other prudent reasons to take immediate action. Given the fact that the amount of time they have at the desk is shrinking, engineers can't afford to let desk-based to-do lists build up while working remotely. Such a backup in design tasks can unnecessarily delay the overall product development process. They need to resolve them immediately, as much as possible, while they are on the go.

STAYING ON SCHEDULE WHILE ON THE GO

Get it done. That's the repetitive message from executives to engineering, time and again. Schedules today are always getting tighter. Competition to get to market first or with breakthrough product capabilities is fierce. To survive, manufacturers must be agile, innovative and on time. While designers and engineers are spending more time than ever away from their desks, they must be productive, even while in transit or staying at a remote location. Put simply, they can't afford to fall behind.

THE TAKEAWAY

Whether it is resolving issues on the go or staying on schedule, even while remote, today's engineers clearly need the capability to run CAD on mobile devices.
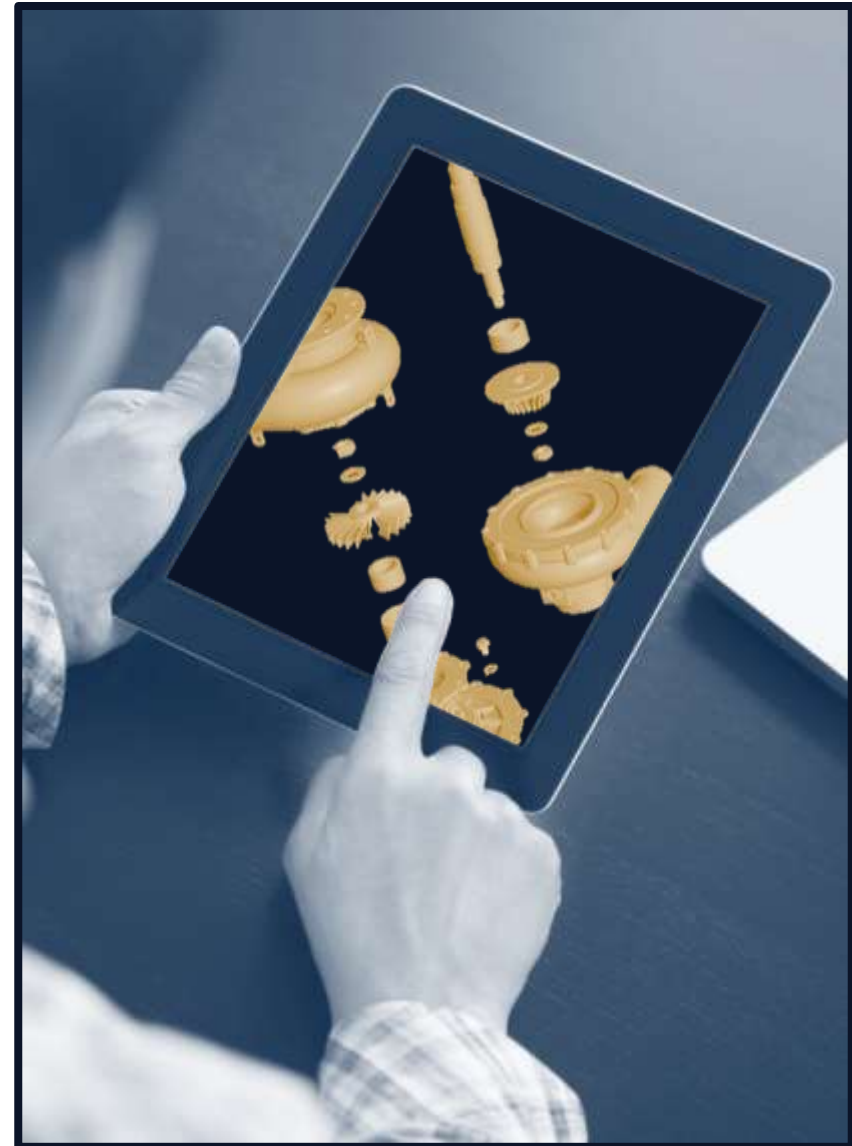
CAN CAD WORK ON MOBILE DEVICES?

There are valid reasons to run CAD on mobile devices. However, is this feasible today? In this section, we'll look at recent technological advances and their implications for CAD applications.

FORM FACTORS AND COMPUTE POWER

Since the advent of CAD software, the most frequently used computing platform to get design work done has been desktop-based workstations. Workstations offer four distinctly different compute resources that CAD applications need to run smoothly: processing power, memory, hard disk space and high graphics performance. 3D models of complex parts or assemblies with hundreds or thousands of components require a lot of compute resources in each of these categories. Underpowered platforms exhibit degraded performance that is a detriment to productivity. Specifically, without the proper compute resources, loading, modifying or manipulating large or complex models can result in time lags or delays. Desktop workstations, with their high capacity and upgradeability for processing power, memory, hard disk space and graphics, have historically been best matched for the largest models built in CAD software.

