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Fall 2015

## Existing Retrofit for Enhanced Performance

Portland State University. School of Architecture

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### Recommended Citation

Portland State University. School of Architecture, "Existing Retrofit for Enhanced Performance" (2015). *Research-Based Design Initiative*. 57.

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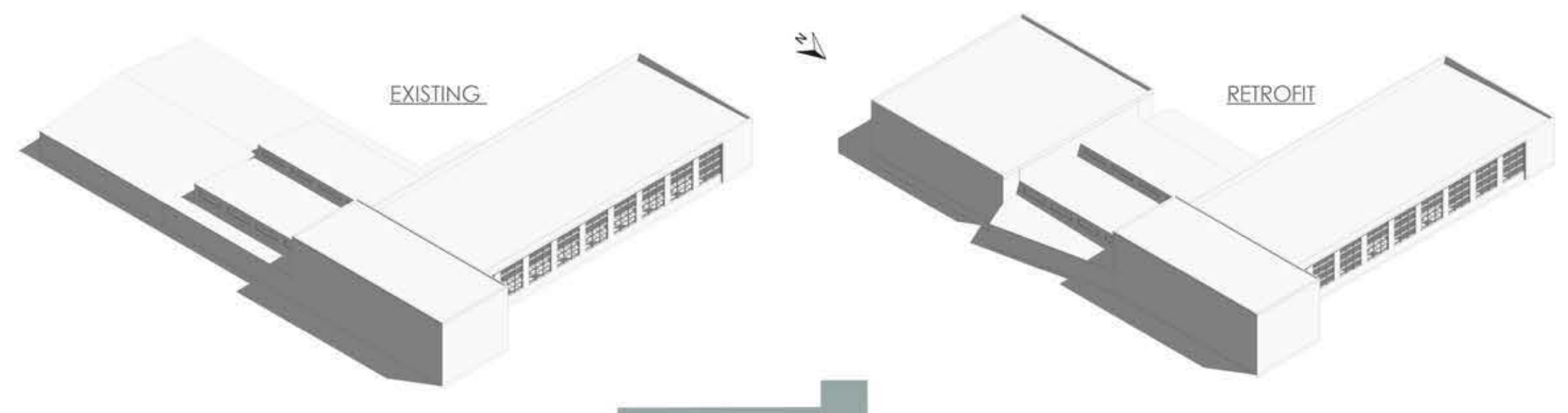
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# EXISTING RETROFIT FOR ENHANCED PERFORMANCE



Hacker is renovating Cruess Hall on the University of California, Davis campus. It is a 22,000 sf structure built in 1959. Over the years it has had many uses included being a meat processing plant and is to become a multi-use space which will include an auditorium and wood shop to name a few.

