



Trailblazing Net Zero Energy Early Learning Center

Prairie Trails School
Mount Prospect, Illinois

October 7, 2022 v8
4:30- 5:30 pm CDT

FGMAARCHITECTS

IMEG



Introductions

Ron Richardson, Moderator
- *Vice President, FGM Architects*

Lyndl Schuster, Speaker
- *Asst. Supt for Business Services, River Trails School District 26*

Dan Whisler, Speaker
- *Director of Buildings and Grounds, River Trails School District 26*

Troy Kerr, Speaker
- *Vice President, FGM Architects*

Jeff Oke, PE, LEED AP
- *Senior Principal / Client Executive IMEG Corp.*

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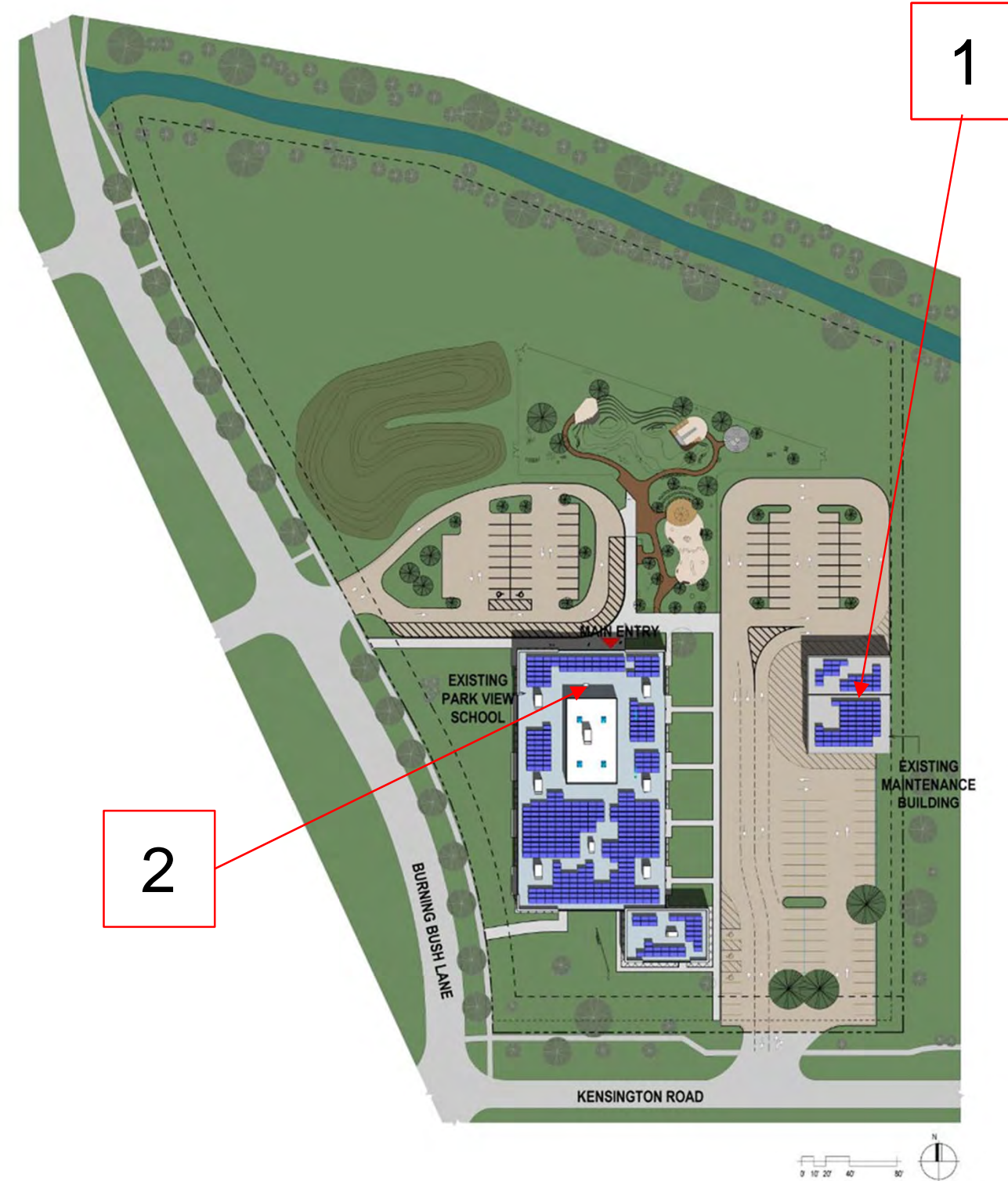
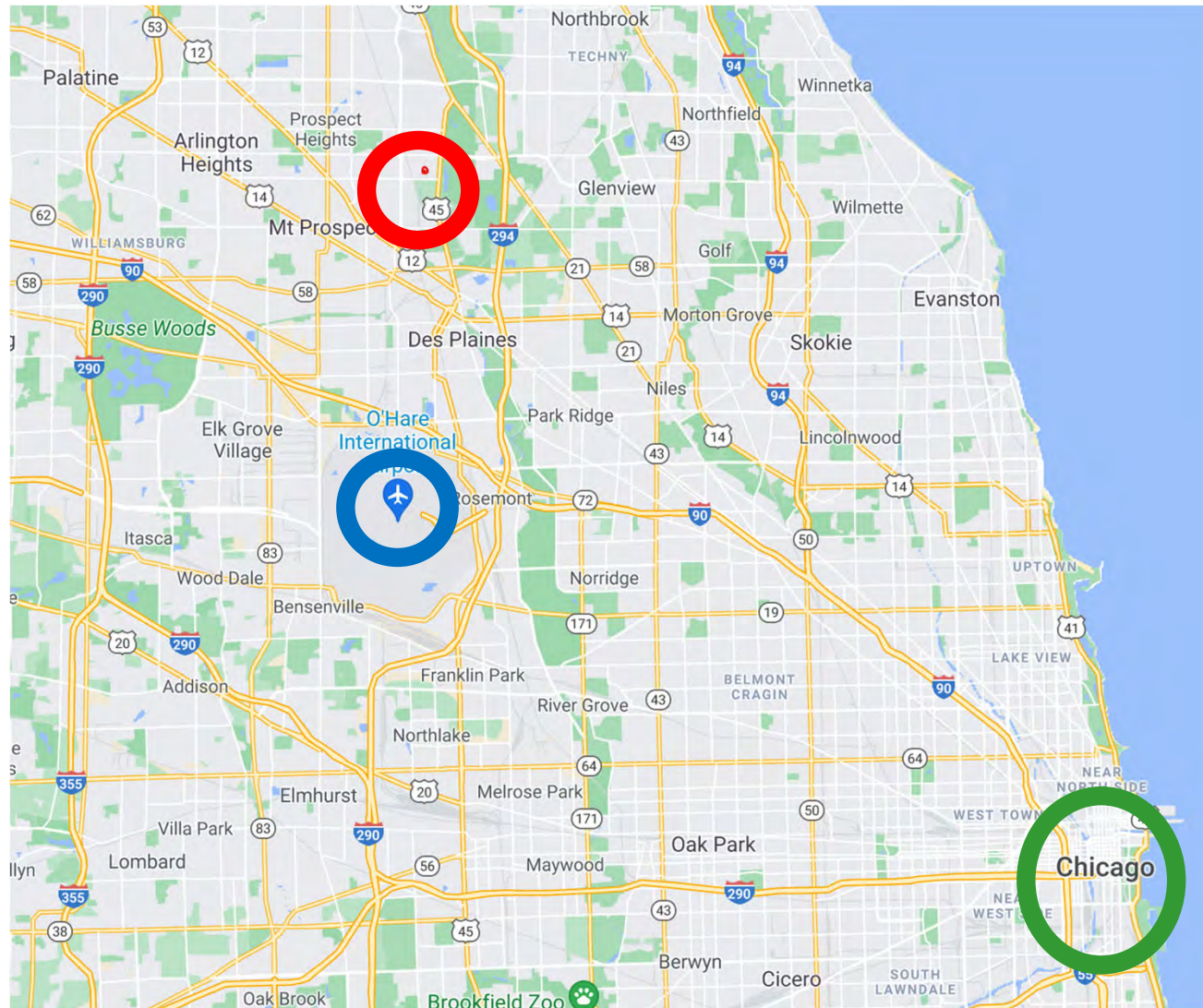
Agenda

