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Helping the Army Advance Master Planning Capabilities using Smart City Technologies



Case Study: Helping the Army Advance Master Planning Capabilities using Smart City Technologies

About: US Ignite, along with Grant Thornton and the U.S. Army Corps of Engineers, Engineer Research and Development Center (USACE-ERDC), completed a study of how different Smart City technologies could be helpful to military master planners. This document reveals the findings on each technology and offers prototypes and design examples based on the recommendations.

INTRODUCTION

Military installations rely on master planners to manage their real property portfolio, control energy costs, and drive capital investment decisions. To do this well, master planners need information about the facilities – like when they are being used and how frequently they are utilized. This information can help them make important decisions like where to station different units, what facilities to expand, and where to allocate maintenance costs. This in turn allows them to maximize the capacity of an installation’s infrastructure and minimize the installation’s real property operations costs. At the same time, facility space utilization data can also be used at enterprise-level to help inform strategic analysis like stationing analysis and beddown, capacity analysis, and base realignment and closure.

As critical as this information is, obtaining it is more challenging than one may think. The data generally available to master planners only reveals how many persons are authorized per building instead of what the structure *actually* supports. Essentially, this would be like a school principal trying to buy enough ice cream for all the students at the school one afternoon but only having access to the max number of students allowed in each classroom instead of how many students showed up to school that day.

This level of data does not suffice for effective facility utilization and building reuse and generates inadequate data for master planning.

A project team made up of Grant Thornton LLP, the U.S. Army Engineer Research and Development Center (ERDC), and US Ignite proposed exploring the power of commercially available modern location data sources, using Fort Carson as a testbed to address this problem. This effort sets off to explore smart cities initiatives for an emerging installation planning capability called PLANNER by leveraging technology to allow the Army to pivot from an industrial-age paradigm to a data-rich, technology-enhanced information-age master planning construct. Smart cities initiatives will help deliver smart installations, a common enabler in the Army Installation Strategy Lines of Effort (AIS 2020). During the exploratory study, the project team surveyed three modern location data sources: cellular networks, IoT networks, and mobile location data aggregators.

The study concluded that master planning could be securely and economically enhanced using mobile cellular location data sourced from mobile location data aggregators. Given this finding, US Ignite developed prototype

applications to understand patterns of life and facility utilization at a military base. Additionally, US Ignite created two example designs for how this can be scaled to inform the development of Army stationing policies and to implement large-scale stationing changes and new unit stationing. These prototypes, and US Ignite’s assessment of the scalability of surveyed technologies, can be found below.

ABOUT THE SURVEYED TECHNOLOGIES

IoT Networks

IoT networks can capture multiple and varied data points, which is an appealing asset for master planning work. For example, the data could include anonymous counts of individuals entering and exiting buildings and how long individuals spend inside a building.

US Ignite engaged the IoT network vendor base to understand their requirements in terms of time and deployment costs and the insight that could be gained from IoT occupancy sensors. The team found that there were four main types of occupancy sensors – passive infrared, ultrasonic, radar/microwave, and people recognition cameras. Generally, improved data features increase the cost of deploying the IoT sensor. However, the cost of deployment is not the only aspect to consider when it comes to master planning. The effort required to deploy IoT networks can vary significantly. While some low-infrastructure “peel-and-stick” sensors would be easy and fast to deploy, installing power and network-requiring sensors at an enterprise scale would require a considerable time investment and coordination effort.

After considering and analyzing IoT networks for master planning purposes, the study found that it could be a good solution. Still, more information is required on low-infrastructure sensor options deployment costs.

Cellular Networks

These refer to the wireless communication system that user equipment (like phones and laptops) uses to communicate with each other. There are multiple generations (3G, 4G, 4G LTE, 5G), and each has different capabilities.

The project team was interested in learning how cellular networks could support data collection for insights on facility utilization, including the CBRS network previously deployed at Fort Carson. US Ignite concluded that the CBRS network needed more usage (or user equipment) to gain insight into facility utilization across the base, so it was not recommended as an enabling technology. Additionally, the Fort Carson fiber infrastructure and the cellular coverage in the city of Colorado Springs were investigated as means of capturing facility utilization data on the base. Still, these were also found not to provide representative data on base facilities to gain insights into building occupancy.

