

Undergraduate Thesis Prospectus

Site Redesign at Crozet Elementary School
(technical research problem in Civil Engineering)

The Controversy over the Beginning of the School Day in the United States
(sociotechnical research problem)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General Research Problem

How can the physical and mental safety and well-being of American K-12 students be improved?

May it be rearing one's own children or contributing to the development of other's children, developing children ensures that the efforts of any generation will be worthwhile and succeeded by someone. One of the main ways they are developed is through education. While some have the opportunity of attending private school, most children must achieve this through public schooling. Successful K-12 public education ensures pupils' physical safety and mental wellbeing. According to Rivelli (2022), in the U.S. "there were more than 1,000 fatal school-transportation-related crashes between 2011 and 2020, with an average of 113 fatalities per year." In addition, according to the CDC, "more than 1 in 3 high school students had experienced persistent feelings of sadness or hopelessness in 2019," (Centers, 2022a), so efforts can be made to improve their safety.

Site Redesign at Crozet Elementary School

How can the site be redesigned to best accommodate more students?

This project is a part of the University's Department of Engineering Systems and Environment. Its technical advisor is T. Donna Chen, an assistant professor within the department. This project is a capstone project, and is being collaborated on with Michael Barbuti, David Coppi, Justin Dibsie, and Josh Rosin.

Three neighborhoods are being redistricted from Brownsville Elementary School to Crozet Elementary School, resulting in Crozet's student population to increase by over 200 students (Fig. 1). Due to this increase, the site must be redesigned to include a new academic wing, and consider more parking, more playground space, and improved safety and accessibility.

SCENARIO 2.2

1. Grayrock (25)
2. Waylands/Bargamin (32)
3. Western Ridge/Wickham Pond (162)

219 moved

Total Students: 545

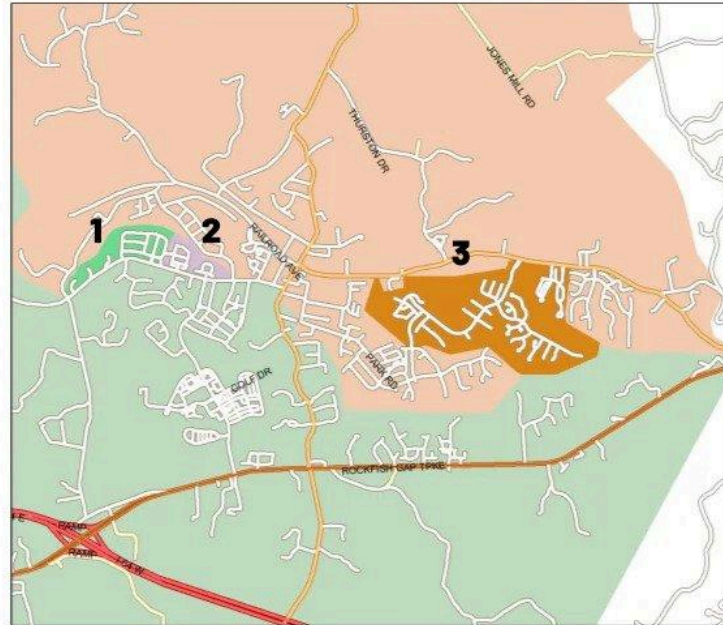


Figure 1: Crozet/Brownsville Elementary School Redistricting Map (Albemarle, 2021)

This project's goal is to redesign the site to include 136 additional parking spaces, a designated bus space for 12 buses, and improved circulation of pedestrians, cars, and buses. In addition, a new location for the basketball court must be found as it is being displaced by the new academic wing. Furthermore, erosion control plans will be needed to guide the contractor during construction, ensuring downstream waterways and properties are protected from construction runoff.

When considering where the additional parking can go, things must stay within the property lines. There are multiple areas of steep grading on the site, so large amounts of cutting and/or filling would be needed to make additional parking feasible in those locations. More parking results in an increase in the amount of impervious area on the site, so measures will need to be taken to counteract this. In addition, there is a small bioretention area on the north part of the site that students use to learn about stormwater management and gardening. This must either be untouched or be replaced with something similar in a different location. The entire site must

be in accordance with ADA accessibility standards, Albemarle County design standards, and VDOT standards.