- Introductions
- About District 26
- Sustainable Features
- Envelope Modifications
- Mechanical System Overview
- Building and Site Safety Improvements
- ADA Improvements
- Operational Lessons Learned
- Cost Information

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Prairie Trails Background:

- Building Area- Approx. 29,000 sf
- District Needed Classroom Space



About District 26

GREEN SPOTLIGHT
Keep looking up

When you look up, you can see the sun, the moon, and the stars. You can also see the air that is around you. The air is made of tiny particles that are always moving. This is why we can feel the wind.

THE OLD BLOW HARD

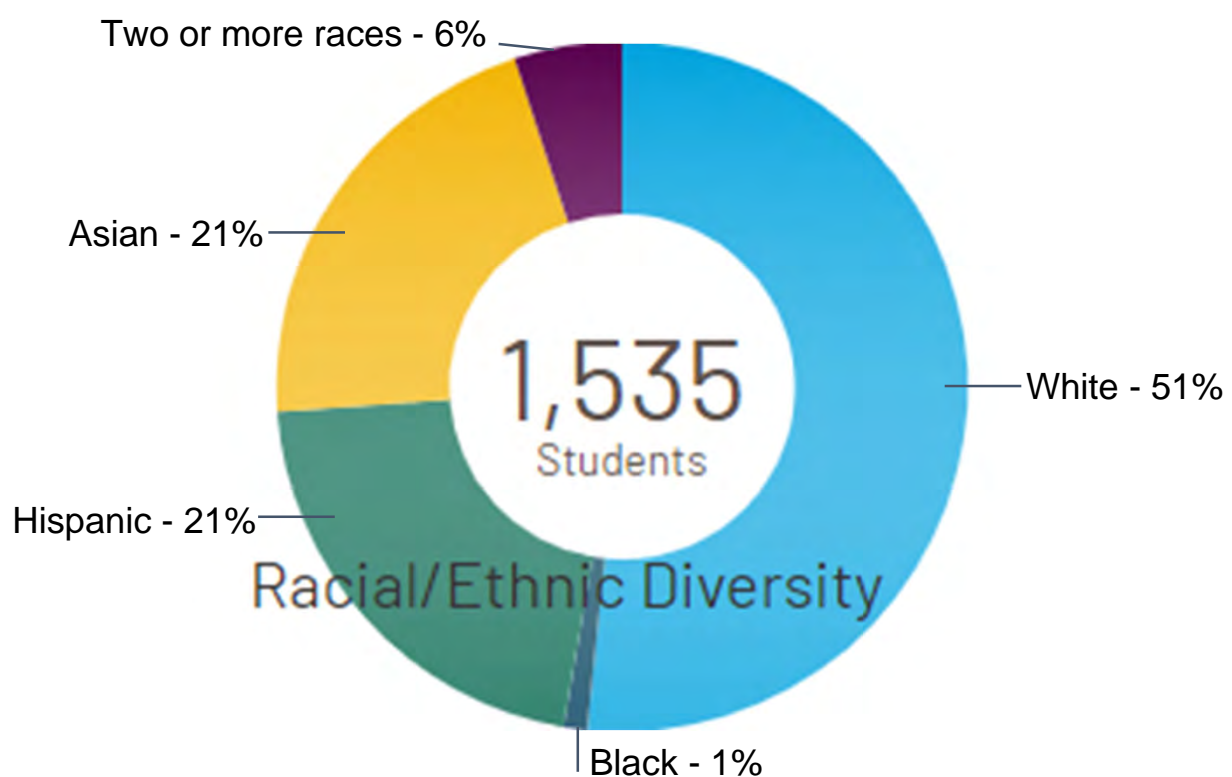
When you blow hard, you can feel the air moving. This is because the air is made of tiny particles that are always moving. When you blow hard, you are pushing the air particles together. This makes the air move faster.

A LOT OF HOT AIR AND COOL AIR, TOO

Hot air rises and cool air sinks. This is why you can feel the wind. The wind is made of tiny particles that are always moving. When you feel the wind, you are feeling the air particles that are moving.

TOUCH





- ❖ **Suburban Chicago School District**
- ❖ **1535 Students in 4 schools**
- ❖ **1 Pre-K and K School (Prairie Trails)**
- ❖ **2 Elementary Schools (1 to 5)**
- ❖ **1 Middle School (6-8)**
- ❖ **49 languages spoken**
- ❖ **25% Low Income**
- ❖ **22% English Learners**
- ❖ **Average per-pupil expenditure: \$15,615**



- ❖ U.S. Dept. of Education 2015 **Green** Ribbon School
 - ❖ River Trails Middle School

- ❖ **Energy Star** Certification at all schools

- ❖ U.S. Dept. of Energy
 - ❖ Better Buildings Challenge Award
 - ❖ Achieve 20% Improvement in Energy Efficiency by 2026
 - Accomplished in 2015
 - ❖ New Goal of 30% by 2026
 - ❖ Better Climate Challenge participation
 - ❖ 2021 Building Envelope Campaign Awardee/Retro 50

- ❖ Illinois Clean Energy Community Foundation
 - ❖ \$2 million grant for Net Zero Energy Renovated School

- ❖ Metropolitan Water Reclamation District of Greater Chicago
 - ❖ Green Infrastructure Partnership Program
 - ❖ Permeable Paver Parking Lot and Rain Gardens



Board



Administration



Passionate Teachers



Students



Community



Sustainable Features



Performance Highlights

- **Baseline** ASHRAE 90.1 EUI **75** kbtu/yr./sf
- **Target EUI** **24-26** kbtu/yr./sf
- Baseline carbon footprint/year: **174** metric tons
- Anticipated carbon footprint/year: **-24** metric tons
- **Carbon footprint reduction** **100+%**
- Estimated annual energy savings to District 26: **+/- \$30,000 /100%**
cost savings





PRAIRIE TRAILS
SCHOOL

Highlights:

- Completed summer 2021
- **Net Zero energy usage**
- **No natural gas** service to the school.
- Target **EUI of 24 to 26**
- Certification achieved through the **Passive House Institute US (PHIUS)**.
The project meets PHIUS+ and PHIUS+ Source Zero performance criteria.
 - PHIUS+ is a “high-performance building standard” – it challenges the building industry to construct buildings that can maintain a comfortable indoor environment **with very low operating energy**.



