2.2 **Hardware and Software Requirements**

As noted in the public access section above. SACSIM19 files and software are open to the public. However, the current version of the model does require specific hardware and software to run. Table 2-1 provides minimum recommended hardware specific to run SACSIM.

2.2.1 Hardware

Table 2-1 Minimum Hardware Recommendations

CPU Speed	Minimum: 1.5 GHz single core Recommended: 2.0 GHz dual-core or better With Cluster: 2.0 GHz quad-core or better
Processor	Minimum: Intel Pentium 4, AMD Athlon Recommended: Intel Core i5, i7, Xeon or better; AMD Phenom II, Athlon II, FX-Series, A-Series APU or better
Memory/RAM	1 GB minimum; 4 GB or higher recommended With Cluster: 2 GB per core recommended
Hard Disk	Minimum: ATAPI IDE; 5,400 rpm Recommended: SATA 3 Gb/s or 6 Gb/s; SAS; 7,200 RPM or better; SSD
Hard Disk Space	10 GB for the application and supporting applications and data (like GIS)100+ GB for output files
Screen Resolution	Minimum: 1024 x 768 at Normal size (96dpi); 16-bit color depth Recommended: 1440 x 900 or higher at Normal size (96dpi); 32-bit color dept
Video/Graphics Adapter	Minimum: 24-bit capable graphics adapter; 64 MB video memory Recommended: 32-bit capable graphics adapter; 512 MB or more video memory
Networking Hardwar	100BT or 1000BT TCP-IP compatible Ethernet or Wireless adapter
Peripherals	DVD-ROM drive(1) available USB port, parallel port, ExpressCard slot, or PCMCIA slot for hardware dongle
Operating System	Recommended: Windows 10
Server Configuration	
CPU Speed	2.0 GHz quad-core or higher; multiple CPUs are ideal

Processor	Recommended: Intel Xeon E3, E5, E7; AMD Opteron 42xx, 43xx, 62xx, 63xx, 83x
Memory/RAM	4 GB minimum; 16 GB or higher recommended, For Cluster, used in SACSIM19: 2 GB per core recommended
Hard Disk	Recommended: SATA 3 Gb/s or 6 Gb/s; SAS; 7,200 RPM or better; SSD
Hard Disk Space	10 GB for the application and supporting applications and data (like GIS)100+ GB for output files

Source: SACOG 2020. Hardware recommendations based primarily on Bentley (formerly Citilabs) Cube Base Reference Guide Recommended workstation and server configurations for Cube Base Version 6.4.4.

2.2.2 Software

SACOG staff uses a variety of software applications to develop, run, and analyze SACSIM19. The section is broken out into two primary categories. Required software is necessary to run SACSIM19. Nonrequired software is additional software that SACOG staff use to develop and maintain SACSIM19, however the model does not explicitly need any of these to be run.

2.2.2.1 Required Software

2.2.2.1.1 Operating system

Microsoft Windows (64-bit version), such as Windows 10.

2.2.2.1.2 Cube Voyager 6.4.4 Software

Cube is a proprietary software package, which is produced, licensed, and marketed by Bentley Systems. Inc. Thus, to run the regional travel model, you will need to purchase the Cube software from Citilabs (www.citilabs.com). Cube software license is required to run SACSIM19.

Cube Voyager: Cube Voyager is the numerical engine that powers the Cube suite of software and includes its own proprietary scripting language. SACSIM19 was developed and applied by using Cube versions 6.4.4.

Cube Cluster

Cube Cluster is also part of the Cube software package used for distributed processing, by running processes across multiple cores. Cube cluster significantly reduces model run times. If not available, Cube clustering can be turned off in SACSIM19 script, but model run time will significantly increase and this is not recommended.

2.2.2.1.3 DAYSIM

DAYSIM a travel demand microsimulation software package that works in conjunction with network modeling software packages to forecast a population's response to changes in transport infrastructure and policy. DAYSIM uses an integrated system of discrete choice models to simulate long term choices for each household, and the activity and travel choices for a 24-hour period for each household member. It uses 48 half-hour time periods across the day as the basic units of

temporal resolution, and uses either individual parcels of land or block-sized microzones as the basic units of spatial resolution. DAYSIM is licensed under an [open source](#) license.

2.2.2.2   Nonrequired

2.2.2.2.1   Cube Base

Cube Base is the network Graphic User Interface (GUI) part of the Cube software package. While this is not technically needed to run SACSIM19, it is strongly recommended. Cube Base is needed to make any edits to the network variables and visualize any SACSIM19 model run results.

2.2.2.2.2   ArcGIS

ArcGIS is an ESRI platform for organizations to create, manage, share, and analyze spatial data. It consists of server components, mobile and desktop applications, and developer tools. SACOG staff uses various desktop and developer tools to develop and display SACSIM data. None ESRI GIS platforms may also be used to display the modeling spatial datasets. During release of this document SACOG staff developed data using Arc Desktop 10.7.0 and Arc Pro 2.5.2

2.2.2.2.3   PopGen version 1.1

PopGen, software developed by the Mobility Analytics Research Group alongside multiple universities and Metropolitan Planning Organizations (MPO), was used to generate a representative synthetic population with person and household-level attributes. More information and PopGen software can be downloaded from the Mobility Analytics webpage https://www.mobilityanalytics.org/popgen.html. Distributed as free software.

2.2.2.2.4   SQL Server

Microsoft SQL Server is a relational database management system developed by Microsoft. SACOG staff use to preform general data processing and analysis tasks. Version used as of release: SQL Server 2019. SQL Server Management Studio v18.3. SQL Server Software is proprietary software, license required.

2.2.2.2.5   Python

Python is an interpreted, high-level, general-purpose programming language. SACOG staff use to preform general data processing and analysis tasks. Version used as of release: Python 3.6.8 (Anaconda, Inc). Python 2.7.9 used for PopGEN version 1.1. Distributed as free software.

2.2.2.2.6   Notepad++

Notepad++ is a text and source code editor for use with Microsoft Windows, distributed as free software. Used to view and edit large text files. Version v7.8.5 used as of release.