UC DAVIS CRUESS HALL ENVELOPE ANALYSIS



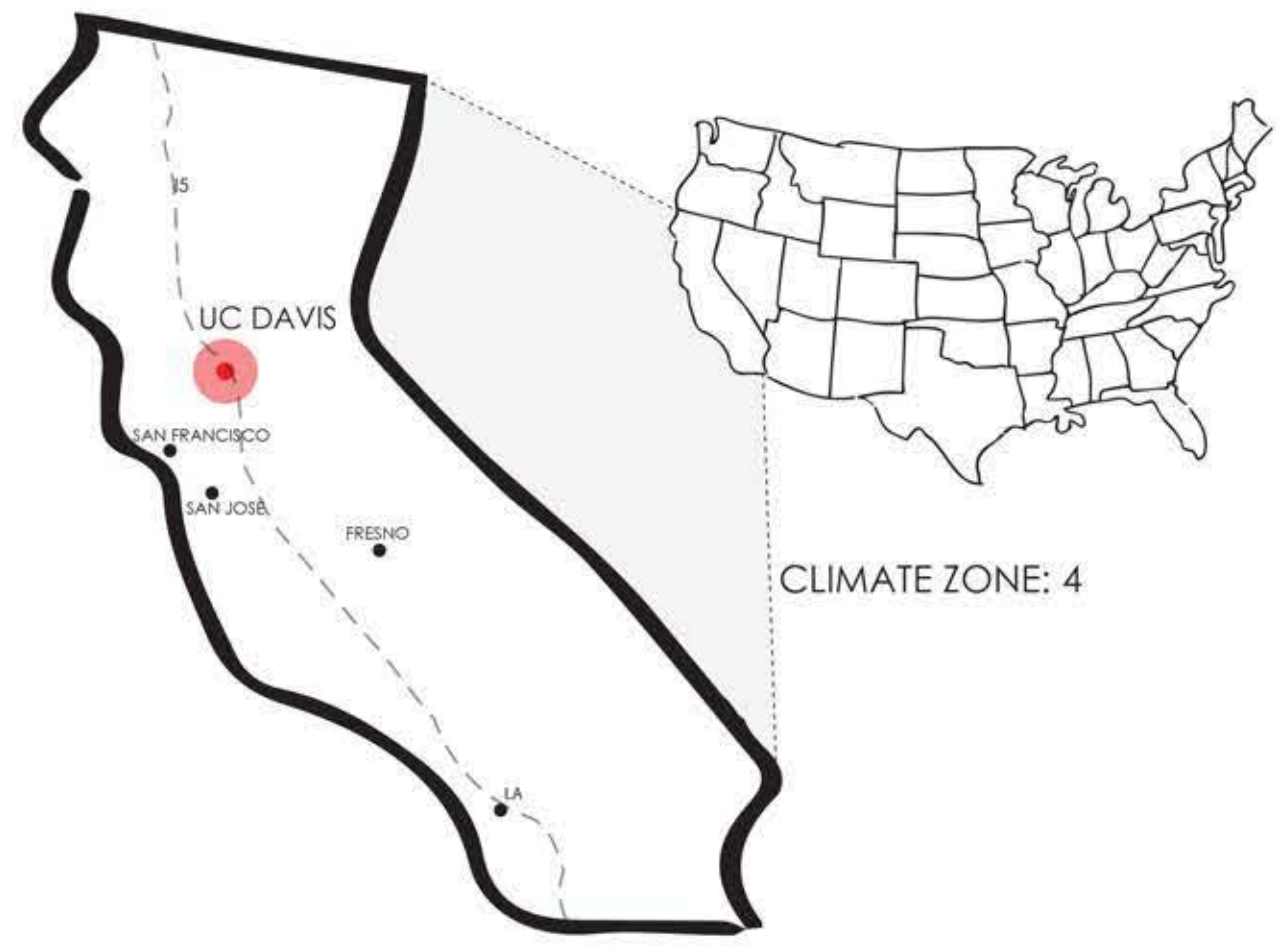
### FACADE GLAZING:

- North Elevation = 49%
- East Elevation = 5.5%
- South Elevation = 7%
- West Elevation = 0%
- No skylights or roof glazing

