

**AMENDMENT TO CONTRACT FOR THE
PROCUREMENT OF PROFESSIONAL SERVICES**

THIS AMENDMENT TO CONTRACT FOR THE PROCUREMENT OF PROFESSIONAL SERVICES (hereinafter "Amendment") is entered by and between the Jefferson County Board of Education, a political subdivision of the Commonwealth of Kentucky doing business as the Jefferson County Public Schools (hereinafter "JCPS") with its principal place of business located at 3332 Newburg Road, Louisville, Kentucky 40218, and Dynamic Ideas LLC/dba Dynamic Ideas Routing with its principal place of business located at 43 Lantern Road, Belmont, MA 02478 (hereinafter "Contractor").

WHEREAS, The Parties have entered into a Contract for the Procurement of Professional Services between JCPS and Contractor dated June 9, 2021, under which Contractor agreed to provide bus routing services and bell time optimization services to JCPS (the "Contract"); and

WHEREAS, the Parties wish to utilize Bell Time Optimization Option B rather than Bell Time Optimization A;

WHEREAS, this alteration in services requires payment of an additional \$65,000.00;

THEREFORE, the Parties wish to amend the Contract to alter the total cost.

This Amendment hereby amends the Contract Amount listed in Article III Compensation. The amount shall read in full as:

Bus Routing Services \$346,667.00* Bell Time Optimization Option B \$227,500*
*costs based on between 60,000 and 70,000 students and would be adjusted proportionately if less than or greater than

All other provisions of the Contract shall remain unchanged. This Amendment is the entire agreement of the parties regarding modifications of the Contract provided herein, supersedes all prior agreements and understandings regarding such subject matter, may be modified only by a writing executed by the parties and their respective successors, legal representatives and assigns. The Contract is ratified and confirmed in full force and effect in accordance with its terms, as amended hereby. In the event of any conflict between the terms of the Contract and this Amendment, the provisions of this Amendment shall control.

This Amendment may be executed via electronic signature in one of more counterparts, each of which will be deemed an original, but all such electronic signatures and counterparts will together constitute but one and the same instrument.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment to be effective as of February 2, 2022.

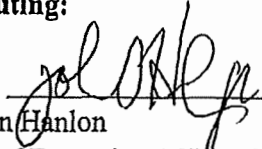
Jefferson County Public Schools:

By: _____

Dr. Martin A. Pollio
Superintendent

Date:

**Dynamic Ideas LLC dba/Dynamic Ideas
Routing:**

By:  _____

John Hanlon
Chief Executive Officer & Cofounder

Date:

12/21/21

Original Contract



JEFFERSON COUNTY PUBLIC SCHOOLS CONTRACT FOR THE PROCUREMENT OF PROFESSIONAL SERVICES

THIS CONTRACT FOR PROCUREMENT OF PROFESSIONAL SERVICES (hereinafter "Contract") is entered into between the JEFFERSON COUNTY BOARD OF EDUCATION (hereinafter "Board"), a political subdivision of the Commonwealth of Kentucky, with its principal place of business at 3332 Newburg Road, Louisville, Kentucky 40218 and Dynamic Ideas LLC/dba as Dynamic Ideas Routing (hereinafter "Contractor"), with its principal place of business at 43 Lantern Road, Belmont, MA 02478.

WITNESSETH:

WHEREAS, the Board desires to procure the particular services of Contractor, which are more fully defined below; and

WHEREAS, Contractor has held itself out to be competent and capable of performing the services contracted for herein;

NOW, THEREFORE, in consideration of the mutual promises and agreements hereinafter set forth, the Board and Contractor (hereinafter "Parties") agree as follows:

ARTICLE I Entire Agreement; Amendments

This Contract is the entire agreement between the Parties and supersedes any and all agreements, representations and negotiations, either oral or written, between the Parties before the effective date of this Contract. This Contract may not be amended or modified except in writing as provided in Article VIII. This Contract is supplemented by the Board's Procurement Regulations currently in effect (hereinafter "Regulations") that are incorporated by reference into and made a part of this Contract. In the event of a conflict between any provision of this Contract and any provisions of the Regulations, the Regulations shall prevail.