Highlights:

- Mechanical system
 - The existing hot water boiler system will be replaced with a **new electric variable refrigerant flow (VRF) system with heat recovery**. The VRF system is coupled with dedicated outside air units with energy recovery wheels for fresh air delivery. The multipurpose room will be conditioned by a single zone variable air volume packaged rooftop unit with energy recovery wheel and fresh air via demand control ventilation.
 - Code minimum: hot water boiler and air-cooled chiller serving unit ventilators
- New temperature controls: **load-specific electrical monitoring**, including plug loads, lighting loads, HVAC loads, and energy generation from the PV panels. Integration (monitoring and display) of the net-zero technologies will be through the BAS system. (The BAS system will monitor, not control, the solar panels)

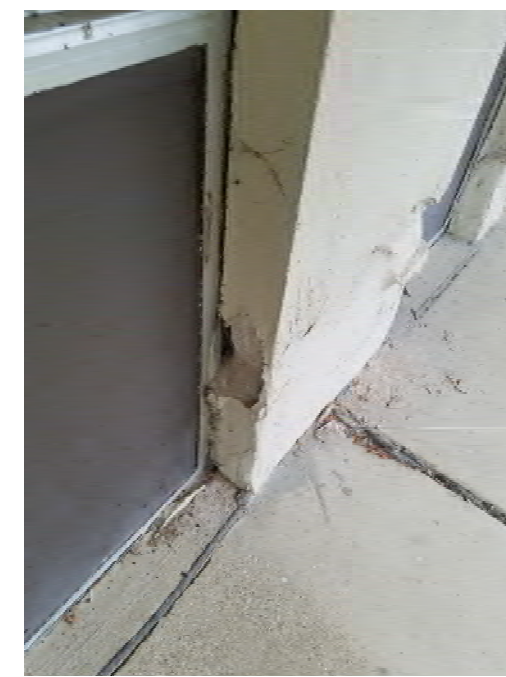
- The remodeling will include **new LED lighting**, with light harvesting, to reduce energy consumption
- New solar panel system to produce electricity
 - **New rooftop photovoltaic system to generate on-site renewable energy.**
The annual production target is currently 227.1 MWh, which includes a 15% buffer (grant- 10%)



Envelope Modifications



Existing Envelope



Existing vs. Code vs. Installed

- Wall Insulation, Existing: None (uninsulated)
- Wall Insulation, Code: R-20 (Zone 5)
- Wall Insulation, Installed: R-24
- Air Barrier, Existing: None
- Air Barrier, Code: 0.04 cfm/sq. ft.
- Air Barrier, Installed: 0.004 cfm/sq. ft.
- Roof Insulation, Existing: R-4 (3/4" Rigid Insulation)
- Roof Insulation, Code: R-30
- Roof Insulation, Installed: R-65
- Window U-Value, Existing: None (single pane)
- Window U-Value, Code: U-0.38
- Window U-Value, Installed: U-0.12



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THIS IS HOW YOU MAKE A WALL SANDWICH

First, you need a strong foundation. Then, you add a layer of concrete. Next, you add a layer of insulation. Finally, you add a layer of sheathing. This is how you make a wall sandwich.

FIBER CEMENT BOARD
"A COAT OF ARMOR"

**REINFORCED
ATTACHMENT SYSTEM**
MEETS BIG INSULATION

THE AIR BARRIER
STARTS OUT ALL WET

**GYPSON
SHEATHING BOARD**
MAKES A HARD SHELL

METAL STUDS
HOLD IT TOGETHER

**THE OLD WALL
SUPPORTS IT ALL**

Mechanical System Overview



Mechanical System Selection

System/ Plant	EUI		Energy Cost	
	(kBtu/ sqft/ yr)	% Savings	(\$/yr)	% Savings
Baseline: 90.1-2013	75	-	\$ 30,128	-
Single Pipe Hybrid Geothermal	20	74%	\$ 21,854	27%
Single Pipe 100% Geothermal	20	74%	\$ 21,682	28%
VRF Hybrid Geothermal	17	78%	\$ 18,264	39%
VRF 100% Geothermal	16	78%	\$ 18,026	40%
VRF Air Cooled	23	69%	\$ 25,327	16%

Energy Source	Utility Costs	
	Electric	\$0.086 per kWh
Natural Gas	\$0.386 per therm	\$0.004 per kBtu

Envelope Assumptions	
Exterior Wall:	R-18 (U-0.055)
Roof:	U-0.032
Windows:	U-0.42 and SHGC: 0.40
Window to Wall Ratio:	35%

DOAS Coupled with VRF System



Dedicated Outside Air System (DOAS)

DOAS Components:

ECM Motor Fan

Electronically Commutated Motor

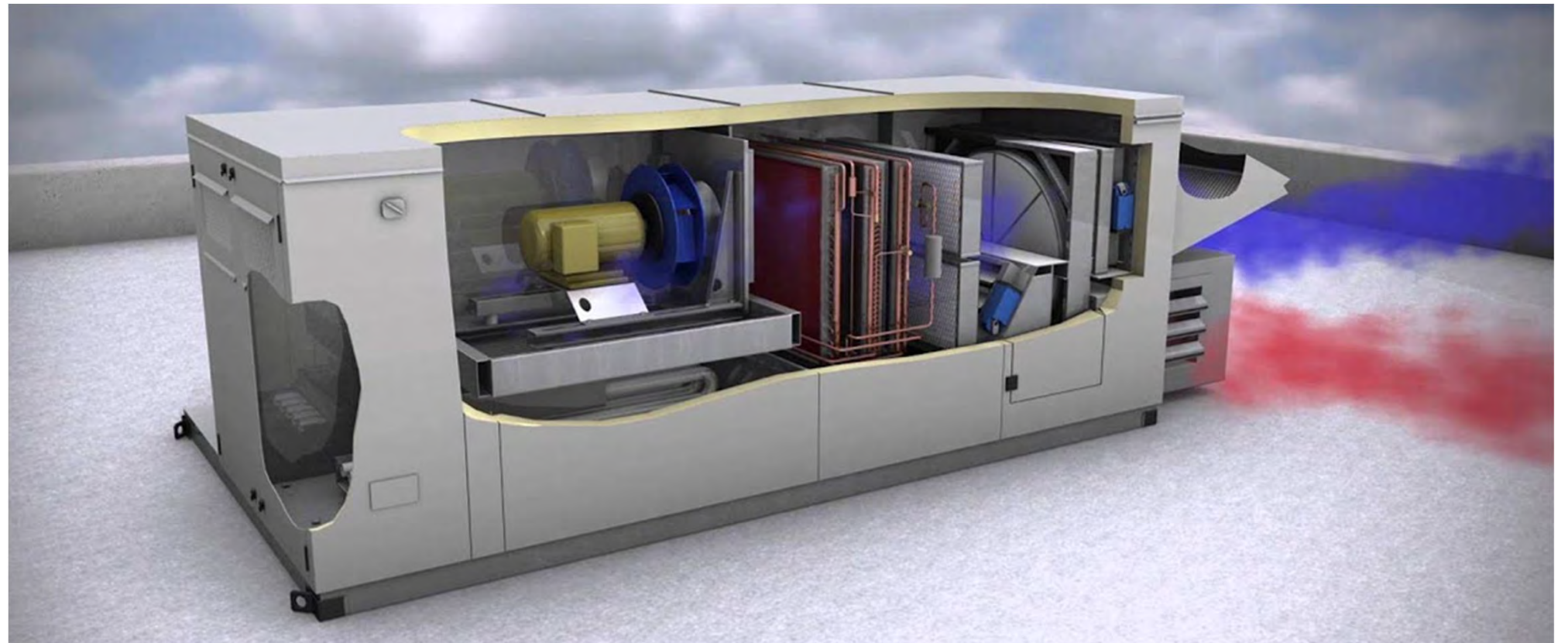
Energy Recovery Wheel

All building exhaust is recovered

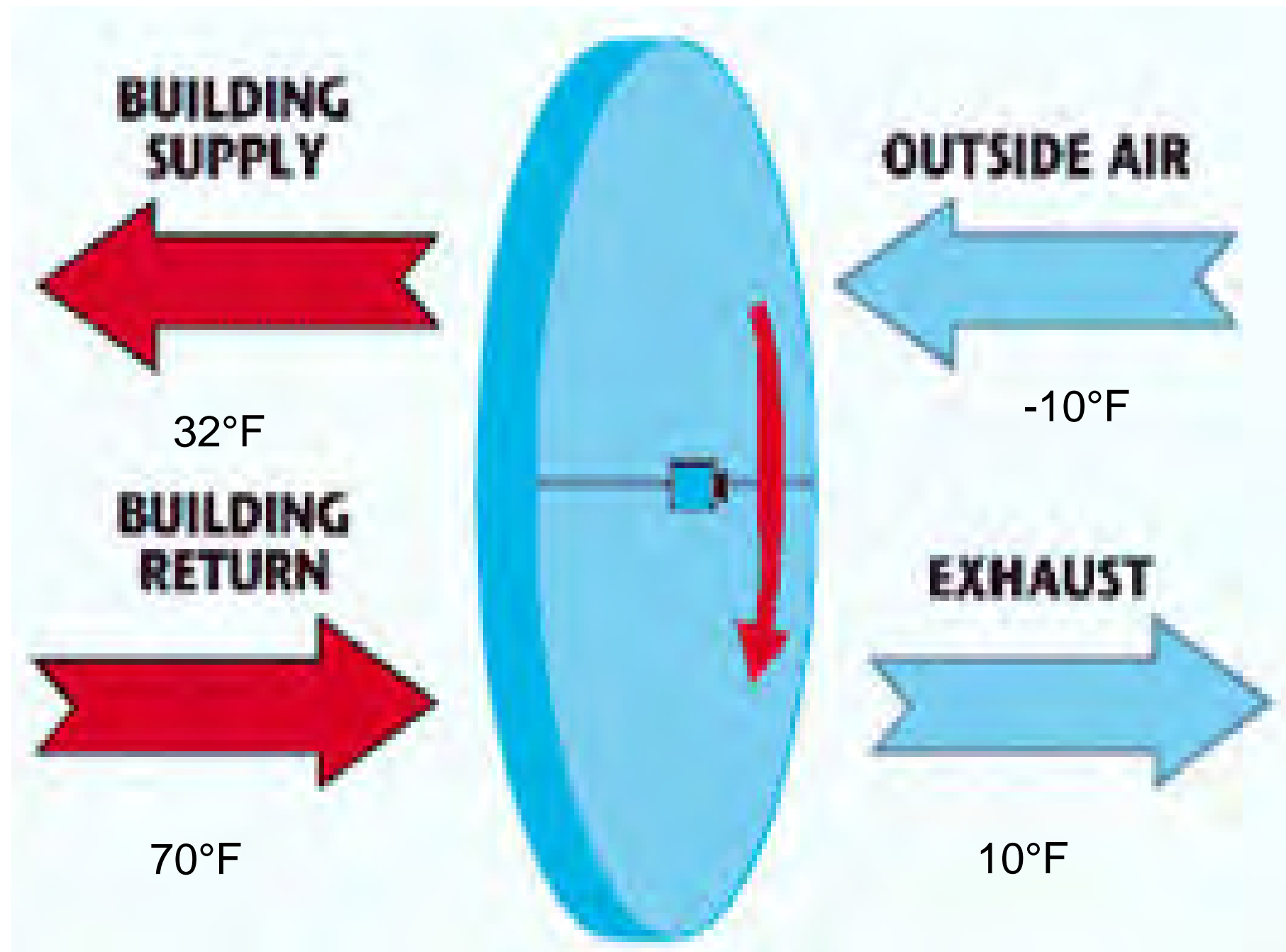
Digital Scroll Compressors

Heat Pump Heating

Coefficient of Performance of 2.3
Operates in heating down to 0°F



Energy Recovery

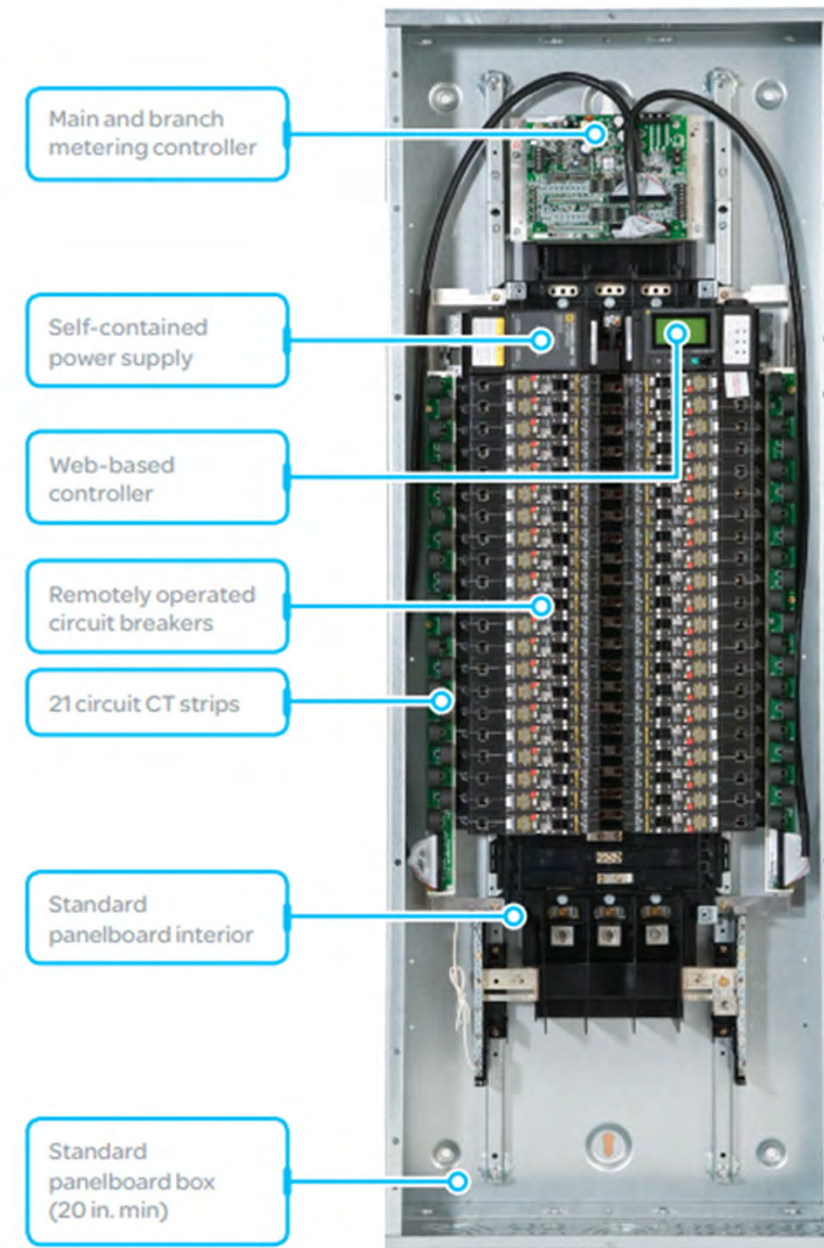


Dedicated Outdoor Air Systems



Energy Efficient Lighting and DHW

- All LED Lighting
- All lighting on vacancy sensor or occupancy sensor where possible
- DHW loop on thermostat-controlled “on demand” system
- Measurement and verification electrical panels for energy monitoring