More than a decade ago, however, laptops started to become a truly feasible option to run CAD applications. The ongoing efforts of software providers to shrink the size of model files helped in this regard. However, other technological advancements had an important impact. The ever-increasing power of processors, both in the form of miniaturization and emergence of multi-cores, provided the necessary computing power. The miniaturization of solid state drives offered the storage space needed. Laptops became the first mobile platform that could run CAD applications.

The evolution of mobile CAD, however, didn't stop there. In the last five years, tablets emerged as the latest and greatest mobile compute platform, providing a hand-held form factor that is more responsive and comfortable than laptops. Yet, when they were initially launched, tablets were not ready to run CAD applications. They lacked the compute power, memory, hard disk space and graphics to perform.

Today, however, tablets are finally ready to run CAD applications. They now have the compute resources to meet performance expectations, running multi-cores, providing excellent graphics capabilities, offering storage space on solid-state drives and expanded memory capacity. Disadvantages of working on a smaller physical graphics screen can be overcome by streaming the display to a larger screen.

LEVERAGING TOUCH-BASED INTERACTIONS

Form factors and compute power aren't the only considerations when running CAD on mobile platforms. Finger gestures on a touch sensitive screen and other peripheral-less interactions on tablets present an opportunity for productivity improvements. Instead of plugging in a physical keyboard and mouse, which may not be possible in some use cases, users can enter text or interact with models on the touch screen directly. Besides supporting the software with the right computation resources, some software providers have retooled the interface and interaction of their CAD application to leverage multi-touch interfaces. Consider how the following touch interactions apply to CAD applications.

TABLE 1: APPLICATION OF GESTURES OR USE OF A STYLUS TO CAD APPLICATIONS

TOUCH INTERACTION	GENERAL APPLICATION	APPLICATION IN CAD SOFTWARE
Tap	Opens or selects the tapped item.	Selects interface option or menu. Selects entity on the model or drawing. Stylus used for fine control.
Tap and Hold	Brings up options for selected item (like right mouse button).	Brings up options or shortcuts for entity (like right mouse button).
Slide or Swipe	Pan across the screen.	Pan across the model or drawing. Drags modification handles for geometry changes or moves. Stylus used for fine control.
Pinch or Stretch	Zoom in or out of the screen.	Zoom in or out of the model or drawing.
Spin or Rotate	Rotate selected item.	Rotates or spins model or drawing.

Touch interaction, however, isn't all about the use of fingers. While gestures provide an easier means of interacting with a model or drawing within a CAD application, the broad contact area of a finger is often not fine enough for the selection and interaction work that CAD applications require. Some software providers have tuned their solution to fully leverage the fine interaction capabilities available through a digital stylus, addressing this issue. The combination of finger-based gestures and the fine control of a stylus, however, offer the greatest potential for productivity gains.

LEVERAGING MULTI-TASKING DURING DESIGN

An oft-overlooked capability of running CAD on a mobile device is the ability to multi-task across simultaneous applications. This allows a user to design in the CAD application, but also take down or dictate specifications on a note-taking app, run a video conference or remotely share their display with collaborators. Such multi-tasking across applications without constantly switching manually between apps positively impacts productivity.

THE TAKEAWAY

With advancements in compute resources, CAD can now feasibly run on mobile devices. But furthermore, through touch-based interactions and multi-tasking across applications, mobile devices can offer advantages not feasible on laptops or desktops.

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CASE STUDY: TRLBY INNOVATIVE

Trbly Innovative is a small machine equipment design and manufacturing firm based in Torrington, Connecticut. Bob Mileti, the owner who designs many of their machines, spends up to 4 days a month out of the office visiting customers and vendors.

"I'm using Solid Edge on a Surface Pro 3 in addition to my workstation," says Bob. "In many ways, I've found it to be better than a laptop. In fact, just in terms of the interface, I've liked it better than the mouse and keyboard that I use on my workstation. Getting into CAD is practically instantaneous. I can manipulate the model using the touch screen. I can take measurements with my stylus."

Bob uses this solution in a few different ways when engaging customers. "I definitely use it for presentations to potential customers. It is really valuable when I run into an objection with my design. I just bring up the model and show them." Customer interaction, however, isn't always face-to-face or even during business hours. "I have customers on the West Coast, so I sometimes take a conference call at 6 o'clock at night from my home," continued Bob Mileti. "I simply pop up the right model in CAD and do what I need to do."