ARTICLE II Services

Contractor agrees to perform the following services (hereinafter "Services") of a quality and in a manner that is within the highest standards of Contractor's profession or business. The Services are as follows:

Bus Routing: Deliver a bus routing plan which reduces the required number of buses as much as possible in order to offset the district's driver shortage per proposal dated 5/27/2021 incorporated herein by reference.

Bell Time Optimization: Optimize school bell times based on relevant district objectives and conditions per proposal dated 5/27/2021 incorporated herein by reference.



ARTICLE III
Compensation

The Board shall pay Contractor the total amount stated below (hereinafter "Contract Amount"). The Contract Amount shall be paid in a lump sum upon completion of the Services, unless a schedule of progress payments is stated below. The Contract Amount shall be for total performance of this Contract and includes all fees, costs and expenses incurred by Contractor including but not limited to labor, materials, taxes, profit, overhead, travel, insurance, subcontractor costs and other costs, unless otherwise stated below. To receive payment, Contractor must submit an itemized invoice or invoices. If progress payments are authorized, each invoice must specify the actual work performed. If payment of costs or expenses is authorized, receipts must be attached to the invoice.

Contract Amount:	Bus Routing Service \$346,667.00 *
	Bell Time Optimization Option A \$162,500 *
	*cost based on between 60,000 and 70,000 students and would be adjusted proportionately if less than or greater than.

Progress Payments (if not applicable, insert N/A): Routing Service: \$50,000 upon execution of contract; \$100,000 at the end of June 2021; \$150,000 at the end of July 2021, and \$46,667 at the end of the 2021-2022 school year. Bell Time Optimization: 25% due on September 1, 2021; 50% due on December 1, 2021 and Final payment due on March 1, 2022.

Costs/Expenses (if not applicable insert N/A): N/A

Fund Source: General Fund

ARTICLE IV
Term of Contract

Contractor shall begin performance of the Services on June 9 , 2021 and shall complete the Services no later than June 8, 2022, unless this Contract is modified as provided in Article VIII.

ARTICLE V
Performance of Services by Contractor

The Services shall be performed by Contractor, and in no event shall Contractor subcontract with any other person to aid in the completion of the Services without the prior written approval of the Contract Administrator defined below.

Contractor shall appoint one person who shall be responsible for reporting to the Board on all Services performed under the terms of this Contract and who shall be available for consultation with the Contract Administrator.

Contractor is an independent contractor, not an employee. Contractor is responsible for the payment of all federal, state and local payroll taxes and providing unemployment insurance and workers compensation coverage to Contractor's employees. Contractor shall provide all equipment, materials and supplies necessary for the performance of the Services.

Contractor shall at all times during the term of this Contract comply with all applicable laws, regulations, rules and policies. Contractor shall obtain and keep in force all licenses, permits and certificates necessary for the performance of the Services.

Contractor agrees to hold harmless, indemnify, and defend the Board and its members, agents, and employees from any and all claims or losses accruing or resulting from injury, damage, or death of any person, firm, or corporation, including the Contractor himself, in connection with the performance of this Contract. Contractor also agrees to hold harmless, indemnify, and defend the Board and its members, agents, and employees from any and all claims or losses incurred by any supplier, contractor, or subcontractor furnishing work, services, or materials to Contractor in connection with the performance of this Contract. This provision survives termination of this Contract.

Unless waived in writing by the Contract Administrator, Contractor shall maintain during the term of this Contract policies of primary insurance covering the following risks and in at least the following amounts: commercial general liability, including bodily injury, property damage, personal injury, products and completed operations, and contractual, \$1,000,000; and automobile liability, \$1,000,000. Contractor shall furnish to the Contract Administrator certificates of insurance evidencing this coverage and naming the Board as an additional insured. Additionally, Contractor shall maintain workers compensation coverage with limits required by law; and professional errors and omissions coverage with minimum limits of \$1,000,000. Contractor shall furnish certificates of insurance evidencing this coverage to the Contract Administrator.