EXIT

EXIT

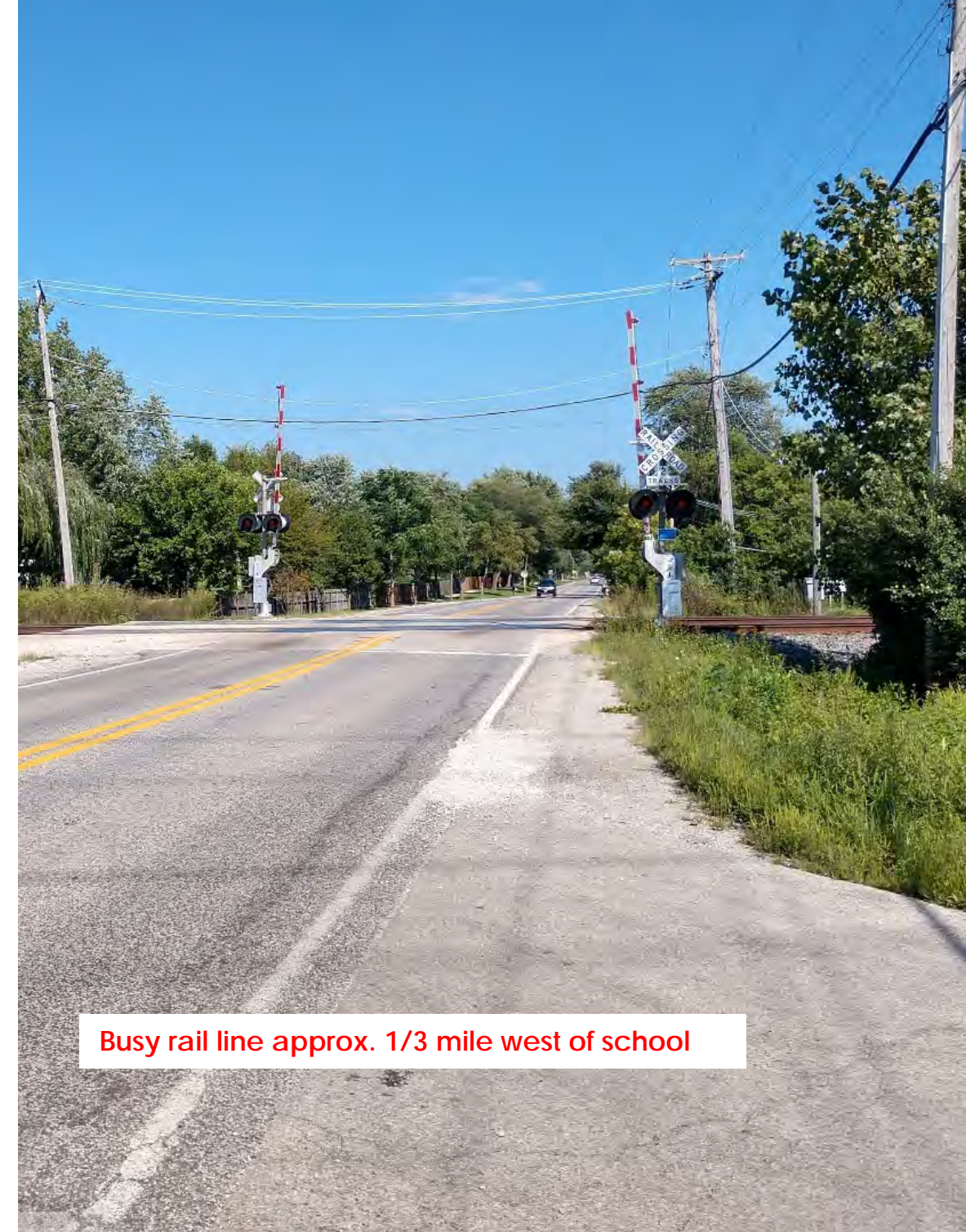
Building and Site Safety Improvements



INTEGRATION WITH DESIGN

Credible Treat 1: Hazardous Materials

- Mt. Prospect First Responders were concerned that the school's proximity to the train tracks put the students and staff at risk in the event of a derailment
- While the school's location isn't changing, provisions can be put into place to address this type of threat
- **The rework of Park View allows the opportunity to replace and modernize the HVAC system and controls. This would include the ability to shut down all outside air, allowing the occupants to shelter-n-place in the building.**