Moreover, adopting 5G networks across the Department of Defense may take significant time, and currently, only highly privileged network owners (operators like Verizon, T-Mobile, etc.) can collect the level of data sought from them. Further, these networks can only capture location data for devices connected to them. These issues meant cellular networks themselves weren’t found to be the best source for master planning data. However, aggregating data from all the mobile devices on Fort Carson, transparent from which network they’re on, does provide complete coverage - described further in the next section.



Mobile Location Data Aggregators

There is a robust commercial market for aggregating, enriching, and reselling mobile (cell phones, tablets, connected devices) location data from cellular carriers, smartphone applications, and web advertisers.

Master planners interested in optimizing space utilization can use mobile location data to understand patterns of use in buildings¹ across an installation. The patterns can be compared to authorized tenancy to estimate over-or-under-utilization, which can help prioritize investments and the reallocation of resources to lower overall operations, maintenance, and sustainment costs.

Although mobile location data aggregators offer an economical and secure solution, military installations should perform due diligence to understand if they are legally permitted to use this solution within the base's state and if the data can be expected to be available for the foreseeable future. To learn more, US Ignite investigated surveys available through the American Bar Association and the Future of Privacy Forum think tank and found that the collection of location data is generally permitted but required to be disclosed.

Legal use of mobile location data was one of many concerns US Ignite considered in evaluating the technology. Since mobile location data can divulge Personally-Identifying Information (PII), it was essential for US Ignite to find an aggregator that mitigated the risks associated with PII. It was found that through "device ID rotation," a process where an anonymous ID representing a particular device is changed regularly to prevent continuous PII monitoring, mobile location data aggregators can mitigate risks on selected military bases. US Ignite recommends that master planners and users on military bases be prevented from accessing raw mobile location data and have access only to base-approved post-processed data and visualization. While this approach may work on some military bases due to the expectations and signed agreements of military personnel, it may not work in many cities due to citizen privacy concerns even when "device ID rotation" techniques are employed.

Following careful consideration of the risks of using mobile location data aggregators, US Ignite did find it to be the most fitting technology to help with master planning. The solution provides the information master planners need to make better decisions and can be securely managed through the abstraction of Personally-Identifying Information (PII) before delivery and via the proper information control policies used by the Army.

PROTOTYPES AND EXAMPLE DESIGNS

To illustrate the potential applications of leveraging mobile location data aggregators, US Ignite developed several working, data-driven prototypes, as well as a handful of example visual designs with mock data below.

Prototype 1: Facility Utilization Dashboard

Using Microsoft PowerBI and leveraging mobile location data, US Ignite built a 'Facility Utilization Dashboard.' This dashboard would allow master planners to sort, filter, and chart facility utilization data by size, mission designation, utilization rate, geographic location, and other categories. Through this dashboard, planners could analyze the data and gain intelligence on occupancy patterns across the installation over time.

The 'Facility Utilization Dashboard' could support energy savings initiatives, capital investment prioritization, site tenancy selection, and many other use cases. Knowing when buildings are over or underutilized helps master planners to maximize the capacity of an installation's existing infrastructure in two ways, first by deciding if certain facilities can be consolidated to reduce real property operations cost, or second by investing in them to reuse,

¹ US Ignite also explored the ability for cellular data aggregators to provide floor- or room-level information but found that the data obfuscation controls implemented to protect privacy prevented getting to this level of detail.

repurpose, or remove existing assets. This all supports sustainability objectives as installations should not heat, cool, or maintain access facilities.