ARTICLE VI Equal Opportunity

During the performance of this Contract, Contractor agrees that Contractor shall not discriminate against any employee, applicant or subcontractor because of race, color, national origin, age, religion, marital or parental status, political affiliations or beliefs, sex, sexual orientation, gender identity, gender expression, veteran status, genetic information, disability, or limitations related to pregnancy, childbirth, or related medical conditions. If the Contract Amount is paid from federal funds, this Contract is subject to Executive Order 11246 of September 24, 1965 and in such event the Equal Opportunity Clause set forth in 41 Code of Federal Regulations 60-1.4 is hereby incorporated by reference into this Contract as if set forth in full herein.

ARTICLE VII Prohibition of Conflicts of Interest

It shall be a breach of this Contract for Contractor to commit any act which is a violation of the provisions of Article XI of the Regulations entitled "Ethics and Standards of Conduct," or to assist or participate in or knowingly benefit from any act by any employee of the Board which is a violation of such provisions.

ARTICLE VIII
Changes

The Board and Contractor may at any time, by mutual agreement set forth in a written addendum, make changes in the definition of the Services; the scope of the Services; and the Contract Amount. The Contract Administrator and Contractor may, at any time, by mutual agreement set forth in a written addendum, make changes in the time within which the Services are to be performed; the schedule of Progress Payments; and mutual Termination of the Contract.

ARTICLE IX
Termination for Convenience of the Board

The Board may terminate this Contract in whole or in part at any time by giving written notice to Contractor of such termination and specifying the effective date thereof, at least thirty (30) days before the specified effective date. The Board shall compensate Contractor for Services satisfactorily performed through the effective date of termination.

ARTICLE X
Termination for Default

The Board may, by written notice of default to Contractor, terminate the whole or any part of this Contract, if Contractor breaches any provision of this Contract, or so fails to make progress as to endanger performance of this Contract, and in either of these circumstances, does not cure the breach or failure within a period of five (5) days after receipt of notice specifying the breach or failure. In the event of termination for default, the Board may secure the required services from another contractor. If the cost to the Board exceeds the cost of obtaining the Services under this Contract, Contractor shall pay the additional cost. The rights and remedies of the Board provided in this Article shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

ARTICLE XI
Disputes

Any differences or disagreements arising between the Parties concerning the rights or liabilities under this Contract, or any modifying instrument entered into under Article VIII of this Contract, shall be resolved through the procedures set out in the Regulations.

ARTICLE XII
Contractor's Work Product

Unless waived in writing by the Contract Administrator, the Board shall retain ownership in and the rights to any reports, research data, creative works, designs, recordings, graphical representations or other works of a similar nature (hereinafter "Works") produced or delivered by Contractor under this Contract. Contractor agrees that the Works are "works for hire" and Contractor assigns all right, title and interest in the Works to the Board.

Any reports, information, data, etc. given to or prepared or assembled by Contractor under this Contract shall not be made available to any individual or organization by Contractor without the prior written approval of the Board. Provided, nothing in this Article may be used to violate the provisions of any Kentucky or Federal statute or regulation which requires reporting of information.

ARTICLE XIII
Contract Administrator

The Board shall appoint a Contract Administrator for the purposes of daily administrative decision-making pertaining to the Contract. If Contractor and the Contract Administrator disagree on any circumstance or set of facts pertaining to the administration or execution of this Contract, the Board shall resolve the matter after notification by either the Contract Administrator or the Contractor in the manner prescribed by the Regulations. If the Board fails to give notice to Contractor of the appointment of a Contract Administrator, the Contract Administrator shall be the Board's Chief Financial Officer.

ARTICLE XIV
Right to Audit

The Board shall have the right to inspect and audit all accounting reports, books or records which concern the performance of the Services. Inspection shall take place during normal business hours at Contractor's place of business. Contractor shall retain all records relating to the performance of this Contract for five (5) years after the end of the term of this Contract.