Busy rail line approx. 1/3 mile west of school

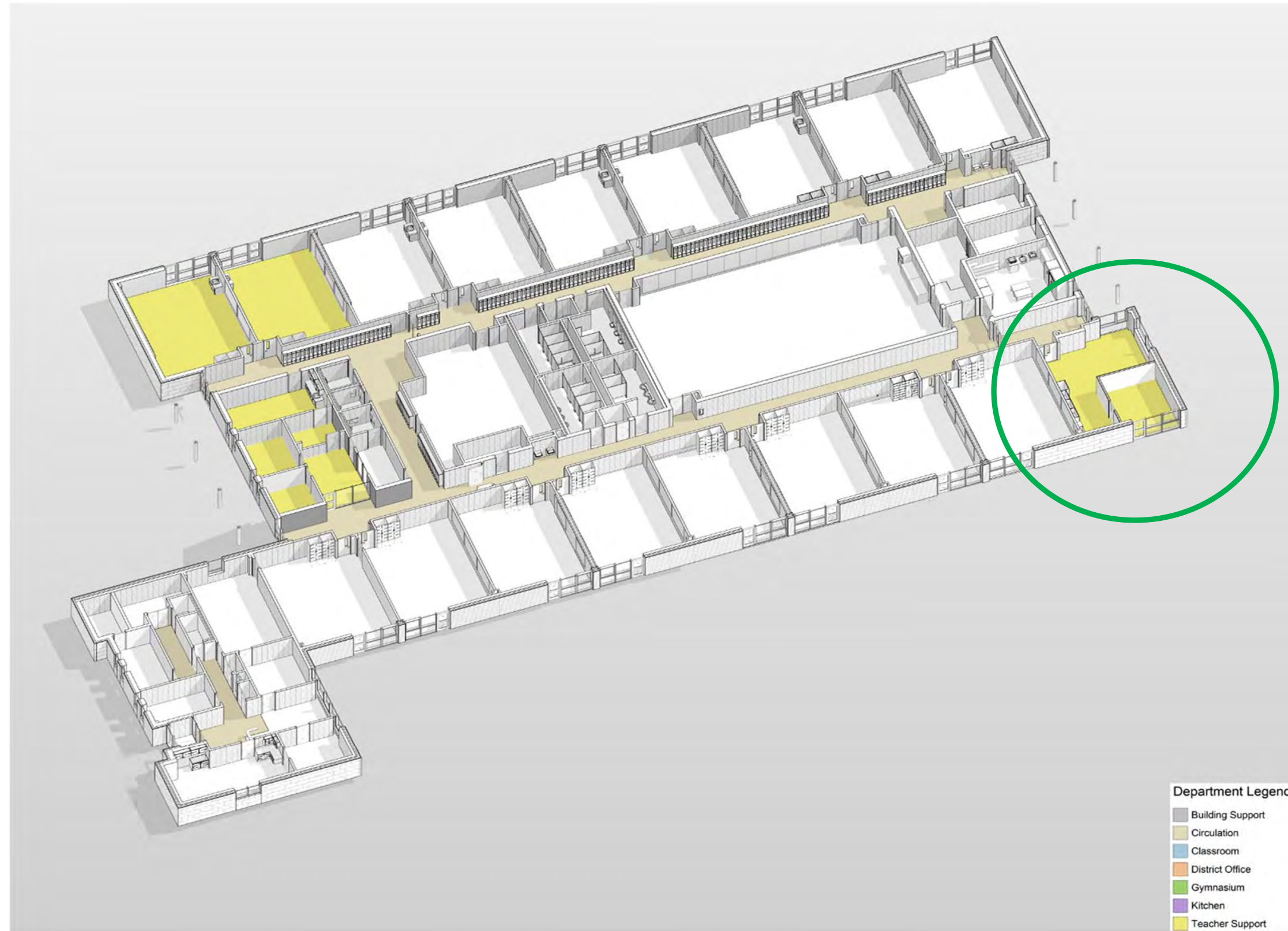
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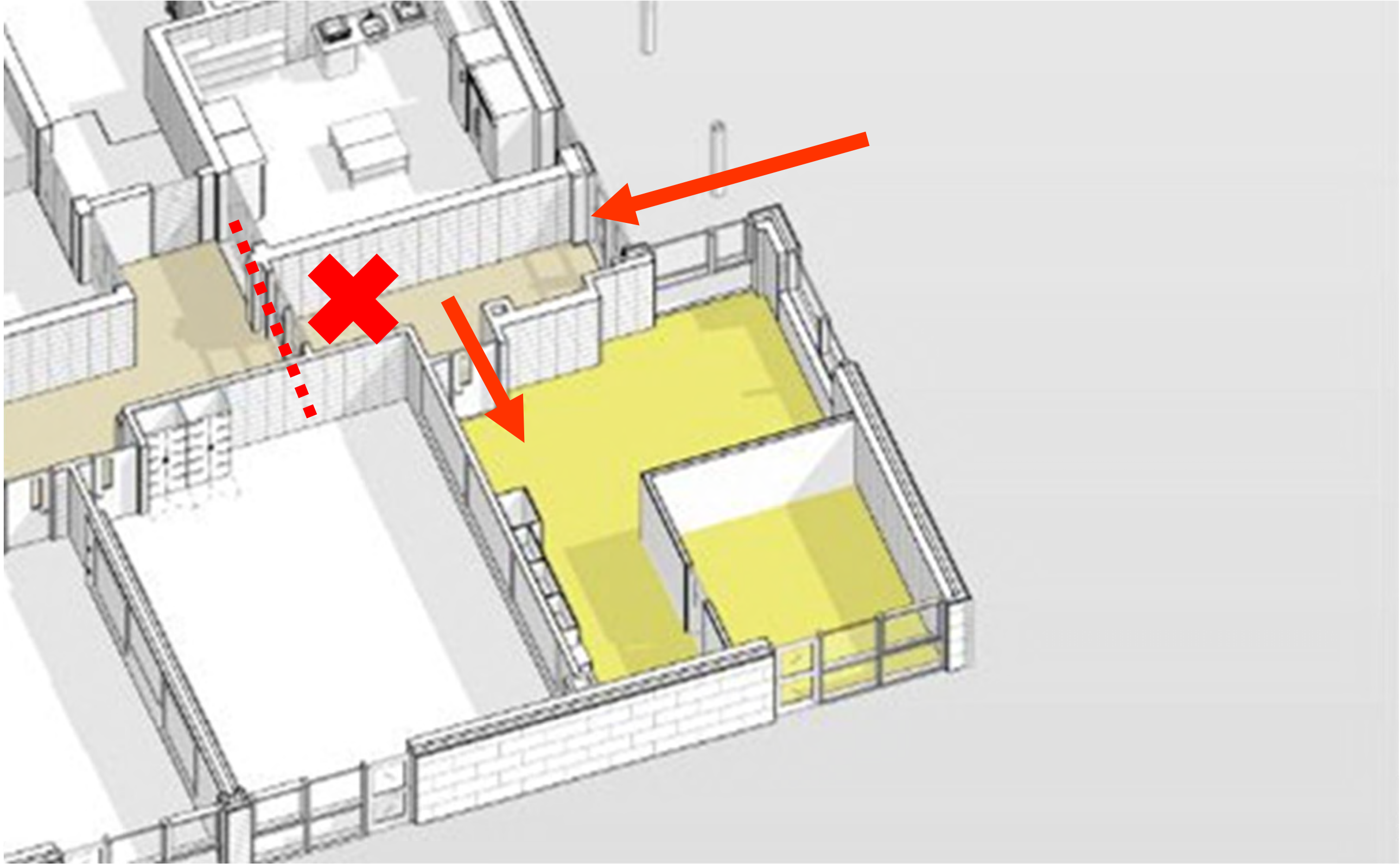


- Credible Treat 2: Intruders

- The new project assumes that Park view becomes a single-tenant building. This was the single greatest improvement to building security.
- The new project improves the school office to provide visual supervision of the entry and the parking lot.
- Reconfiguration of the District Administration space provides the opportunity to redesign the security between the school and the Administrative office.



INTEGRATION WITH DESIGN





INTEGRATION WITH DESIGN

- Credible Threat 3: Transportation Issues



The existing site layout combined parent and bus drop off, as well as drop off for a separate use. This created confusion and increased the likelihood of traffic issues.

