AUTODESK® GREEN BUILDING STUDIO

Regression Test Validation of Autodesk Green Building Studio

Regression Test Validation Results: Build Version 2014.2.29.6004, Release Date May 15, 2013

Green Building Studio (GBS) Build 2014.2.29.6004, released May 15, 2013 passed the regression testing. The new release has differing, but expected energy usage results compared to the previous release dated 2/22/2013. All previous successfully simulated files are successfully simulated. All intentionally blocked files from previous release blocked. The number of surfaces and area of surfaces; the number of openings and area of openings remain unchanged for all runs.

Summary of Test Cases

The current iteration runs 464 energy analysis simulations, using 464 different GBS projects and 4 different conceptual models. The main purposes of the regression testing are:

1. Exercise different model configurations and building types in 16 ASHRAE climate zones for pass/fail

2. Compare energy usage results between previous release and current release candidate.

	Number of			
Weather data	Building	Number of	Number of	number of
source	Types	locations	models	test cases
Autodesk				
Climate Server	29	16 U.S.	4	464
TMY2	1	1 U.S.	201	201
	Weather data source Autodesk Climate Server TMY2	Number of Building sourceAutodesk Climate Server29TMY21	Number ofWeather dataBuilding BuildingNumber of locationssourceTypeslocationsAutodeskClimate Server2916 U.S.TMY211 U.S.	Number of BuildingNumber of locationsNumber of modelssourceTypeslocationsmodelsAutodeskClimate Server2916 U.S.4TMY211 U.S.201

Table 1. Test Cases

Regression Test Cases

Test Suite A

- The current iteration runs 464 energy analysis simulations, using 464 different projects & 4 different xml files. Main purposes
- 1. Exercise building types in 16 ASHRAE climate zones for pass/fail
- 2. Tracks Energy results

Test Suite B

Currently runs 201 xml files under one GBS project

These are old models (~4 years. Some run, some are intentionally blocked, and some intentionally crash/fail) Main purposes:

- 1. Previous blocked files should still be blocked. Failing files should trigger appropriate error message. Successful runs should still succeed.
- 2. Tracks pre- and post-GBS processing surface count and surface area and opening area
- 3. Tracks Energy results

Results Summary

	Successful simulation	Check for errors	energy results differences	Pre Surface Count	Post Surface Count	Pre Surface Area	Post Surface Area	Pre Opening Count	Post Opening Count	Pre Opening Area	Post Opening Area
							percent cha	ange			
Test Suite A	PASS	N/A	expected & PASS	0%	0%	0%	0%	0%	0%	0%	0%
Test Suite B	PASS	PASS	expected & PASS	0%	0%	0%	0%	0%	0%	0%	0%

Table 2. Results Summary

Typical Meteorological Year (TMY2) Weather Data

TMY2 weather data sets are a collation of selected weather data for a specific location, generated from the 1961-1990 National Solar Radiation Data Base. The data is selected so that it presents the range of weather conditions for the location, which are consistent with the long-term averages for the location.

Autodesk Climate Server Weather Data

GBS has 1.3 million weather station locations worldwide at a spatial resolution of approximately 20 km. For some locations ASHRAE climate zone assignments using GBS weather may differ from ASHRAE Climate Zone assignments usingTMY2 weather because the weather data used by GBS represents observed and/or derived data from one calendar year while TMY2 weather data, used by most energy analyses, is a compiled dataset of weather spanning thirty years.

Locations

The locations chosen for the regression test suite covers sixteen representative locations of ASHRAE Climate Zones in the U.S.

Representative ASHRAE Climate Zones Locations in the U.S

- 1A Miami, FL United States
- 2A Mobile, AL United States
- 2B Phoenix, AZ United States
- 3A Oklahoma City, OK United States
- 3B Las Vegas, NV United States
- 3B Los Angeles, CA United States
- 3C Santa Rosa, CA United States
- 4A Philadelphia, PA United States
- 4B Briscoe, TX United States
- 4C Seattle, WA United States
- 5A Columbus, OH United States
- 5B Burns, OR United States
- 6A South Burlington, VT United States
- 6B Dillon, MT United States
- 7 Fargo, ND United States
- 8 Fairbanks, AK United States

GBS Building Types

Twenty nine GBS Building Types, which are based upon ASHRAE building type categories, are used in the regression tests.