ARTICLE XV
Miscellaneous

- A. All Articles shall be construed as read, and no limitation shall be placed on any Article by virtue of its descriptive heading.
- B. Any notices or reports by one Party to the other Party under this Contract shall be made in writing, to the address shown in the first paragraph of this Contract, or to such other address as may be designated in writing by one Party to the other. Notices shall be effective when received if personally delivered, or three days after mailing if mailed.
- C. If any part of this Contract is held to be void, against public policy or illegal, the balance of this Contract shall continue to be valid and binding.
- D. This Contract shall be governed and construed in accordance with the laws of the Commonwealth of Kentucky.
- E. No delay or omission by either Party in exercising any right under this Contract shall operate as a waiver of that or any other right or prevent a similar subsequent act from constituting a violation of this Contract.
- F. At all times during the term of this Contract, Contractor shall comply with the Family Educational Rights and Privacy Act of 1974. If Contractor has access to student records, Contractor shall limit its employees' access to those records to persons for whom access is essential to perform this Contract.
- G. If this Contract requires Contractor and/or any employees of Contractor access to school grounds on a regularly scheduled and continuing basis for the purpose of providing services directly to a student or students, all individuals performing such services under this Contract are required to submit per KRS 160.380 to a national and state criminal history background check by the Department of Kentucky State Police and the Federal Bureau of Investigation and have a letter, provided by the individual, from the Cabinet for Health and Family Services stating no administrative findings of

child abuse or neglect found through a background check of child abuse and neglect records maintained by the Cabinet for Health and Family Services.

- H. Contractor shall be in continuous compliance with the provisions of KRS Chapters 136, 139, 141, 337, 338, 341 and 342 that apply to the Contractor or subcontractor for the duration of this Contract and shall reveal any final determination of a violation by the Contractor or subcontractor of the preceding KRS Chapters.

IN WITNESS WHEREOF, the Parties hereto have executed this Contract to be effective as of June 9, 2021.

Contractor's Social Security Number or Federal Tax ID Number:

JEFFERSON COUNTY BOARD OF
EDUCATION

Dynamic Ideas LLC dba/Dynamic Ideas
Routing
CONTRACTOR

By: M. A. Pollio

By: J. Hanlon

Title: Martin A. Pollio, Ed.D.
Superintendent

Title: John Hanlon
Chief Executive Officer & Co-
Founder

Cabinet Member: _____	<u>CF</u> (Initials)
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Jefferson County Public Schools
**NONCOMPETITIVE NEGOTIATION
DETERMINATION AND FINDING**

1. An emergency exists which will cause public harm as a result of the delay in competitive procedures (Only the Superintendent shall declare an emergency.) —

State the date the emergency was declared by the superintendent: _____

2. There is a single source for the items within a reasonable geographic area —

Explain why the vendor is a single source: See attached

3. The contract is for the services of a licensed professional, education specialist, technician, or an artist —

State the type of service: _____

4. The contract is for the purchase of perishable items purchased on a weekly or more frequent basis —

State the item(s): _____

5. The contract is for proprietary item(s) for resale: This can include the buying or selling of item(s) by students when it is part of the educational experience —

State the type(s) of item(s): _____

6. The contract is for replacement parts when the need cannot be reasonably anticipated and stockpiling is not feasible —

State the item(s): _____

7. The contract or purchase is for expenditures made on authorized trips outside the boundaries of Jefferson County Public Schools —

State the location: _____

8. The contract is for a sale of supplies at reduced prices that will afford Jefferson County Public Schools a savings (Purchase must be approved by Director of Purchasing) —

Explain the logic: _____

9. The contract is for the purchase of supplies which are sold at public auction or by receiving sealed bids —

State the items: _____

I have determined that, pursuant to K.R.S. 45A. 380, the above item(s) should be obtained by the Noncompetitive Negotiation Methods since competition is not feasible.

Brent West

Print name of person making Determination

GIS Services

School or Department

Brent West

Signature of person making Determination

5/27/2021

Date

Dynamic Ideas LLC dba/Dynamic Ideas Routing
Name of Contractor (Contractor Signature Not Required)

Requisition Number

Explanation of Noncompetitive Negotiation Methods can be found under K.R.S. 45A.380 and on page 15 in the Procurement Regulations

F-471-1

Revised 05/2011

Jefferson County Public Schools - Bell Time Analysis and Route Planning
March 26, 2021

Sole source justification letter to Jefferson County Public Schools for the purpose of optimizing school bell times and bus routing

