4 MATIV Resource Hub

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Service Differentiation In Stop Design

See how Cincinnati Public Schools used a differentiated approach to adjust home-to-stop levels and achieved better routing efficiency over a multi-year span.



Modeling Changes to Stop Distance

In its work with clients, 4MATIV often finds ample opportunities to streamline routes and enhance system efficiency. One common opportunity is adjusting the distances that students travel to get to their bus stops. Differentiating stop distances not only ensures each child receives the just right transportation service they need, this approach also makes efficient and strategic use of resources, which improves service guality and reliability across the system, benefiting every rider.



4MATIV takes multiple approaches to establish stop distance limits and differentiate service levels. This work starts with building sophisticated scenarios to model the impact of implementing various design changes. These findings then inform the development of updated transportation routing practices and policies.

Determine an Appropriate Stop Distance:

There are several common approaches to stop distance limit-setting and updating policies or practices that have historically provided more accommodating stops than is required or efficient. Options include defining a maximum stop distance (e.g., up to 1.0 mile from a student's home residence), defining a maximum percentage increase (e.g., 150% of current stop distance), or a combination thereof (e.g., 150% of current stop distance up to 1.0 miles). Within 4MATIV's models, these limits serve as design criteria for assigning students to stops, changing existing policies or practices, and consolidating stops and re-assigning students. However, stop limits are not necessarily intended as proposed constrictions (or expansions) of official district policies. Rather stop limits should guide internal routing practices for the ongoing day-to-day work of trying to accommodate change, responding to new student enrollment, and maintaining maximum efficiency and system performance while doing so.

Differentiate Stop Location:

Differentiation in stop design means establishing stop distances for various subsets of a student population that appropriately accommodate those groups without overly accommodating groups that may not need it. Intentional differentiation also allows for expanded choice or geographic coverage while maintaining high seat utilization and strong performance. Common approaches to differentiating service levels include varying distance thresholds by programming type, grade level, school type, and geographic area. For instance, a school system may choose to model the impact of locating stops for students attending an in-boundary "neighborhood" school up to 0.5 miles away for students in grades PK-5, up to 0.75 miles for students in grades 6-8, and up to 1.0 miles for students in grades 9-12. The school system may have less accommodating service levels for students attending out-of-boundary schools.

Accommodate Student Needs:

Stops for students with transportation accommodations of any kind (e.g., requiring vehicles with wheelchair lifts, aides, curb-to-curb service, etc.) remain unchanged in illustrative models. Service must be truly personalized for these students and take into consideration their specific needs and goals. As such, 4MATIV advises school systems on how to evaluate service provision for students with accommodations and how to build out and leverage a spectrum of offerings to best serve each child.

Identify Tolerance Thresholds:

Whatever stop distance and stop location parameters are ultimately set, school systems are unlikely to perfectly emulate those distance targets, as there are often reasonable exceptions that need to be made based on safety barriers and practicality. As such, 4MATIV encourages clients to identify the maximum stop distance that they deem tolerable for their community standards. On average, if stop distance targets are well-designed and well-implemented, a school system should expect to have a roughly normal distribution of stop distances, with the typical student having a home-to-stop distance that is approximately half to two-thirds of the distance target.

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Case Study: Cincinnati Public Schools

Background:

In February of 2023, 4MATIV conducted an initial Opportunity Analysis for Cincinnati Public Schools (CPS). The objective of this analysis was to quickly assess the CPS student transportation system, identify areas for improvement, recommend levers for stabilizing transportation service, and estimate the potential gain from implementing solutions.

Findings:

Among other findings, the Opportunity Analysis revealed that there was ample room to consolidate stops within the district's existing stop distance policy, thereby increasing vehicle utilization (allowing each bus trip to pick up more students) and reaping cost savings by reducing the overall number of buses needed to serve the system.

In the fall of SY22-23, a typical student's stop was located 0.17 miles from their home—about three blocks away—despite the approved Board policy that permitted a stop distance up to 0.5 miles.

Stop distances were not meaningfully differentiated by grade level, with kindergartners having stops located roughly the same distance from their home as high school students, and students attending magnet and open enrollment schools having comparable stop distances as students attending their neighborhood CPS school.

On average, just 52 percent of seats were filled on routed vehicles when using practical seating assumptions (how many students could comfortably ride in a vehicle, usually two per seat). On a full-size bus with 60 practically available seats, this meant 29 seats were empty on a typical route.

Process:

To more precisely estimate the potential efficiency to be gained from consolidating stops and increasing stop distances, CPS leaders, in consultation with 4MATIV, identified decision parameters and maximum stop distance thresholds for various student groups. 4MATIV then used this information to produce a sophisticated model demonstrating the potential impact of different system interventions. Ultimately, CPS settled on differentiated distance maximums by grade level and differentiated proportional increases by student.

Results:

The outcome of this analysis led to significant increases in efficiency and cost savings. 4MATIV found that strategic and differentiated increases in stop distances would allow for the removal of up to 18 percent of stops and improve seat utilization by over 10 percent. 4MATIV's simulation produced updated stop assignments for every rider, with the typical student's stop located 0.25 miles from their home—a modest increase that yielded significant vehicle reductions. The analysis estimated that CPS could save \$3 million annually and eliminate up to 36 buses via targeted stop consolidation.



4MATIV is transforming student mobility. With our technology and performance management platform and multi-modal approach, we get students to school for less cost and with less hassle so they can access the learning opportunities that maximize their potential. For more information, visit <u>4mativ.org</u>.

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