INTEGRATION WITH DESIGN

- o Credible Threat 3: Transportation Issues

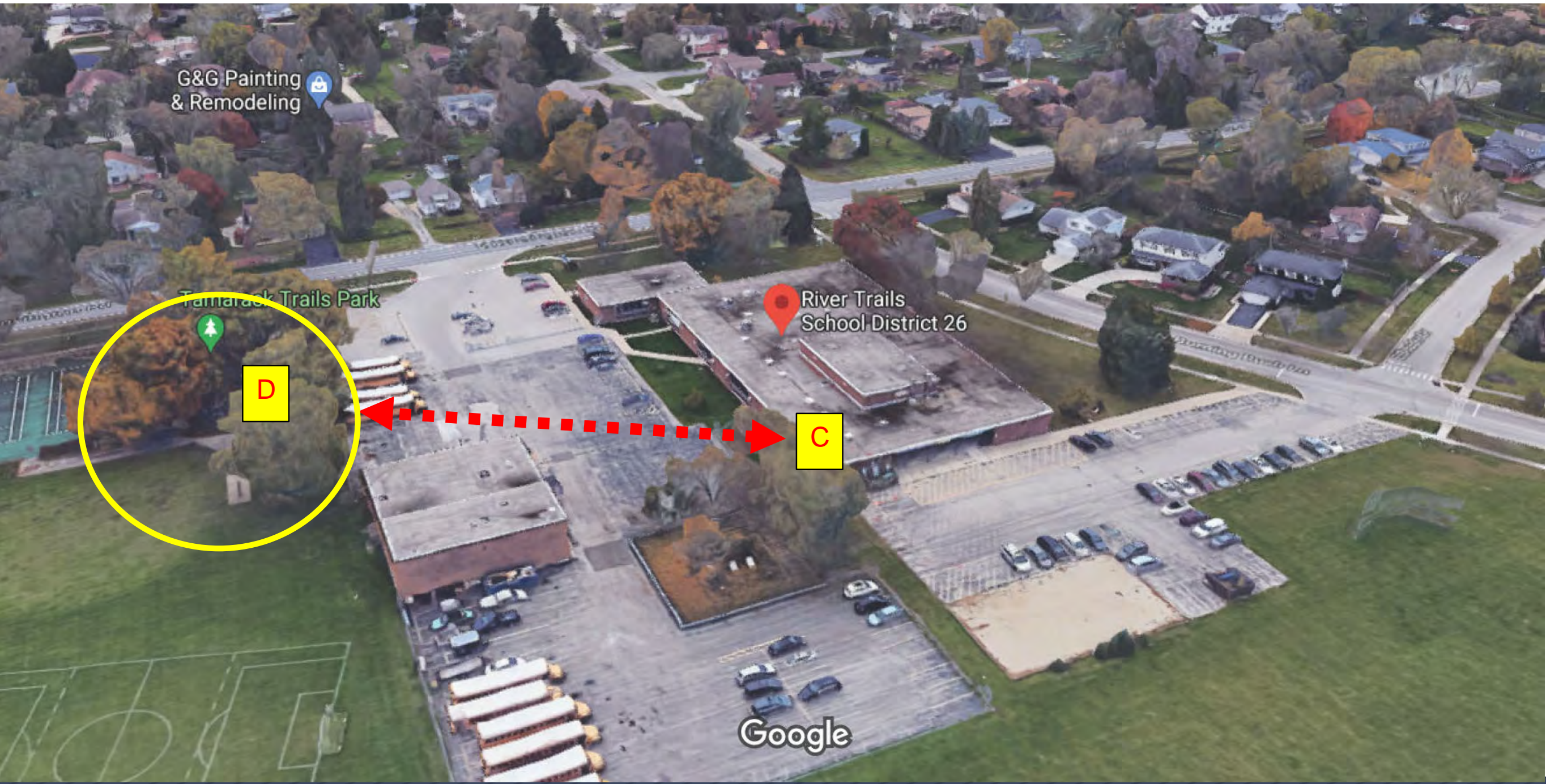


The new design has separate and distinct traffic circulation for cars and buses, as well as ample vehicle queuing space on the school property.



INTEGRATION WITH DESIGN

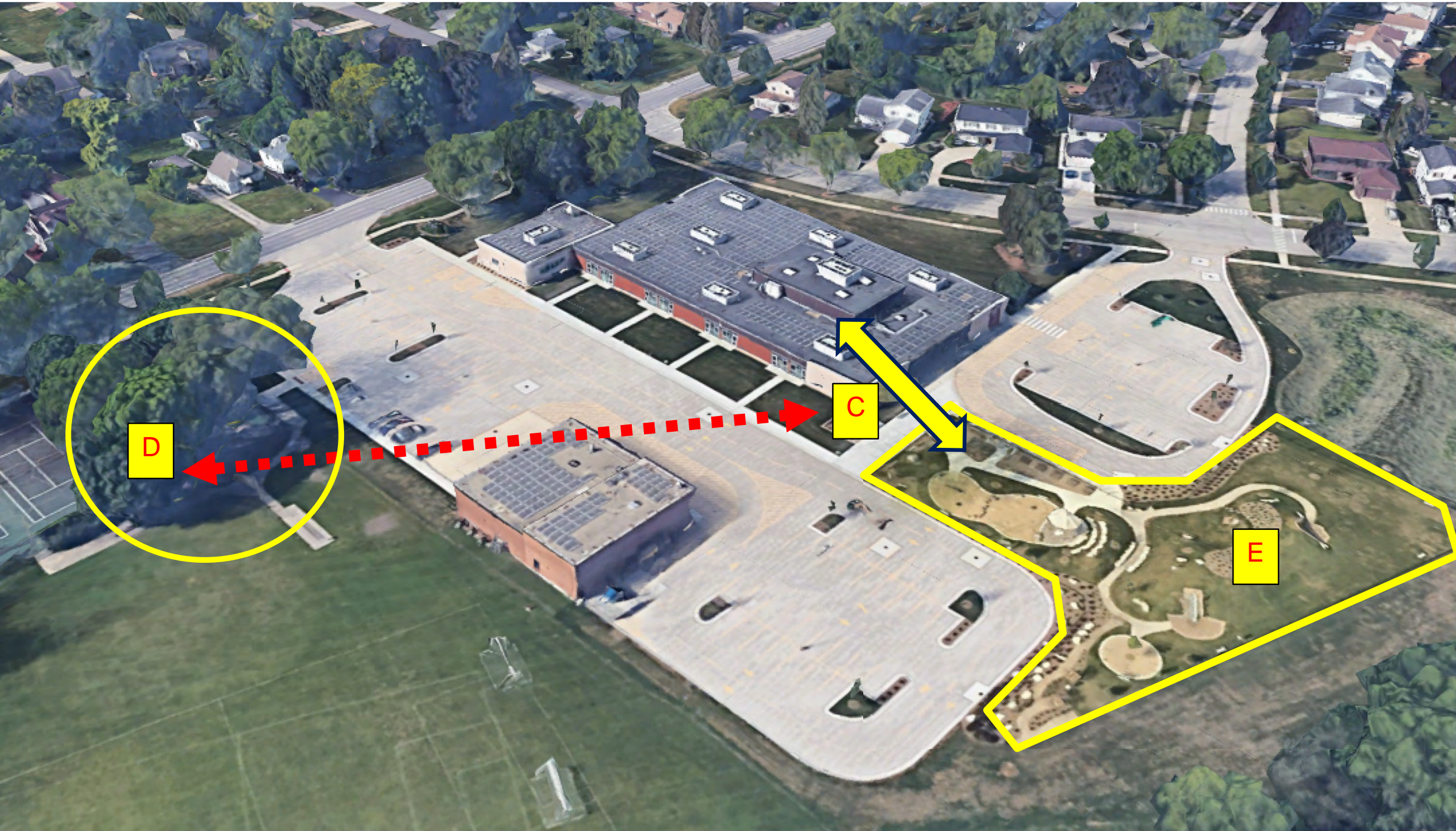
- Credible Threat 3: Transportation Issues



The existing building had no playground for students on the property. Students had to cross the maintenance yard to access the adjacent public park.