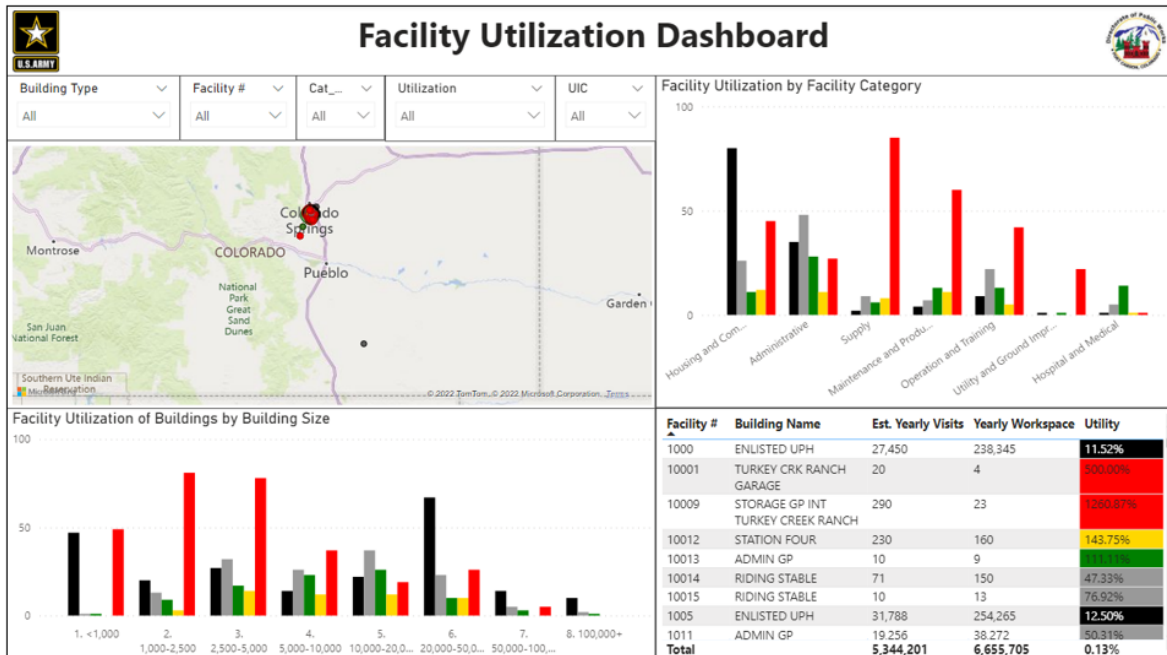


Figure 1. Facility Utilization Dashboard

Prototype 2: Access to Amenity Analysis

Over a regular day, servicemembers have limited time between work shifts and lunch breaks to reach all the places they need to, like to drop off children at childcare and pick up lunch. The delays and stress of this phenomenon impact workplace productivity and the servicemembers' quality of life.

Using mobile location data, the Army can understand what areas may not provide adequate access to amenities within the base. US Ignite developed an approach to estimate the average trip time between different base locations to support this process.

Analyzing people's trip start and end points and duration can help master planners identify 'food deserts' near large employment centers and gaps in childcare locales. Optimizing the plans so that servicemembers can access the places they need within their schedule constraints ensures that the Army meets the quality-of-life objective of the Army Installations Strategy.