Jefferson County Public Schools is facing a massive operations challenge. The district manages one of the most complex school transportation systems in the country, requiring 900-plus buses and several non-traditional bus routing models to serve nearly 70,000 students everyday. On top of that, the district has been hit with an unprecedented driver shortage. JCPS must do whatever it can to reduce its fleet size to mitigate against the loss of drivers. More optimal bus routing can help and other fundamental steps should also be explored, including an analysis of the district's bell times and the efficiencies that can be gained by shifting the existing schedule. There can be no doubt that this schedule contributes to the inefficiency in the system and the need for the large number of buses. Unfortunately, truly optimizing school district bus fleets and bell schedules is not something that is commonly available in the marketplace.

Dynamic Ideas Routing -- an MIT-founded company -- offers a suite of best-in-class tools to allow districts to solve a range of problems, including the daunting challenges above. Our innovative school routing platform reshapes how districts think about their transportation planning, helping teams to create the most efficient and flexible bus routes without compromising reliability or student safety. **In our work with other districts, we've found we can help reduce transportation budgets by 10-30%.** This includes districts who use market-leading software to develop their bus routes. Our work shows these districts that other software simply cannot do what we can do.

Leveraging cutting edge operations research, we work with school systems to optimize their bus routing, adjust their school start-times, or change their student assignment model. Our unique technology can evaluate millions of scenarios in hours while accounting for countless variables. **To our knowledge, we are the only vendor in the market who uses sophisticated mathematical modeling and machine learning to optimize entire bus fleets and district bell times.** This has been reinforced in conversations with school districts across the United States and beyond, who have struggled using their existing software to increase the efficiency of their operations.

The current JCPS bell schedule, with two primary bell tiers spread nearly 90 minutes apart and a third tier which runs slightly later than the second, is a leading contributor to the district's need for 900-plus buses. (Another is the district's extremely generous degree of school choice countywide, which is something we seldom see in other districts.) A typical approach to adjusting bell tiers amounts to looking at existing bus trips at the school level and manually moving them, in whole, to different times of the day. But this approach has substantial shortcomings. First, it fails to appropriately consider the interconnectedness of bus runs across the day: you cannot simply move bus runs around the schedule without considering the implications these moves have on each bus's daily schedule. Second, it lacks precision: today's bus trips necessarily should

Jefferson County Public Schools - Bell Time Analysis and Route Planning
March 26, 2021

look different in a changed bell schedule, and yet this approach does not allow for that. Third, and most important, this is simply not a realistic methodology for a district as complex as JCPS: the district uses double-runs, magnet transfers, and countywide transportation for many thousands of students. Humans simply cannot possibly compute all this complexity into any rudimentary exploration of changing bell times.

Similarly, routing software used by school districts across the country cannot compute all the permutations that this kind of transportation system has for its routing network, and thus district bus fleets across the country, including in JCPS, are inefficient and suboptimal.

The only way to truly address these two challenges – optimizing bus routes and bell times – is to use sophisticated mathematical modeling and machine learning, and again we appear to be the only company capable of doing this. Our approach has been featured in *The Wall Street Journal* and has been published in a leading operations research journal.¹ Moreover, the team involved in the development of our technology – a partnership between MIT and Boston Public Schools – was named as a finalist for the INFORMS² Franz Edelman Award, the most prestigious award for enterprises focused on optimization and operations. I add these last points to illustrate that we are not just another vendor, but a company with a rich background in ground-breaking academic research, the kind of background necessary to solve a problem as complicated as the one confronting Jefferson County Public Schools.

In closing, we are confident that we are the only provider in the marketplace with the sophistication and advanced technology necessary, under the timelines being discussed, to handle the complexity within the JCPS transportation framework and optimize the district's bus fleet *and* its bell times. If contracting with the district, then we will present multiple scenarios for consideration showing significant potential for cost savings, reduced buses (and drivers), and proposed bell schedules which can achieve multiple objectives.

Please let us know if you need further information.

Yours truly,



John Hanlon
CEO & Co-Founder

¹ The research referenced above was published in *PNAS – Proceedings of The National Academy of Science of the United States of America*.