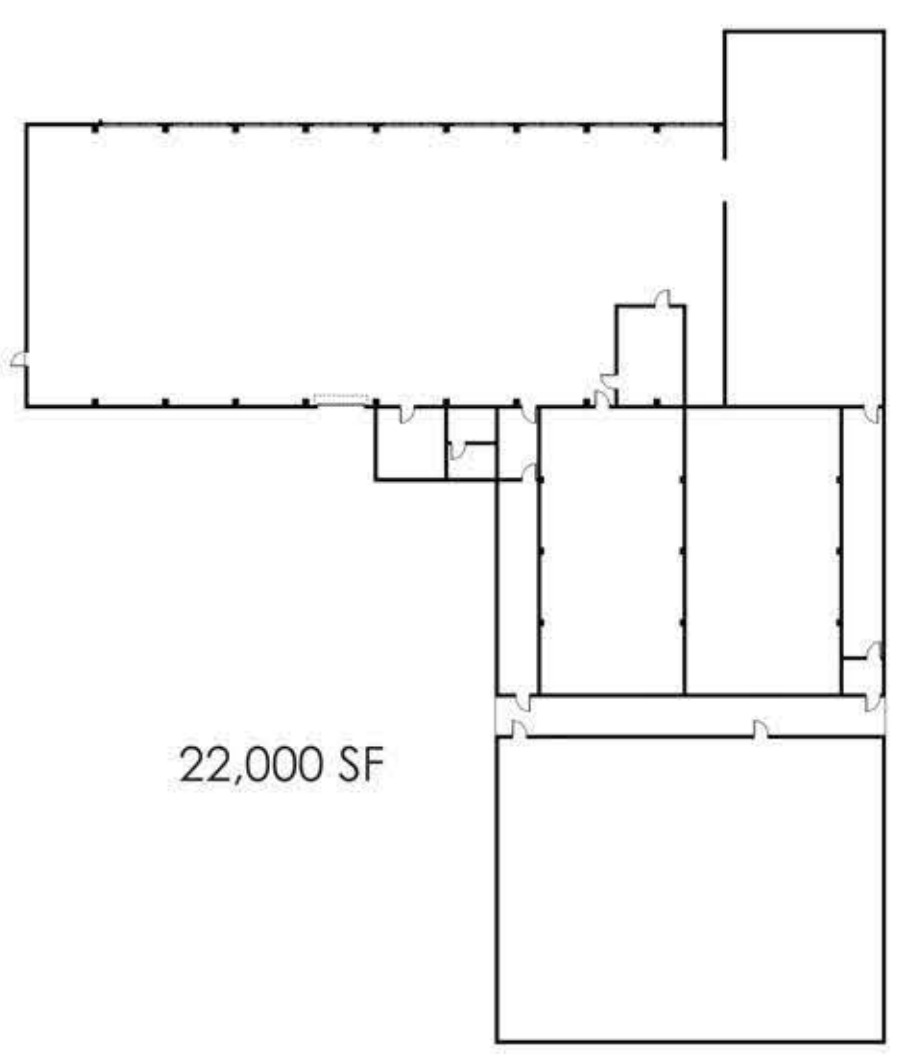
### OCCUPANCY:

Occupied 9 months out of the year. With full 100% occupancy during weekdays from 8am-5pm and 50% occupancy from 5pm-9pm to account for night classes. On weekends light occupancy ranging from 10-25% is assumed for shop use.