INTEGRATION WITH DESIGN

- Credible Threat 3: Transportation Issues



The PK/K playground was relocated to an area adjacent to the building, lowering the likelihood of a pedestrian/vehicle accident. The playground is also fully enclosed by a fence.

INTEGRATION WITH DESIGN

- Credible Threat 3: Transportation Issues

Existing site layout

- Bus storage/Maintenance yard
- No clear delineation between parent and bus traffic
- No student-centric amenities – play equipment access on adjacent Park District property



INTEGRATION WITH DESIGN

- Credible Threat 3: Transportation Issues

New site layout

- Separate entrances and queuing areas for parent and bus traffic
- Clear markings for pedestrian walks, with protective bollards
- Large natural playground
- Improved lighting and camera positions



ADA Improvements



Improving Accessibility

- Parking Access
- Improved clearances
- Toilet room improvements
- Acoustic improvements (HVAC noise reduction)
- Variety of seating choices
- Playground access



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Ongoing Maintenance Considerations



Ongoing Maintenance Considerations

- **Deferred Maintenance is not an option**
 - Air makeup units and refrigeration units must be
 - inspected
 - tuned
 - kept in perfect condition.
- **Continuous building envelope inspections are a priority**
 - Areas to monitor:
 - door and window seals
 - door thresholds
 - caulk joints
 - mechanical dampers.

Ongoing Maintenance Considerations

- **Monitoring, trending and responding to BAS information is critical**
 - The energy load and solar generation reporting will help identify system issues early, and help meet annual energy goals.
 - Need to expect building control challenges. These systems are complex and need tuning.
 - Include complete BAS scope that includes all tools and points necessary to maximize building efficiencies.
 - Provide staff time and expertise to assure successful start up and system adjustments
 - Consistent adjustments of the building occupation schedule.

Ongoing Maintenance Considerations

- **Building content must be monitored to ensure NO**
 - personal refrigerators
 - microwaves
 - heaters and fans
 - Monitor seep mode, enabled
- All of which will increase the building mechanical and electrical load.



January to Mid September Performance

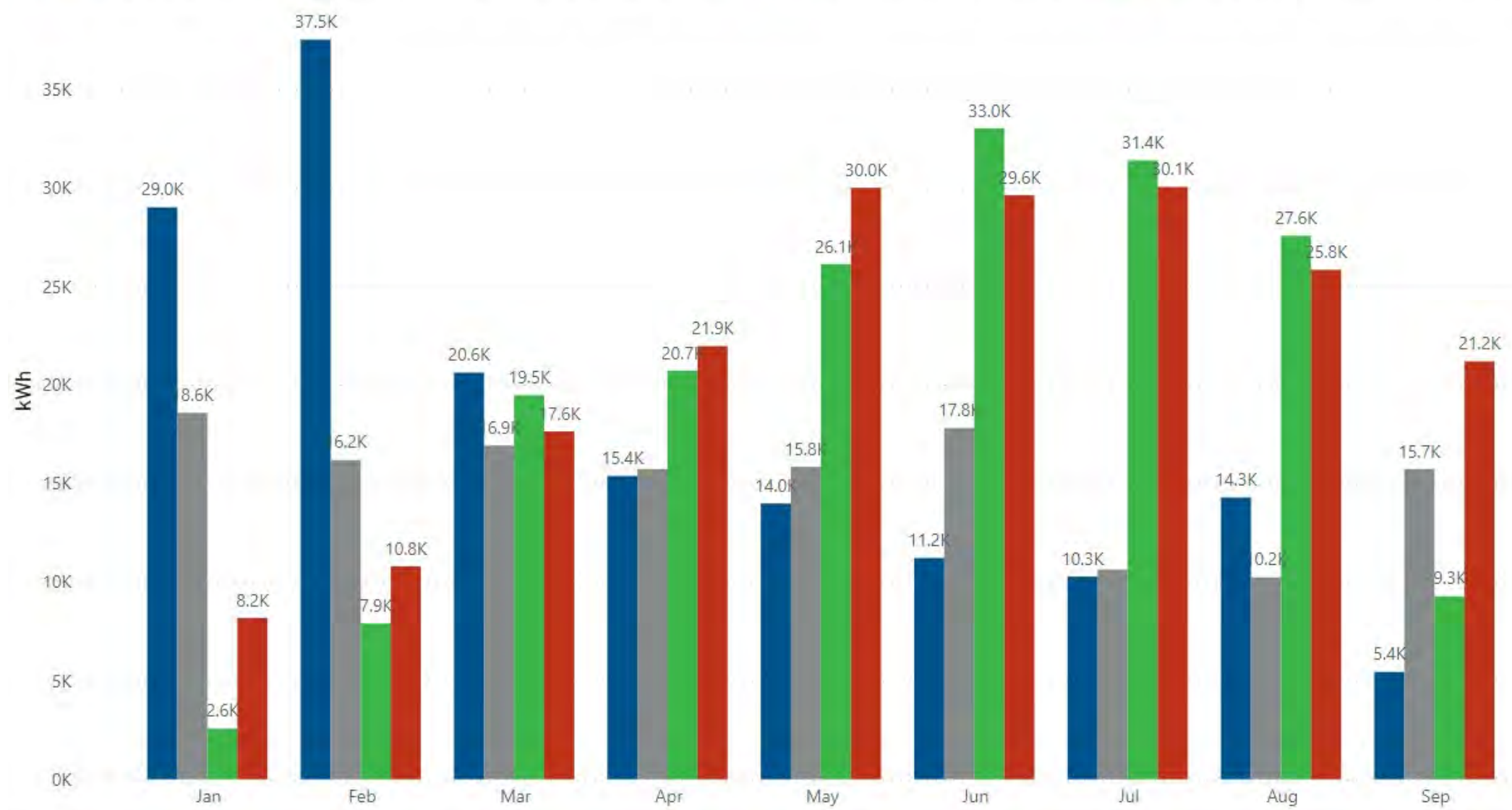


- Select all
- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

Notes: Data prior to 2/15/22 includes a metering error.

Monthly Data

● Building Usage to Date (Actual) ● Monthly Building Usage (Modeled) ● Solar Production to Date (Actual) ● Monthly Solar Production (Estimate)



Selected Range Totals

- 20.19**
Actual Usage (EUI)
- 22.80**
Solar Production (EUI)
- 157,664**
Actual Usage (kWh)
- 137,535**
Model Usage (kWh)
- 178,028**
Solar Production (kWh)
- 195,232**
Solar Estimate (kWh)

March to September Performance



Cost Data



Cost Data

Project Cost as of 11.11.20

		cost	area	cost/sf	
1	Hard Costs				
	a Total Hard Cost	\$11,119,985	\$28,737	\$387	86%
2	Soft Costs				
	a Total Soft Cost	\$1,869,522	\$28,737	\$65	14%
3	Total Project Cost	\$12,989,507	\$28,737	\$452	100%
4	Grants:				
	a Net Zero Energy (maximum allowance)	-\$2,000,000	\$28,737	-\$70	
	b ISBE School Maintenance Grant	-\$50,000	\$28,737	-\$2	
	c ComEd Energy Grant	-\$49,800	\$28,737	-\$2	
	d Total value of grants	-\$2,099,800	\$28,737	-\$73	-16%
5	Summary	\$10,889,707	\$28,737	\$379	

Questions

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