² INFORMS is the leading international association for professionals in operations research and analytics.



DYNAMIC IDEAS
Routing

**Proposal to Jefferson County Public Schools
for
Routing as a Service and
Bell Times Optimization**

May 27, 2021

1. About Us

Dynamic Ideas Routing dates back to the spring of 2017, when Boston Public Schools (BPS) launched the BPS Transportation Challenge. This was a hackathon-style event led by the district's Chief Operations Officer, John Hanlon, who now serves as the Dynamic Ideas Routing CEO. The event sought to find solutions for two of the district's most vexing problems: its need to save money in transportation by automating more efficient bus routes, and its ongoing challenge of determining how to best adjust school bell times. A team from MIT entered the event and produced solutions that not only led them to win the competition but also garner districtwide attention and press acclaim. By the end of the summer, the team's efforts were chronicled in *The Wall Street Journal* and their bus routing solution was implemented, leading to a reduction of 50 buses from the BPS fleet and an estimated savings of \$5 million. The technology behind that ground-breaking solution became the foundation of Dynamic Ideas Routing, and the team involved were named as finalists for the Franz Edelman Award, the most prestigious honor in the world for those who specialize in operations research and optimization. (Coincidentally, the award was won that year by the Louisville Metropolitan Sewer District, working in collaboration with Tetra Tech.)

Dynamic Ideas Routing is a subsidiary of Dynamic Ideas LLC, a company with a 20-year track record of using the latest in operations research, machine learning, and advanced analytics to solve complicated problems across multiple industries. The company was founded by Professor Dimitris Bertsimas, who is the Dean of Business Analytics at MIT, a worldwide leader in optimization, and a member of the National Academy of Engineering. Since 1999, the firm has created customized tools and game-changing solutions in the worlds of finance, supply chain management, revenue management, healthcare, and crime prediction and prevention, to name a few. Clients and related research have spanned the public and private sectors in several countries and have also included work on one of the leading COVID-19 predictive models.

Our philosophy, and that of Dynamic Ideas LLC, is that the fields of mathematics, machine learning, and artificial intelligence can and should be harnessed to drive substantial benefits for the public good. We believe that districts should spend more money investing in students' instruction and less on bus routing. We use the power of our unique approach to show districts how they can do just that, alleviating driver shortages and saving millions of dollars in transportation costs that can be reinvested in the classrooms. Our MIT-based algorithms typically allow school systems to reduce their bus fleets by 10% to 30%.

2. Background

We have been in contact with Jefferson County Public Schools (JCPS) since last year and have accelerated our work of late, as part of a free demonstration period we extended to the district. Brent West from the JCPS Transportation Department has been our main point of contact and

Jefferson County, KY – Routing as a Service / Bell Times Optimization
May 27, 2021

has shared some of the challenges facing his team, including but not limited to the current driver shortage, last reported to us as 175 drivers. We have not seen a district as complex as JCPS in its size and especially its extent of school choice and the range of transportation methodologies used to provide countywide busing (e.g., hub and spoke routing, double runs, and shared busing). We applaud the JCPS Transportation Department for finding sometimes creative measures to allow for safe and reliable transportation, amidst enormous complexity and an ever-growing driver shortage.

Despite this complexity, we built models to replicate and then optimize JCPS routing plans and recently developed a baseline scenario which showed the potential to reduce the district fleet by 55 buses. Given new flexibilities which have recently been authorized and the significant potential for improvement upon our initial demonstration results, we are confident that we can help JCPS to further reduce its number of buses and, as a result, the number of drivers necessary. It is worth noting, however, that we do not anticipate being able to completely offset the size of the current driver shortage – not without significant policy changes, some of which might not be advisable at this time. Among those policy changes could be an adjustment to the district's bell times, which we have also discussed with the JCPS team.

3. Purpose

Dynamic Ideas Routing will undertake the scope of work described here to assist JCPS with its ability to offer required transportation services during the 2021-22 school year and beyond. This project will serve two purposes: (1) to optimize 2021-22 school bus routes with the intent of reducing the required number of buses as much as possible; and (2) to optimize JCPS school bell times with a goal to stabilize the number of buses needed amidst the continuing driver shortage and, potentially, to accommodate national research on school start times.