Working with customers isn't the only scenario where his mobile CAD solution is valuable. "Sometimes I'll sit down with a vendor to troubleshoot an issue. I'll wirelessly project my display onto a 60" screen. We can really zoom in and identify the issue." Bob also uses it to work through manufacturability issues with his vendors. "I'll bring it to a vendor that is making parts for me. They might point out an aspect of the design that is feasible, but expensive. We'll sit down at their offices, work through the changes. Then I can leave the finalized models and drawings. It really shortens the time to part resolution."

THE TAKEAWAYS

Bob Mileti, the owner of Trbly Innovative, runs CAD on a mobile device in addition to a workstation. He utilizes it in front of customers, resolving objections about designs as well as with vendors when troubleshooting a design. He also uses it to stay productive after hours without staying in the office.

**BOB MILETI,
OWNER,
TRBLY INNOVATIVE**
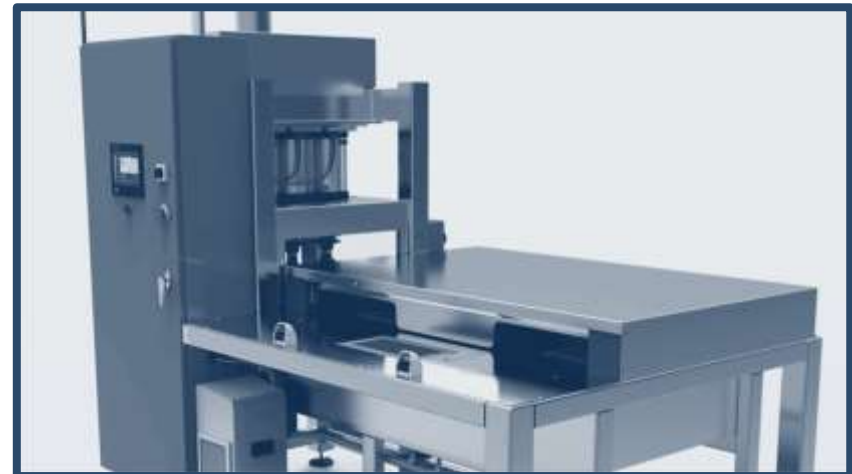
THE ADVANTAGES, FOR ENGINEERS AND ORGANIZATIONS

Engineers have always had the need for mobile CAD, even if that need became more acute only in the past five to ten years. But somehow, engineers and design organizations have survived without it to this point. So, what is the real advantage? This section explores the answer to that question by looking at the impact that CAD on mobile devices can have, both for the organization and the individual.

FOR ORGANIZATIONS

The effectiveness of engineering organizations is inherently limited by their human capital. Their function is to design products to specification, whether that is evolutionary or revolutionary, within a certain schedule. The productivity of engineers in the organization directly affects its ability to achieve those goals.

Unfortunately, not many organizations are successful. Findings from Lifecycle Insight's *2015 PLM Study*, which collected responses from over 760 organizations, show that on average only 55% of development projects are released on time.

CAD running on mobile platforms provides two main advantages. First, it allows engineers to resolve issues, whether they are manufacturing issues, potential configurations for prospective customers or something else, and immediately allows the organization to move forward in the product development process. Second, it allows engineers to make progress on their design tasks even when away from their desks. Both of these organizational capabilities increase the likelihood that designs can be released on time and products can be launched on schedule.

FOR INDIVIDUALS

Designing new products is inherently unpredictable. Problems and issues crop up, time and again, throughout the product development process. As a result, engineering organizations often must unexpectedly shift resources back and forth between projects in an attempt to keep them on schedule. Findings from Lifecycle Insight's *2015 PLM Study* reveal that 41% of projects require at least a 10% shift in resources to stay on track. That, of course, delays projects that have been deprioritized, continuing the cycle of delays and missed deadlines.

All of this has a personal impact on engineers. Findings from Lifecycle Insight's *2013 3D Collaboration and Interoperability Study* showed that 50% of engineers work late and on weekends. When deadlines loom, engineers have to stay extra hours in an attempt to catch up, sacrificing their family and personal time.

CAD running on mobile devices isn't a cure all. However, it allows engineers to be more responsive and resolve issues more quickly. This increased agility translates into a greater chance to complete design work and recoup personal and family time.

CASE STUDY: STREETSCAPE

Streetscape is a New Zealand company that designs and manufactures street furniture, including picnic seats, bike racks, street lighting, drinking fountains and more. The three divisions of the company employ 35 people. Sean Creswell, the Design Office Manager, acts as the design head but also as the sales engineer.

SEAN CRESWELL, DESIGN MANAGER, STREETSCAPE

"I spend about 80% of my day at my desk," states Sean. "About 99% of that time I use CAD. But the other time I spend traveling to clients, walking down the shop floor and walking suppliers through specifications. The only computer I use is the Surface Pro. I have no need for any other computer," continues Sean. "While at my desk, I plug it into a docking station connected to a 28" screen and 3D mouse to speed up detailed work. Most of our models have 300 to 2,000 parts."