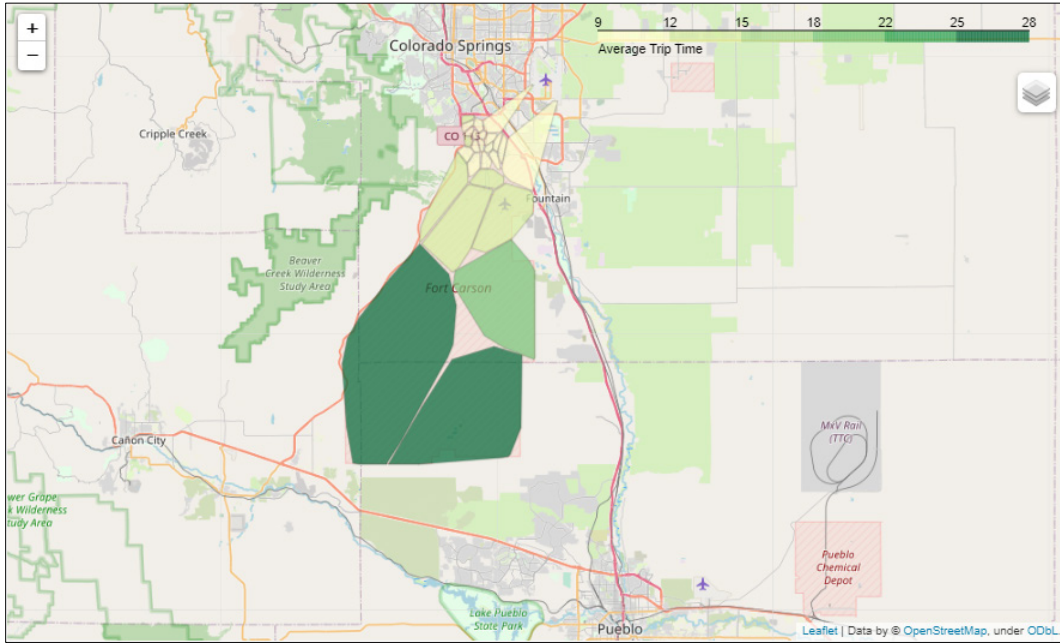


Figure 2. Average Travel Time for each Fort Carson Internal Trip Cluster

Example Design 1: Stationing Change Impact Assessment Tool

Fielding new units can mean thousands of new service members and their families coming onto an installation. Sustaining that much additional occupancy can strain the real property portfolio. Inversely, when units leave during deployment, Base Realignment and Closure (BRAC), or other scenarios, an installation can suddenly be responsible for maintaining tens or hundreds of millions of dollars of underutilized property. Mobile location data can help improve scenario planning for both these processes.

The 'Stationing Change Impact Assessment Tool' offers installations a way to understand how utilization may change with demographic shifts, servicemember in-and-outflux, and supply fluctuations of nearby facilities. With this tool, installations could simulate BRAC or new unit sustainment before it happens and ensure they provide adequate and cost-effective facilities.

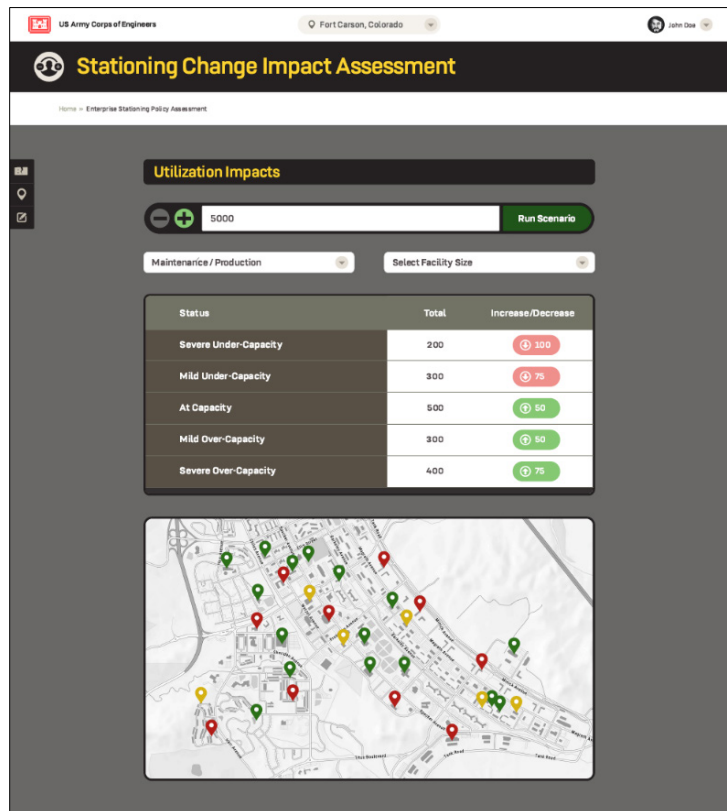


Figure 3. Stationing Change Impact Assessment Tool

Example Design 2: Stationing Policy Exception Request Tool

Army Headquarters uses a top-down process to develop and implement facility stationing policies. Currently, master planners at the installation levels cannot provide feedback or make policy exception requests to headquarters. To improve this process, US Ignite created a mock example - the 'Stationing Policy Exception Request Tool.' This tool demonstrates how master planners could use facility utilization data to justify a request for an exception to an existing stationing policy based on that policy's impact on over or under-utilization. At a macroscopic level, Army leadership could then use the metadata of the exception requests across policies to make refinements.

