## **Appendix D**

**Building Descriptions** 

## **APPENDIX D**: Building Descriptions

The purpose of the *Building Descriptions* is to assist the user in selecting an appropriate type of building when using the Air Conditioning estimating tools. The selected building type should be the one that most closely matches the actual project. These summaries provide the user with the inputs for the typical buildings. Minor variations from these inputs will occur based on differences in building vintage and climate zone. The *Building Descriptions* are referenced from the 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study. It should be noted that the user is required to provide certain inputs for the user's specific building (e.g. actual conditioned area, city, operating hours, economy cycle, new AC system and new AC system efficiency). The remaining inputs are approximations of the building and are deemed acceptable to the user. If none of the typical building models are determined to be a fair approximation then the user has the option to use the Custom Building approach. The Custom Building option instructs the user how to initiate the Engage Software. The Engage Software is a stand-alone, DOE2 based modeling program.

	Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
1.	Assembly	DEER	Auditorium	33,235	97.8	Thermal Zoning: One zone per activity area.
			Office	765	2.2	Model Configuration: Matches 1994 DEER prototype
			Total	34,000		
						HVAC Systems: The prototype uses Rooftop DX systems, which are changed to Rooftop HP systems for the heat pump
						efficiency measures.
2.	Education -	DEER	Classroom/Lecture	31,500	63.0	Thermal Zoning: One zone per activity area.
	Primary		Dining Area	7,500	15.0	, ,
	School		Exercising Centers and Gymnasium	7,500	15.0	<b>Model Configuration:</b> 1994 DEER model consisted of one building. Current model consists of two identical models,
			Kitchen and Food Preparation	3,500	7.0	each rotated 90 degrees to achieve reasonable distribution of
			Total	50,000		solar gains.
						<b>HVAC Systems:</b> The prototype uses Rooftop DX systems.
						The system is changed to Rooftop HP for the heat pump efficiency measures.
<u> </u>		l				efficiency measures.
3.	Education -	DEER	Classroom/Lecture	88,200	58.8	Thermal Zoning: One zone per activity area.
	Secondary School		Computer Room	3,082	2.1	Model Configuration: 1994 DEER model consisted of one
	School		(Instructional/PC Lab)	22.500	15.0	building. Current model consists of four identical models that
			Dining Area	22,500		comprise that include the classroom, computer room, kitchen,
			Exercising Centers and Gymnasium	22,500	15.0	dining and office areas, each rotated 90 degrees to achieve
			Kitchen and Food Preparation	10,500	7.0	reasonable distribution of solar gains. A fifth building represents the gym.
			Office (General)	3,218	2.1	
			Total	150,000		HVAC Systems: The prototype uses Rooftop DX systems.
						The system is changed to Rooftop HP for the heat pump
						efficiency measures. For built-up system measures applicable to this prototype, the system is VAV, except for the kitchen
						areas, which are served by Rooftop DX systems that are
						changed to Rooftop HP.

	Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
4.	Education -	DEER	Classroom/Lecture	150,825	50.3	Thermal Zoning: One zone per activity area.
	Community		Computer Room	9,625	3.2	
	College		(Instructional/PC Lab)			<b>Model Configuration:</b> 1994 DEER model consisted of one building. Current model consists of two identical models that
			Dining Area	26,250	8.8	comprise that include the classroom, computer room, kitchen,
			Kitchen and Food Preparation	5,625	1.9	dining and office areas, each rotated 90 degrees to achieve
			Office (General)	70,175	23.4	reasonable distribution of solar gains.
			Total	300,000		Č
						<b>HVAC Systems:</b> The prototype uses VAV systems, except for the kitchen areas use Rooftop DX systems that are
						changed to Rooftop HP systems for the heat pump efficiency
						measures.
5.	Education -	DEER	Classroom/Lecture	431,160	43.1	Thermal Zoning: Main instructional buildings use generic
	University		Comm/Ind Work (General Low	80,000	8.0	thermal zones with all activity area characteristics averaged
			Bay)			across the entire zone. The dormitory buildings are zoned by
			Computer Room	27,540	2.8	individual activity area.
			(Instructional/PC Lab)			Model Configuration: 1994 DEER model consisted of two
			Corridor (Dormitory)	30,000	3.0	buildings: one instructional building and one dormitory.
			Dining Area	24,000	2.4	Current model consists of four identical instructional
			Hotel/Motel Guest Room	170,000	17.0	buildings each rotated 90 degrees to achieve reasonable
			(Dormitory)	10.700		distribution of solar gains. There are also two identical
			Kitchen and Food Preparation	10,500	1.1	buildings representing dormitories, each rotated 90 degrees.
			Office (General)	226,800	22.7	HVAC Systems: The prototype uses VAV systems, except
			Total	1,000,000		for the kitchen areas use Rooftop DX systems that are
						changed to Rooftop HP systems for the heat pump efficiency
						measures.

	Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
27.	Education - Relocatable	HPCBS	Classroom/Lecture	1,920	100.0	Thermal Zoning: One zone per activity area.
	Classroom					Model Configuration: Matches HPCBS prototype.
						<b>HVAC Systems:</b> The prototype uses Rooftop DX systems, which are changed to Rooftop HP systems for the heat pump efficiency measures.
6.	Grocery	DEER/	Comm/Ind Work (Loading Dock)	2,860	5.7	Thermal Zoning: One zone per activity area.
		Vacom	Office (General)	3,500	7.0	
			Refrigerated (Food Preparation)	1,268	2.5	Model Configuration: Vacom developed the prototype
			Refrigerated (Walk-in Cooler)	1,560	3.1	based on their experience in providing energy efficiency
			Refrigerated (Walk-in Freezer)	812	1.6	services to grocery stores.
			Retail Sales Grocery	40,000	80.0	HVAC Systems: The prototype uses Rooftop DX systems
			Total	50,000		for the non-refrigerated spaces. These are switched to Rooftop DX systems for heat pump efficiency measures. The refrigerated spaces use detailed refrigeration systems developed using the eQUEST refrigeration version. A complete description of grocery refrigeration systems is included in Section 7.3 Grocery Refrigeration Measures.
7.	Health/Medical	DEER	Dining Area	4,375	1.8	<b>Thermal Zoning:</b> One zone per activity area.
	- Hospital		Kitchen and Food Preparation	1,875	0.8	
			Laboratory Medical	57,917	23.2	Model Configuration: Matches 1994 DEER prototype.
			Medical and Clinical Care	95,000	38.0	<b>HVAC Systems:</b> The prototype uses FPFC systems for the
			Office (General)	90,833	36.3	patient rooms. The kitchen uses a Rooftop DX system, which
			Total	250,000		is changed to a Rooftop HP system for the heat pump efficiency measures. Except for the oldest vintage, VAV systems are used for all other spaces. The oldest vintage uses a CV Reheat system.

	Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
8.	Health/Medical	DEER	Corridor	3,333	5.6	Thermal Zoning: One zone per activity area.
	- Nursing		Dining Area	6,300	10.5	
	Home		Hotel/Motel Guest Room (incl.	26,667	44.4	Model Configuration: Matches 1994 DEER prototype
			toilets) (Patient Rooms)			<b>HVAC Systems:</b> The prototype uses FPFC systems for all
			Kitchen and Food Preparation	2,700	4.5	spaces except the kitchen. The kitchen uses a Rooftop DX
			Office (General)	21,000	35.0	system, which is changed to a Rooftop HP system for the
			Total	60,000		heat pump efficiency measures. FPFC systems are changed to
						a VAV system for any applicable measures for built-up
						systems.
9.		DEER/	Bar Cocktail Lounge	800	0.4	<b>Thermal Zoning:</b> One zone per activity area.
	Hotel	NCC	Corridor	20,085	10.0	,
			Dining Area	1,250	0.6	Model Configuration: The building envelope and
			Hotel/Motel Guest Room (incl.	160,682	80.3	occupancy matches 1994 DEER Prototype. Guestroom areas are divided into unoccupied rooms (40,171 ft²/20%) and
			toilets)			occupied rooms (120,511 ft <sup>2</sup> /60%). HVAC systems are based
			Kitchen and Food Preparation	750	0.4	on NCC.
			Laundry	4,108	2.1	
			Lobby (Hotel)	8,217	4.1	HVAC Systems: The kitchen is served by a Rooftop DX
			Office (General)	4,108	2.1	system which is changed to a Rooftop HP system for the heat
			Total	200,00		pump efficiency measures. The remaining public areas are served by a CV Reheat system for the oldest vintage, VAV
						systems for the second and third vintages and Rooftop VAV
						systems for the latest two vintages. Guestrooms are served by
						FPFC systems for the first three vintages and PTHP systems
						for the latest two vintages.

	Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
10.	Lodging -	DEER	Corridor	3,333	11.1	Thermal Zoning: One zone per activity area.
	Motel		Hotel/Motel Guest Room (incl.	25,587	85.3	
			toilets)			Model Configuration: Matches 1994 DEER configuration.
			Laundry	480	1.6	Guestrooms are divided among 12 hour occupied (12,794 $ft^2/42.6\%$ ), 24-hour occupied (6,397 $ft^2/21.3\%$ ) and
			Office (General)	600	2.0	unoccupied rooms (6,397 ft $^2$ /21.3%).
			Total	30,000		
						<b>HVAC Systems:</b> The oldest vintage uses PTAC systems with electric resistance heating. All other vintages use PTHP systems.
11.	Manufacturing - Bio/Tech	NCC	Comm/Ind Work (High Tech Bio Tech Lab)	90,669	45.3	<b>Thermal Zoning:</b> The model uses generic thermal zones with all activity area characteristics averaged across the entire
			Computer Room (Mainframe/Server)	4,000	2.0	zone.
			Conference Room	4,000	2.0	Model Configuration: Matches NCC prototype.
			Corridor	40,001	20.0	HVAC Systems: The prototype uses Rooftop DX systems,
			Dining Area	6,000	3.0	which are changed to Rooftop HP systems for the heat pump
			Kitchen and Food Preparation	2,000	1.0	efficiency measures.
			Office (General)	53,330	26.7	
			Total	200,000		
12.	Manufacturing	DEER	Comm/Ind Work (General High	80,000	80.0	Thermal Zoning: One zone per activity area.
	- Light		Bay)			
	Industrial		Storage (Unconditioned)	20,000	20.0	Model Configuration: Matches 1994 DEER prototype
			Total	100,000		<b>HVAC Systems:</b> The prototype uses Rooftop DX systems, which are changed to Rooftop HP systems for the heat pump efficiency measures.

Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
13. Office - Large	NCC	Conference Room	7,000	4.0	Thermal Zoning: The model uses generic thermal zones
		Copy Room (photocopying	3,500	2.0	with all activity area characteristics averaged across the entire
		equipment)			zone.
		Corridor	17,500	10.0	Model Configuration: Matches NCC prototype.
		Lobby(Office Reception/Waiting)	8,750	5.0	Woder Comiguration: Matches NCC prototype.
		Mechanical/Electrical Room	7,000	4.0	HVAC Systems: The oldest vintage uses a CV Reheat
		Office (Executive/Private)	43,750	25.0	systems, and all other vintages us VAV systems.
		Office (Open Plan)	78,750	45.0	
		Restrooms	8,750	5.0	
		Total	175,000		
14. Office - Small	NCC	Conference Room	400	4.0	Thermal Zoning: The model uses generic thermal zones
		Copy Room (photocopying	200	2.0	with all activity area characteristics averaged across the entire
		equipment)			zone.
		Corridor	1,000	10.0	Model Configurations Metaless NCC greateting
		Lobby (Office	500	5.0	Model Configuration: Matches NCC prototype.
		Reception/Waiting)			HVAC Systems: The prototype uses Rooftop DX systems,
		Mechanical/Electrical Room	400	4.0	which are changed to Rooftop HP systems for the heat pump
		Office (Executive/Private)	7,000	70.0	efficiency measures.
		Restrooms	500	5.0	
		Total	10,000		
15. Restaurant -	DEER	Dining Area	2,000	50.0	Thermal Zoning: One zone per activity area.
Sit-Down		Kitchen and Food Preparation	1,200	30.0	
		Lobby (Main Entry and	600	15.0	Model Configuration: Matches 1994 DEER prototype
		Assembly)			HVAC Systems: The prototype uses Rooftop DX systems,
		Restrooms	200	5.0	which are changed to Rooftop HP systems for the heat pump
		Total	4,000		efficiency measures.

	Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
16.	Restaurant -	DEER	Dining Area	1,000	50.0	Thermal Zoning: One zone per activity area.
	Fast-Food		Kitchen and Food Preparation	300	15.0	
			Lobby (Main Entry and	600	30.0	Model Configuration: Matches 1994 DEER prototype
			Assembly)			HVAC Systems: The prototype uses Rooftop DX systems,
			Restrooms	100	5.0	which are changed to Rooftop HP systems for the heat pump
			Total	2,000		efficiency measures.
17.	Retail - 3-Story	DEER	Office (General)	6,000	5.0	Thermal Zoning: One zone per activity area.
	Large		Retail Sales and Wholesale	96,000	80.0	
			Showroom			Model Configuration: Matches 1994 DEER prototype
			Storage (Conditioned)	18,000	15.0	HVAC Systems: The oldest vintage uses a CV Reheat
			Total	120,000		systems, and all other vintages us VAV systems.
18.	Retail - Single-	NCC	Auto Repair Workshop	5,165	4.0	Thermal Zoning: One zone per activity area.
	Story Large		Kitchen and Food Preparation	1,462	1.1	
			Office (General)	4,698	3.6	Model Configuration: Matches NCC prototype.
			Retail Sales and Wholesale Showroom	107,273	82.2	<b>HVAC Systems:</b> The prototype uses Rooftop DX systems, which are changed to Rooftop HP systems for the heat pump
			Storage (Conditioned)	11,902	9.1	efficiency measures.
			Total	130,000		•
19.	Retail - Small	DEER	Retail Sales and Wholesale	6,400	80.0	Thermal Zoning: One zone per activity area.
			Showroom			
			Storage (Conditioned)	1,600	20.0	Model Configuration: Matches 1994 DEER prototype
			Total	8,000		<b>HVAC Systems:</b> The prototype uses Rooftop DX systems,
						which are changed to Rooftop HP systems for the heat pump
						efficiency measures.

	Prototype	Source	Activity Area Type	Area	% Area	Simulation Model Notes
20.	Storage - Conditioned	NCC	Storage (Conditioned)	500,000	100.0	<b>Thermal Zoning:</b> The model uses generic thermal zones with all activity area characteristics averaged across the entire zone.
						Model Configuration: Matches NCC prototype.
						<b>HVAC Systems:</b> The prototype uses Rooftop DX systems, which are changed to Rooftop HP systems for the heat pump efficiency measures.
21.	Storage - Unconditioned	NCC	Storage (Unconditioned)	500,000	100.0	<b>Thermal Zoning:</b> The model uses generic thermal zones with all activity area characteristics averaged across the entire zone.
						Model Configuration: Matches NCC prototype.
						<b>HVAC Systems:</b> The prototype uses UH systems only for freeze protection.
22.	C	Vacom	Comm/Ind Work (Loading Dock)	8,000	8.0	Thermal Zoning: One zone per activity area.
	Refrigerated		Office (Executive/Private)	2,000	2.0	
	Warehouse		Refrigerated (Cooled Storage)	49,950	50.0	<b>Model Configuration:</b> Vacom developed the prototype based on their experience in providing energy efficiency
			Refrigerated (Food Preparation)	40,050	40.1	services to refrigerated warehouses.
			Total	100,000		HVAC Systems: The prototype uses Rooftop DX systems for the non-refrigerated spaces. These are switched to Rooftop DX systems for heat pump efficiency measures. The refrigerated spaces use detailed refrigeration systems developed using the eQUEST refrigeration version. A complete description of grocery refrigeration systems is included in Section 7.4 Refrigerated Warehouse Measures.