The first purpose above represents an immediate need and will require our team to begin work as soon as possible. The second will begin to take shape after 2021-22 bus routes have been completed. This project could result in new proposed bell times for the 2022-23 school year, and as such, we hope to complete preliminary analyses of new bell times during the fall of 2021, in time for the district's school registration period.

4. Scope of Work

The scope of this project will be divided into two overlapping phases, described below:

1. Routing as a Service. Expected timeframe: June 9 through 2021-22 school year
2. Bell Times Optimization: Expected timeframe: August 2021 – August 2022

Jefferson County, KY – Routing as a Service / Bell Times Optimization
May 27, 2021

This project will include but not be limited to the following tasks and milestones:

- Receipt of data from JCPS regarding students, schools, buses, etc. (*see Information Needed section below*)
- Receipt of information and further guidance from JCPS on relevant rules, policies, and other factors, which Dynamic Ideas Routing should build into its routing system (*see Information Needed section below*)
- Integration of the data/information into the Dynamic Ideas Routing Optimization Engine, including necessary data cleaning, possibly requiring further clarity from JCPS
- Computation of the data/information through the Dynamic Ideas Routing Optimization Engine, resulting in one or more routing plans for JCPS
- Delivery of routing plans to JCPS, including but not limited to:
 - A pdf or csv report on relevant routing metrics, if requested (e.g., number of buses, average walk-to-stop distance, average student-on-board time, etc.)
 - A copy of all routes via pdf or some other agreed-upon format, if requested
 - Access to the Dynamic Ideas Routing interface to evaluate and copy routes, if requested
 - Assistance with accessing the interface and interpreting the route copies, where necessary
- Further refinement of each routing plan, if needed
- Multiple check-in meetings involving members of the JCPS and Dynamic Ideas Routing teams

Service will begin upon execution of a contract between Jefferson County Public Schools and Dynamic Ideas Routing, under the guidelines of this proposal.

The tasks and milestones above will appear in both phases of this project. See below for more detailed information on each phase.

Phase 1: Routing as a Service

The primary goal of Phase 1 will be to deliver a safe and reliable 2021-22 routing plan to JCPS which reduces the required number of buses as much as possible, to best offset the district's driver shortage. This phase is likely to extend throughout the upcoming school year but the immediate focus of the work will be on the period from June 9 until mid-July – roughly from execution of a contract until the JCPS drivers' bid.

The tasks and milestones listed above are all relevant to this phase, as are the following three sub-phases of work, which we believe will assist us and the district in reducing the size of the bus fleet:

1. Collaboration with district on Dynamic Ideas Routing mapping tool

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May 27, 2021

Our team has built an innovative mapping tool, which we have shown to JCPS staff, that allows us to easily group students at each school into different transportation methodologies, including traditional/direct routing, hub and spoke, and double runs. Our preliminary baseline solution was the result of our team's first attempt at using this tool, but we believe that greater results can be found by collaborating with the district on the use of this tool and exploring new student groupings. We will provide this tool to the JCPS team, along with training on how to use it.

2. Route optimization using new district flexibilities

Our preliminary baseline solution used the rules and policies in place when we first began our free demonstration period, but we understand that the district has adopted one or more routing policy changes which can allow for greater route optimization (e.g., allowing students to arrive 55 minutes before the start of school). We will conduct new route optimizations using this and potentially other new policy adjustments and expect that they will lead to further route reductions.

3. Exploration of additional district policies for consideration

We understand that the district is not intending to change district bell times until the 2022-23 school year, but we intend to explore other policies which also influence the number of buses/drivers needed and which may, potentially, be more politically viable in a short timeframe than changing bell times. These include walk-to-stop distances and maximum ride-times and possible others as well. As mentioned previously, we do not expect that the steps above, nor even our technology, will allow the district to completely offset the size of the current driver shortage. Changing additional policies might then be worth consideration.