1.	Automotive Facility	10.	Gymnasium	19.	Performing Arts Theater	28.	Transportation
2.	Convention Center	11.	Health Care Clinic	20.	Police Station	29.	Warehouse
3.	Courthouse	12.	Hospital	21.	Post Office		
4.	Dining: Bar Lounge/Leisure	13.	Hotel	22.	Religious Building		
5.	Dining: Cafeteria/ Fast Food	14.	Library	23.	Retail		
6.	Dining: Family	15.	Motel	24.	School/University		
7.	Dormitory	16.	Motion Picture Theatre	25.	Single Family		
8.	Exercise Center	17.	Office	30.	Sports Arena		
9.	Fire Station	18.	Penitentiary	31.	Town Hall		

Models

Models used for the energy simulations include: 4 simplified schematic models to fully exercise all GBS energy setting defaults and 201 previously failed models and intentionally blocked models (obtained with users' permission). GBS automatically applies intelligent energy setting defaults to models where the parameters necessary for energy analysis have not been specified. These default values vary by building type, building size, and location. The GBS WikiHelp topic, <u>Green</u> <u>Building Studio Building Assumptions and Details</u>, provides more information on these defaults.

Regression Test Criteria

Regression test criteria determine whether or not energy usage results of the new release are within an acceptable tolerance range with the results of the previous release. Tests are passed where differences are expected due to bug fixes and improvements.

Results Detail:

The following differences are all due to a bug fix and an improvement. The bug fix addressed the method used for floor and ceiling area calculations used for for generating the DOE-2 .inp file for simulation. The improvement revised the assignment of schedules for infiltration rates.

- Domestic Hot Water process flow
- Outside ventilation flow rates
- Plug loads
- Lighting loads
- Occupancy density
- Loads due to Infiltration

Cases where the DOE-2 daylighting keyword is not written to the DOE-2 file is acceptable for this release, as it has no impact on energy results. Currently daylighting energy savings are calculated using the California Energy Commission method of applying an adjustment to the lighting power density, rather than simulating the daylighting in DOE-2.

Electricity usage decreased for all runs except one. The average decrease is -1.44%, maximum decrease is -4.619%, one run increased by 0.66%.

Fuel usage increased for most runs. Average increase is 1.29%, maximum increase is 4.398%

Detailed results

• Electricity usage change:



• Fuel usage change



• The following images show the differences between DOE-2 files

•	Infiltration	schedule

583 § Infiltration -	583 § Infiltration -	
584 "ds-241-FanINF" = DAY-SCHEDULE	584 "ds-241-FanINF" = DAY-SCHEDULE	
585 TYPE = FRACTION	585 TYPE = FRACTION	
586 HOURS = (1, 24)	586 HOURS = (1, 24)	
587 VALUES = (1, New recults	587 VALUES = (1,	
588 1, New results	588 ¹ / Last baceline	
589 1,	589 1, Last baseline	
590 1,	590 1,	
591 1,	591 1,	
592 1,	592 1,	
593 1,	593 1,	
594 0.25,	594 0,	
595 0.25,	595 0,	
596 0.25,	596 0,	
597 0.25,	597 0,	
598 0.25,	598 0,	
599 0.25,	599 0,	
600 0.25,	600 0,	
601 0.25,	601 0,	
602 0.25,	602 0,	
603 0.25,	603 0,	
604 0.25,	604 0,	
605 0.25,	605 0,	
606 0.25,	606 0,	
607 0.25,	607 0,	
608 0.25,	608 0,	
609 1,	609 1,	
610 1)	610 1)	
611	611	