Given the existing site, not much can be done to meet the design requirements. There is insufficient parking, the existing bus space does not meet what the client wants, and the pick-up/drop-off area is too small for the increase in student body. Therefore, when approaching this problem, ideas can be taken from previous projects, including the redesign of another Albemarle County elementary school, Woodbrook Elementary School. This school was facing a similar issue where it needed expansion and modernization to accommodate an increase in its student population. Below is what the site looked like before and after the project (Fig. 2 & 3) as well as the final concept design of the new school (Fig. 4). This project utilized the space the site provided quite well while including much more parking and a new and separate bus loop and pick-up/drop-off area. These takeaways will become the basis of the redesign for Crozet Elementary School.

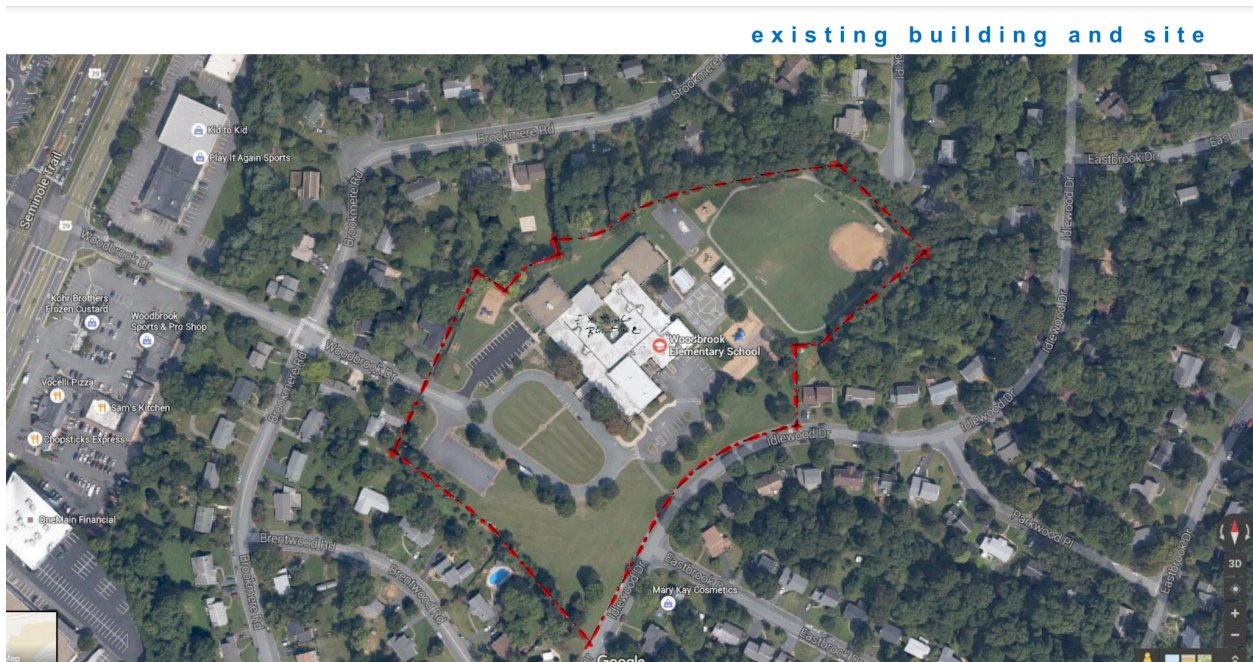


Figure 2: Google Maps View of Old Woodbrook Elementary School (Albemarle, 2016)



Figure 3: Google Maps View of Current Woodbrook Elementary School (author)



CONCEPT SITE & FLOOR PLAN

Figure 4: Final Concept Design of Woodbrook Elementary School (Albemarle, 2016)

The group was given a PDF and CAD file of the original site as well as what the site would look like with the academic wing included. When approaching the problem, preliminary ideas and concepts will either be hand drawn or will be generated in an application called

Bluebeam, a very thorough PDF editor. Some of these ideas include where new parking can go, the location of the basketball court, a designated bus loop, and how to best manage bus, car, and pedestrian traffic to maximize safety and minimize queue length and wait time. Once a final concept is decided on, it will be drawn in CAD where grading assessments can be made and stormwater routes can be seen. From there, changes will be made until the CAD design meets all of the criteria.