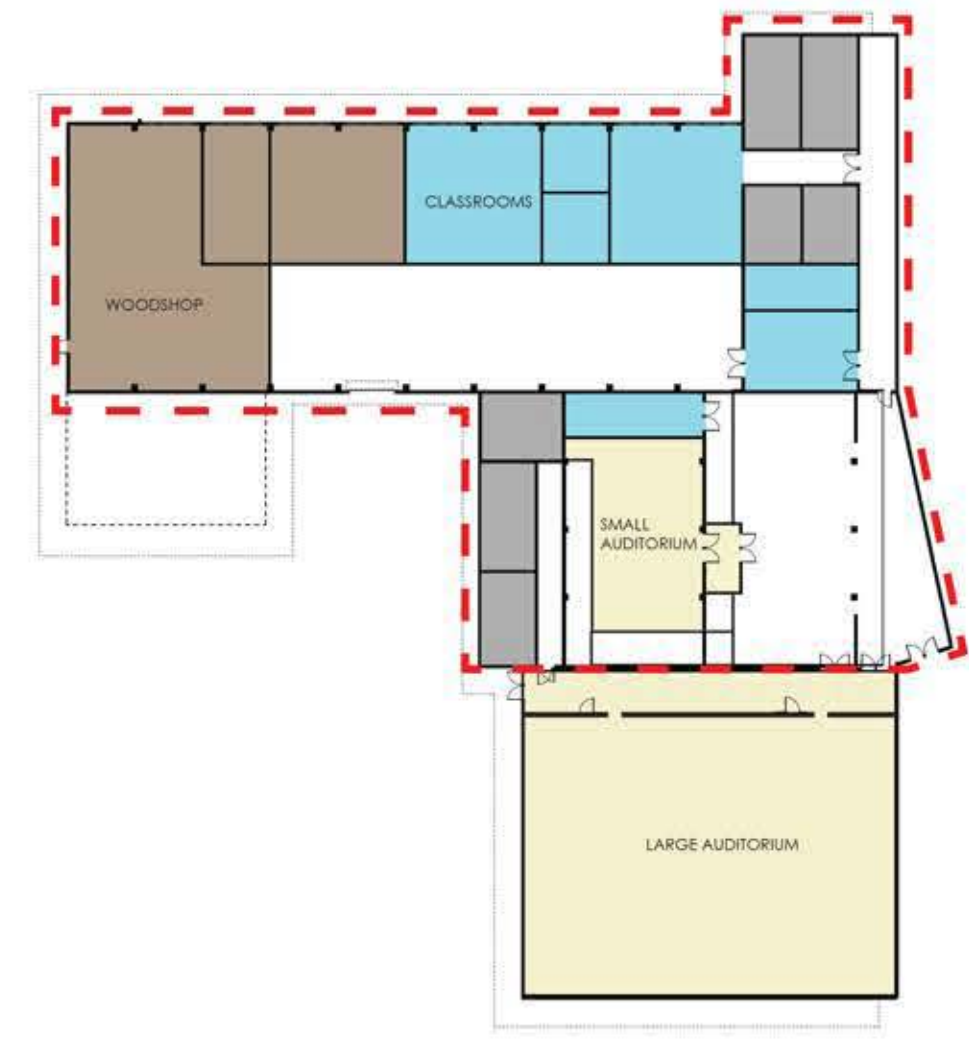
### LOCATION: CALIFORNIA



### EXISTING CONDITIONS:



### RETROFIT WITH NEW CONSTRUCTION:



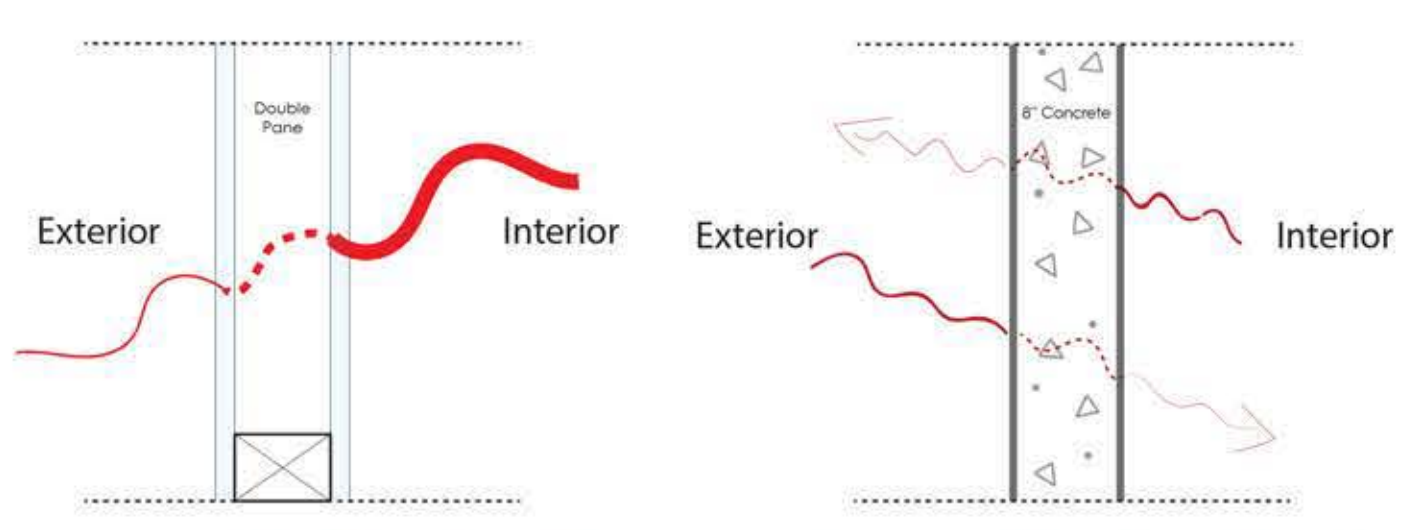
### TESTING RETROFIT OPTIONS

Category	Option	U-Value	SHGC	EUI
WALL INSULATION	Existing (R4)	-	-	55 EUI
	ADD 2" OF RIGID INSULATION (2" Total)	R5	-	52 EUI
	ADDITIONAL 2" OR RIGID INSULATION (4" Total)	R11	-	50 EUI
	ADDITIONAL 2" OR RIGID INSULATION (8" Total)	R24	-	50 EUI
ROOF INSULATION	Existing (R9)	-	-	49 EUI
	Roof on sloped steel structure with 4" of insulation	R22	-	43 EUI
	Roof on sloped steel structure with 6" of insulation	R37	-	41 EUI
WINDOW GLAZING	Existing (U-FTR: .52, SHGC: .4)	.52	.4	56 EUI
	PERFORMANCE DOUBLE GLAZING (low-e) including frame and sash	.37	.4	55 EUI
	TRIPLE GLAZING including frame and sash	.18	.4	55 EUI
Overall Building	Existing Assembly	-	-	56 EUI
	Optimal Performance Bundle	-	-	36 EUI
	Best Value Bundle	-	-	38 EUI