•	Lighting powe	r density and da	ylighting						
6817					6817				
6818	VOLUME	= 23944.0			6818	VOLUME	= 23944.0		
6819	LTG-SPEC-METHOD	= POWER-DEFINIT	ION		6819	LTG-SPEC-METHOD	= POWER-DEF	INITION	
6820	LIGHTING-W/AREA	= (1.199)			6820	LIGHTING-W/AREA	= (1.24)		
6821	EQUIPMENT-W/AREA	A = (1.2196)			6821	EQUIPMENT-W/AREA	= (1.2196)	
6822	NUMBER-OF-PEOPLE	2 = 25.5			6822	NUMBER-OF-PEOPLE	= 25.5		
6823	PEOPLE-HG-SENS	= 250.0			6823	PEOPLE-HG-SENS	= 250.0		
6824	PEOPLE-HG-LAT =	= 200.0			6824	PEOPLE-HG-LAT =	200.0		
6825	AZIMUTH	= 0.0			6825	AZIMUTH	= 0.0		
6826	Х	= 0.0			6826	Х	= 0.0		
6827	Y	= 0.0	N D 1.		6827	Y	= 0.0	Last	Baseline
6828	Z	= 0.0	New Results		6828	Z	= 0.0		
6829					6829				
6830	SHAPE	= POLYGON			6830	SHAPE	= POLYGON		
6831					6831				
6832	POLYGON="sp-7-Sp	aceGEOM"			6832	POLYGON="sp-7-Sp	aceGEOM"		
6833					6833				
6834	C-SUB-AREA	= 2660.444			6834	C-SUB-AREA	= 2660.444		
6835	C-OCC-TYPE	= 10			6835	C-OCC-TYPE	= 10		
6836					6836				
6837					6837				
6838	ZONE-TYPE	= CONDITIONED			6838	ZONE-TYPE	= CONDITION	ED	
6839	LIGHTING-SCHEDUI	LE = "LightSched-3	5"		6839	LIGHTING-SCHEDUL	E = "LightSch	ed-35"	
6840	PEOPLE-SCHEDULE	= "peopleSched-	34"		6840	PEOPLE-SCHEDULE	= "peopleSc	hed-34"	
				2	6841	DAYLIGHTING	= NO		
				2	6842				
				2	6843	MIN-POWER-F	RAC = 0.30000	0	
				2	6844	MIN-LIGHT-F	RAC = 0.10000	0	
				2	6845	LIGHT-SET-P	OINT1 = 30.00	0000	
				2	6846	ZONE-FRACTI	ON1 = 0.29500	0	
				2	6847	LIGHT-REF-P	OINT1 = (48.2)	4852700,	
					6848				50.07490000,
				2	6849				9.5000000)
				2	6850				
				1	6851	LIGHT-SET-P	OINT2 = 30.00	0000	
				12	6852	ZONE-FRACTI	ON2 = 0.09500	0	
					6853	LIGHT-REF-P	OINT2 = (2.71)	705400,	
				1	6854				51.29447900,
				//	6855				9.5000000)
				2 2					

Lighting and equipment power density, and number of people

	 Lighting and equipment power density, and number of people 	opie	
4041	A	4041	
4042	VOLUME = 963181.998	4042	VOLUME = 963181.998
4043	LTG-SPEC-METHOD = POWER-DEFINITION	4043	LTG-SPEC-METHOD = POWER-DEFINITION
4044	LIGHTING-W/AREA = (1.6)	4044	LIGHTING-W/AREA = (1.604)
4045	EQUIPMENT-W/AREA = (0.5412)	4045	EQUIPMENT-W/AREA = (0.5414)
4046	NUMBER-OF-PEOPLE = 7042.1	4046	NUMBER-OF-PEOPLE = 7044.2
4047	PEOPLE-HG-SENS = 250.0 Nor recall to	4047	PEOPLE-HG-SENS = 250.0
4048	PEOPLE-HG-LAT = 200.0	4048	PEOPLE-HG-LAT = 200.0 Last baseline
4049	AZIMUTH = 0.0	4049	AZIMUTH = 0.0
4050	X = 0.0	4050	X = 0.0
4051	Y = 0.0	4051	Y = 0.0
4052	Z = 0.0	4052	Z = 0.0

Comparison all of the surface counts and areas, and the opening counts and areas between pre- and post-processed gbXML files with zero percent change between the current and the previous release.