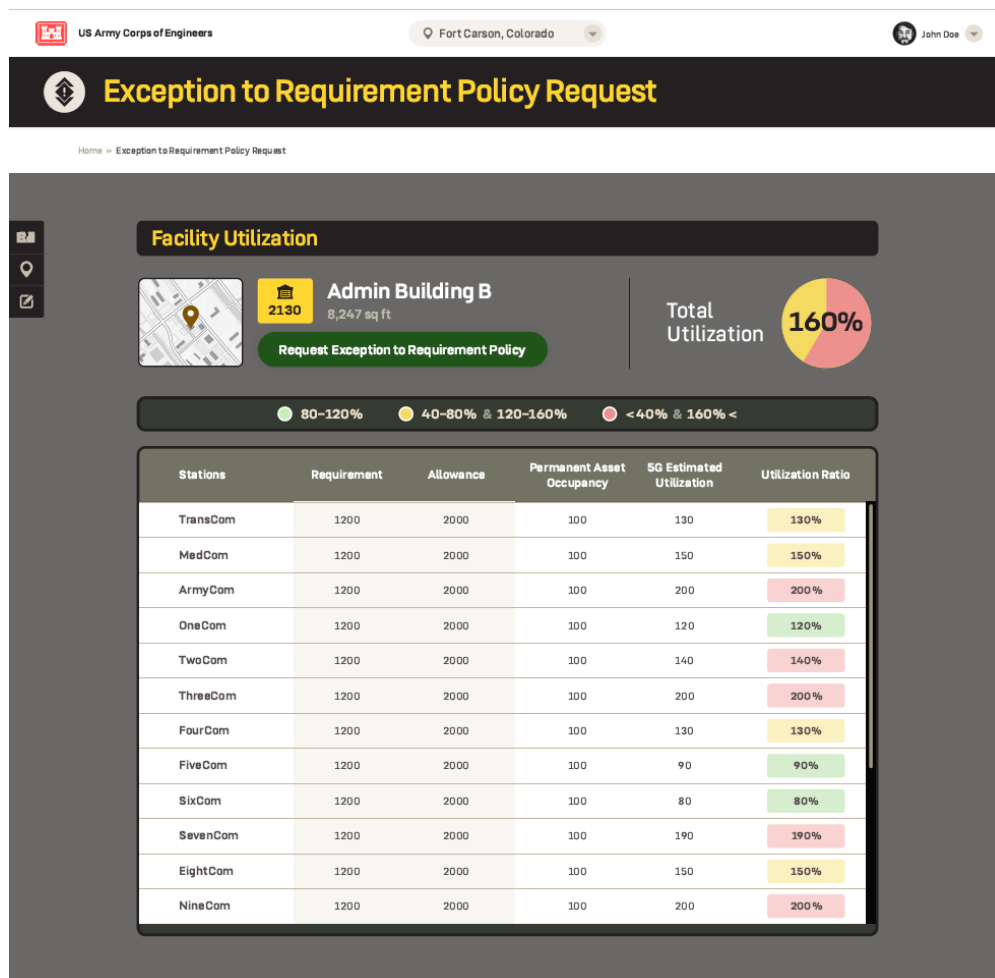


Figure 4. Stationing Policy Exception Request Tool

IMPACT

To support the advancement of these prototypes, US Ignite built a business case analysis and found that the recommended solutions would yield a high return on investment, considering their low deployment costs.

The business case analysis estimated that through decisions made using the information in the developed dashboards, the Army could:

- Improve the workspace allocation of 100,000 - 1.7M servicemembers;
- Save up to a million hours in personal travel time and workplace absenteeism per year;
- Realize \$100,000 - \$2M per year in avoided annual operation and maintenance costs during Base Realignment and Closure (BRAC); and
- Save \$100,000 - \$150,000 in annual energy costs through footprint consolidation.
- Visualize and mitigate impact of operations as aligned against climate events

US Ignite and Grant Thornton's investigation into modern building occupancy data sources and prototype development has created a resource trove for future master planning modernization efforts. Additionally, the findings encountered in this could inform future decisions to expand this capability across the Army enterprise.