At the project's completion, a full redesign of the site will be completed with everything previously stated taken into account. This design will give the contractors and construction firm(s) the information they need to carry out the redesign.

The Controversy over the Beginning of the School Day in the United States

In the U.S., how do different social groups, such as school systems, parents, teachers and health experts, compete to determine the start time of the public school day?

About 10-15 years ago, researchers suggested that insufficient sleep in adolescents was a public health problem warranting a later beginning to the school day (CDC, 2022b). Sleep deficits put teenagers at greater risk of depression (Winsler et al., 2014) and can impair academic performance (Keller et al., 2014). Some school districts have begun the school day later to better serve students' needs (Chesterfield, 2021), but others have been more responsive to competing pressures, such as a shortage of school buses (Erickson, 2022).

The American Academy of Pediatrics brought the problem to the public's attention. Its Adolescent Sleep Working Group found that "the evidence strongly implicates earlier school start times (i.e., before 8:30 am) as a key modifiable contributor to insufficient sleep" (ASWG, 2014). It endorses "the efforts of school districts to optimize sleep in students and urges high schools and middle schools to aim for start times that allow students the opportunity to achieve

optimal levels of sleep (8.5–9.5 hours) and to improve physical (e.g., reduced obesity risk) and mental (e.g., lower rates of depression) health, safety (e.g., drowsy driving crashes), academic performance, and quality of life.”

Researchers have considered how modified school days may affect specific school districts. In a study of students in Fairfax, Virginia, Winsler et al. (2014) concluded that “the odds of teen hopelessness, suicidal ideation and suicide attempts, and substance use are sizeably reduced with one more hour of weeknight sleep” (Winsler et al., 2014, 376). Researchers in Kentucky observed “associations between early school start time and poorer school performance ... primarily for schools serving few students who qualify for free or reduced-cost lunches” (Keller et al., 2014).

Responding to the reported benefits of beginning the school day later, some school districts have done so. Citing recommendations of the American Academy of Child and Adolescent Psychiatry and the U.S. Centers for Disease Control and Prevention (CDC), Virginia’s Chesterfield County Public Schools now begin the school days of its middle and high schools later (Chesterfield, 2021).

Parents’ sleep schedules are also implicated in school day schedules. In many homes, if the children can sleep later, then the parents can too. Such parents can enjoy similar health benefits (Murez, 2022). Some teachers favor later start times for the sake of their students, or to have more time for lesson planning and professional development (Hardison, 2022).

Despite the advantages of beginning the school day later, however, practical obstacles complicate schedule changes. Nationwide bus driver shortages, due largely to low pay, have been exacerbated by the coronavirus pandemic. Despite federal subsidies, many school districts were forced to lay off bus drivers. The high median age of bus drivers, at 56, can make many more

vulnerable to coronavirus. Bus drivers typically have long working days; their day may begin 12 hours before it ends. Despite such long days, however, school bus drivers are typically paid only for their driving hours, not the idle hours between (Crockett, 2021). Many school districts, such as Dorchester County District 2 in South Carolina (Erickson, 2022) and Lynchburg City Schools in Virginia (Doner, 2021), must schedule their school days to make optimum use of scarce bus drivers.

Some parents, teachers, and students, oppose schedule changes for other reasons. If school days ended later, some older children with after-school caregiving responsibilities would be unavailable until later in the afternoon. Later dismissals leave students with less time for extracurricular activities or part-time jobs. Some teachers object to later start times because of heavier rush-hour traffic or interference with doctor and bank appointments (Hardison, 2022).

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