### WHAT IS BEING MEASURED?

$$EUI = \frac{\text{Energy Use}}{\text{Intensity}} \text{ sf/yr}$$

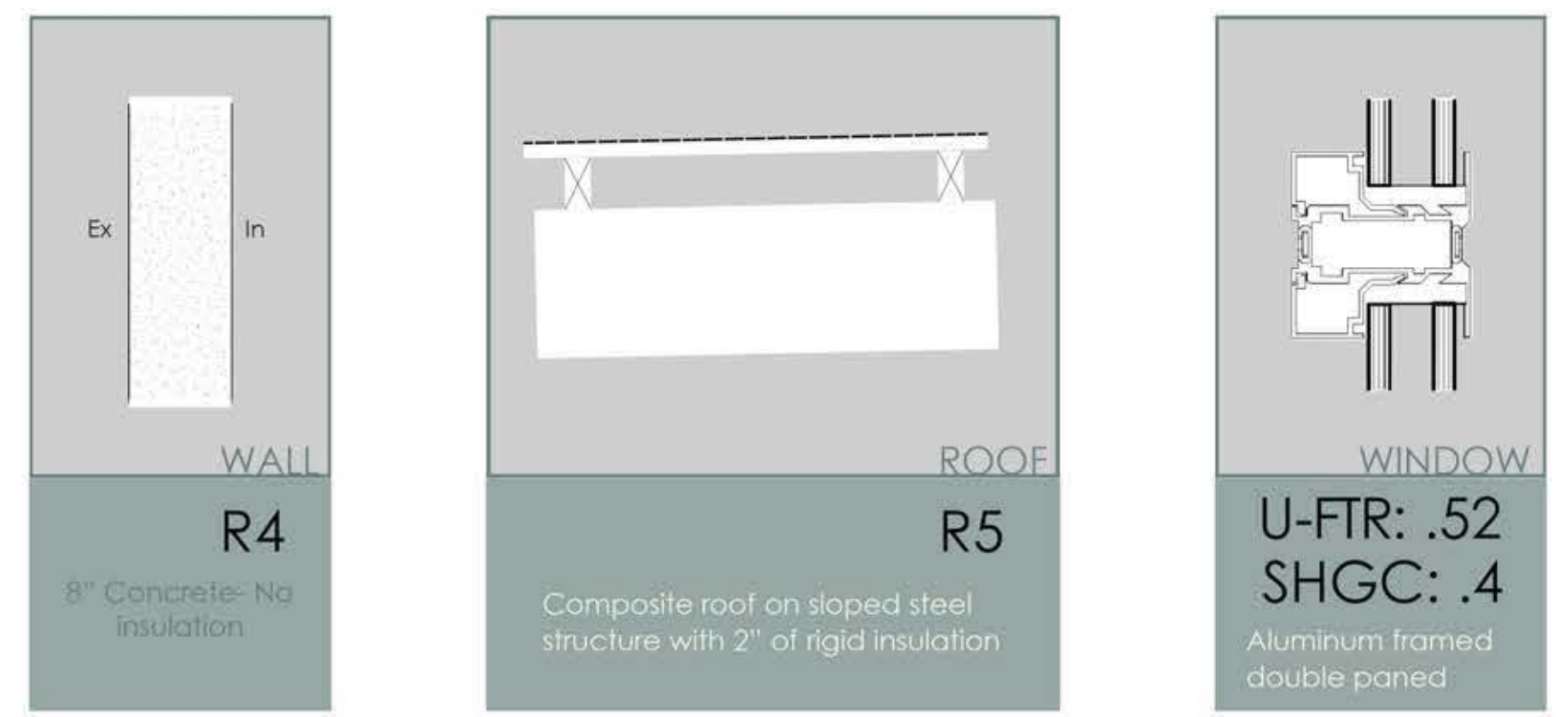
$$\text{ANNUAL ENERGY USE} \div \text{TOTAL SF} = \text{EUI}$$



