Bob,

Kyle and myself have reviewed the drawings we have and pieced together what you currently have at the High School.  The last renovation was in 1999 and at that time they modified the system to eliminate the cold duct of the dual duct system.  This creates a problem with just adding cooling to the existing units and if we were to attempt this and maintain the single duct arrangement it would results in very little control in the spaces when cooling was active.  This could result in overcooling of spaces or depending on the strategy high humidity levels.  Looking at our options we we came up with the following.

**Gymnasium**

The gymnasium, since it is a single zone, could be cooled by adding a cooling coil to the unit.  I would figure going with direct expansion cooling (think your condensing unit and furnace at home) since it is low maintenance and lower cost to implement.  For this we would have to add the coil, new units, and with all the units refurbish the air handling unit (new dampers, controls, drain pan, upgrade supply fan with variable speed fan per energy code).  I came up with a rough budget of $200k (and when I use budgets I have included contingency and design costs in that number) for this upgrade.

**Locker room/lower level**

This is an area where we could go either way to add or not add cooling.  If you wanted to just leave as a heating unit then I would just refurbish the unit so it operates better.  To refurbish only I budgeted $40K and if you wanted to add cooling I would add another $50K.

**1st Level Classroom - Option 1 - Dual Duct**

We can undo the changed made in 1999 and put the dual duct system back into place by changing the ductwork back.  Since we would be reusing the air handlers I would refurbish those units as with the gym unit, add DX cooling to the cold duct, modify the ductwork back to have a cold and hot deck, insulate the cold deck, install new dampers and controls to mix and condition the space.  This is a pretty archaic system and not very energy efficient, but it would get the job done.  I came up with a rough budget of $750K for this option.  Downsides are lower energy efficiency and utilizing old equipment that is already past useful life.

**1st Level Classroom - Option 2 - Existing VAV Modification**

Another option would be to refurbish the units, add cooling, and use the single duct as modified.  The duct would need to be insulated so it does not condense and then we would install fan powered vav terminals for zone control with electric reheat.  This would be comparable to a modern system, but the cost would go up due to the VAV terminals.  I would budget this at $1,050,000 to $1,100,000.  Electric reheat would be more cost effective then installing a hot water system, but have higher energy usage long term.  You could opt to no do the reheat and operate as a variable volume and temperature system (VVT), but zone temperature control will not be as consistent.  A VVT system is one that looks at each zone and determines how many need heat and how many cooling then provides heating and cooling based on that.

**1st Level Classroom - Option 3 - Packaged Rooftops with VVT**

Last option would be to install multiple packaged rooftops on the roof and tie into existing ductwork runs.  The ductwork lends itself to 5 rooftops, one for cafeteria (not zoned), 2 for the core classrooms, 1 for the north facing classrooms, and 1 for the east facing classrooms.  By utilizing multiple units with similar heating and cooling loads a VVT system can be a very cost effective way to provide zoning with pretty good temperature control.  We would have to get a structural engineer involved in this to verify the building can hold the units and the best placement.  To accomplish this we would have to insulate the ductwork, install VVT zone dampers, and modify ductwork for those zones.  I budgeted this work at around $600K to $650K.  For something like this I would be going with nicer rooftops and adding energy recovery for the classroom ventilation to keep unit size down.  Upsides is all new equipment that can easily be replaced at its end of life.  Downside is that all maintenance would be on the roof for the equipment.

From a Covid 19 standpoint the building really does need the ventilation systems repaired and/or revised for the newest ventilation requirements.

Let me know if you have questions or if you want to get on a call to discuss these options.  Lastly I'm going to throw this tidbit of information out to you since it seems to be the trend on projects.  A big push has been to do these projects through cooperative purchasing to speed up the timeline and deal with tighter budgets.  I'm working on two with Carrier Corporation through Sourcewell and it may be an option if you want to discuss.

Thanks,

Ryan Kopko, PE

RKS Consulting and Commissioning, Inc

833 Wooster Road North

Barberton, Ohio 44281

Cell: 330-241-3349