"In front of clients, I mainly use the touch screen. I primarily use it as a sketch environment, capturing their ideas and how we might be able to make it," Sean says. "I capture notes in an app right alongside my CAD tool. I use the 'tap and hold' gesture a lot to bring up the radial menu. Other than the tablet, I carry a wireless mouse. But the type-cover is an adequate keyboard.

"Being predominantly a sheet metal shop, we sometimes have guys on the shop floor that misinterpret complex folding operations. I'll take my tablet and fire up CAD to resolve issues and get it right," he states. "I'll also take it to suppliers. I'll take their models, bring them up and start making modifications. I can walk them through changes I'd like to see. They're often surprised I can work with their designs because they come from other CAD tools."

THE TAKEAWAYS

Sean Creswell, the Design Manager at Streetscape, exclusively uses CAD on a mobile device in a variety of scenarios. He uses it at his desk, connected to a large screen, in front of clients capturing concepts, on the shop floor to clarify engineering documentation and with suppliers to edit their designs for changes.
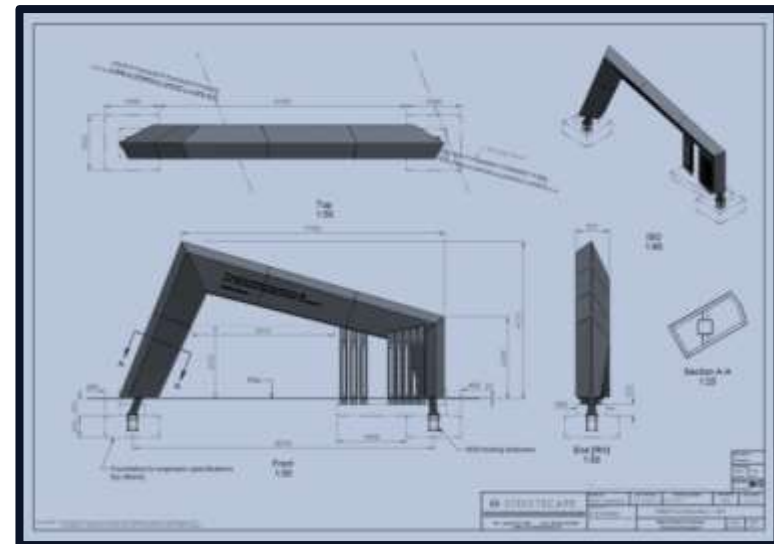
RECAP AND CONCLUSION

We started this eBook with a simple question: Is CAD on mobile devices ready? Here, we'll recap the takeaways from each section, leading to our final conclusion.

WHY DO ENGINEERS NEED MOBILE CAD?

Today, engineers find themselves in a myriad of scenarios, away from their desk, where they need to resolve design issues. It happens on the shop floor, in the procurement office, in front of a customer and on a supplier's campus. Furthermore, with development schedules tighter than ever, engineers must be productive, even while on the go. In today's time crunch, it is obvious that there is a need for CAD on mobile devices.

THE EVOLUTION OF CAD ON MOBILE DEVICES

Desktops and laptops have the compute resources, including processing power, memory, hard disk space and graphics, to run CAD responsively. In the past couple of years, however, mobile devices have caught up in these terms. Mobile devices now have the compute horsepower to run CAD smoothly, all in a better form factor.

Touch-based interactions, whether through gestures or the use of a stylus, offer a more natural means of interacting with the design. Additionally, new capabilities to run multiple apps simultaneously, even while splitting the device's screen, allow engineers to multi-task more readily.

From a computational and user interaction perspective, mobile devices are now ready to run CAD.

THE ADVANTAGES, FOR ENGINEERS AND ORGANIZATIONS

Findings from Lifecycle Insight's *2015 PLM Study* show that on average only 55% of development projects are released on time, a disturbingly low statistic. Findings from Lifecycle Insight's *2013 3D Collaboration and Interoperability Study* showed that 50% of engineers work late and on weekends. Resolving issues earlier and recouping productivity, even while on the road, increases the likelihood of releasing products on time. Furthermore, addressing issues on the go means engineers won't have as deep a to-do list when they do get to their desk, decreasing their need to work nights and weekends to catch up.

FINAL TAKEAWAYS

Today's reality is that engineers are always on the go, even when they need to do design work. CAD on mobile devices is finally feasible and ready. Together, the two are a natural fit.

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Chad Jackson is an analyst, researcher and blogger with Lifecycle Insights, providing insights on technologies that enable engineering, including CAD, CAE, PDM & PLM. chad.jackson@lifecycleinsights.com

More information on Lifecycle Insight's studies can be found at the following links: 2015 PLM Study, 2014 Model-Based Enterprise Study, and 2013 3D Collaboration and Interoperability Study.

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