$$U_{\text{Value}} = \frac{H E A T}{L O S S}$$

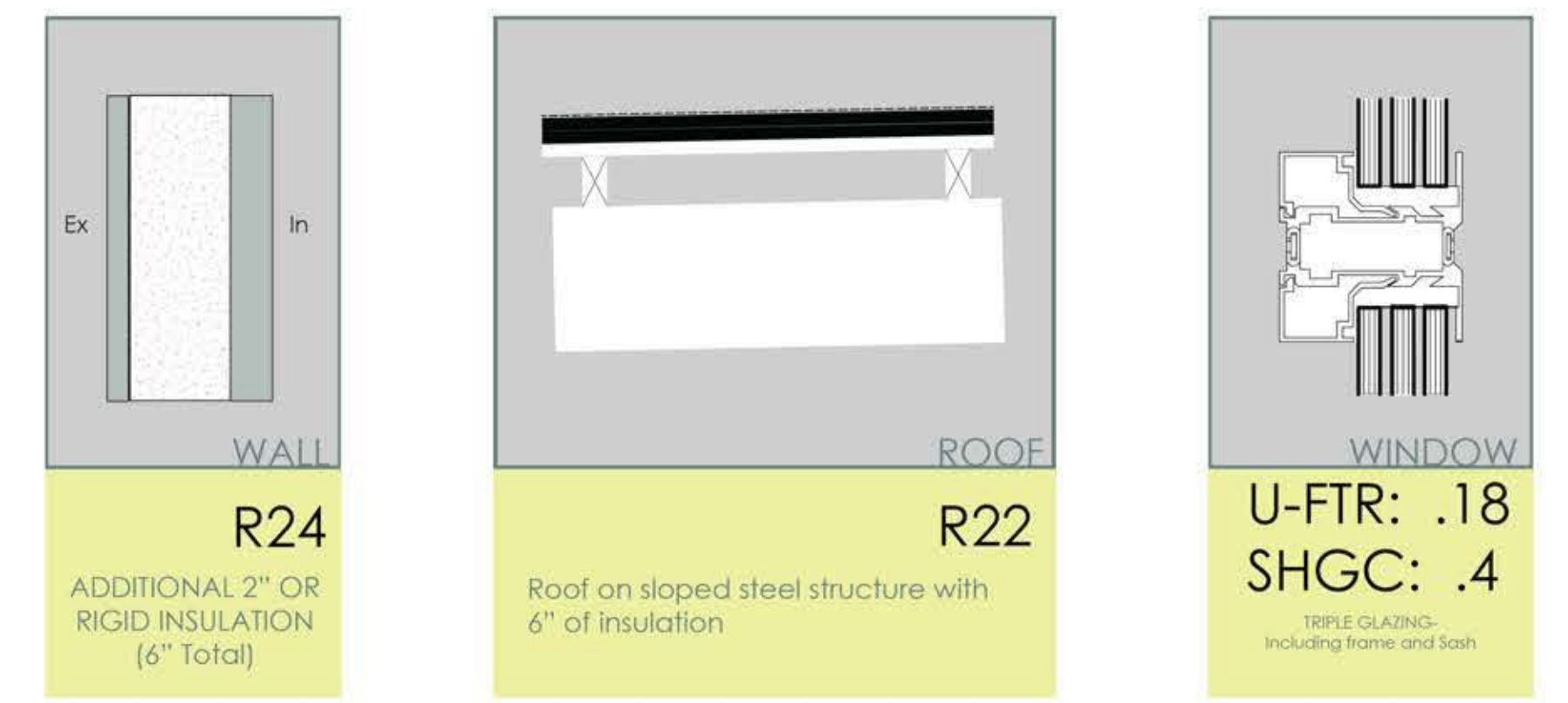
$$R_{\text{Value}} = \frac{H E A T}{R E S I S T A N C E}$$

### EXISTING ASSEMBLY



Annual Energy Consumption: 1,171,069 kBtu  
EUI: 56

### OPTIMAL ASSEMBLY



Annual Energy Consumption: 948,598 kBtu  
EUI: 36