The sub-phases above will happen in parallel with one another and may in fact inform one another. As a result, our team will be prepared to conduct numerous route optimizations throughout this period. Each one will instigate a feedback cycle, through which we and JCPS learn and then decide which new changes to make in the next route optimization. This will be a highly iterative process, involving substantial input from the JCPS team and the full extent of our technical skills, but we expect that this is what is needed to get closer to an optimal number of buses for the school district. **Given the district's emergency and the tight timeline involved, Dynamic Ideas Routing will set aside substantial staff and server capacity to best meet the challenges of this phase.**

Subsequent work during the 2021-22 school year:

The main thrust of Phase 1, as mentioned, will take place in advance of the drivers' bid, after which we will largely transition to Phase 2 – Bell Times Optimization, but we anticipate that the district will need us to be on call throughout the 2021-22 school year, for additional route optimizations if any further changes occur (e.g., student enrollment, driver availability, policies,

Jefferson County, KY – Routing as a Service / Bell Times Optimization
May 27, 2021

etc.). During this period (after drivers' bid through the end of the 2021-22 school year), we will be on hand to deliver up to three additional route optimizations and will conduct refinements to each one within 30 days of delivery. These route optimizations often entail re-routing the entire district, and so they are not recommended unless major changes occur. The refinements to each optimization typically involve smaller details and change requests.

We would be happy to discuss these additional optimizations and refinements in more detail if requested.

Dynamic Ideas Routing expects to deliver any additional route optimizations and iterations within two weeks from the date all data is available. Delivery time may vary with routing plan optimization or refinement complexity.

Option for subsequent Routing as a Service work:

Knowing that the national driver shortage crisis is likely to continue, we propose to JCPS that you consider adding option years to any contract resulting from this proposal, so that we can continue to assist the district's team in meeting its transportation challenges and providing safe and reliable bus routing to your students. We anticipate that the substantial effort required over the next two months will make route optimizations in subsequent years somewhat less challenging, but no less necessary.

Phase 2: Bell Times Optimization

The primary goal of Phase 2 will be to optimize JCPS school bell times based on relevant district objectives and conditions. We will transition to this phase after delivery of final 2021-22 school bus routes and no later than October 1, 2021 – the timeline will likely be determined in large part by JCPS readiness and availability. We expect that this effort will result in either a further reduction in the number of buses needed or a simplification of the JCPS routing system, alleviating some of the pressure points which might be necessary to provide routing to all required students in 2021-22 (e.g., the aforementioned 55-minute window before the opening bell to drop off students). That aside, the district may choose to undergo a change to school bell times for reasons outside of the size of the bus fleet and bus driver availability; if so then the result may or may not decrease the required number of buses.

The tasks and milestones listed on page 4 are again relevant to this phase, in addition to others listed below:

- Receipt of information from JCPS on relevant bell-time considerations, which Dynamic Ideas Routing should build into its analysis (*see Information Needed section below*)
- Computation of the data/information through the Dynamic Ideas Routing Optimization Engine, resulting in routing plans that meet multiple bell-time objectives and conditions

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- Delivery of summary results to JCPS, including a pdf report of each bell time scenario, with a full listing of all schools and their current and proposed bell times, and a set of relevant summary metrics, including but not limited to the number of start-time tiers, the number of buses, the number of schools and students at each tier, and the number and percent of schools remaining at current bell times and changing bell times

We will provide two options to JCPS for this work:

- Up to two different analyses, evaluating two different objectives, each with its own set of conditions and constraints
- Up to four different analyses, evaluating four different objectives, each with its own set of conditions and constraints

Each analysis may include multiple distinct scenarios for consideration – each meeting the objectives and conditions of the given analysis – and may include one revision if requested. Revisions will be limited to small changes which do not significantly alter the analysis but which aim to modify certain elements of the analysis. More details on the analyses and revisions can be provided upon request.

Similar to our route optimization capability, we are unique in the industry in our ability to optimize district bell times across a range of objectives and variables. To our knowledge, ours is the only technology available which will allow districts to fully evaluate multiple bell-time scenarios, not through high-level reviews of district statistics, practices, and policies, but through complete routing plan simulations, allowing for more precise projections of the changes which would result from each scenario.

5. Information Needed from Jefferson County Public Schools

The proposed work will require all of the following for the 2021-22 school year:

- Student data (school assignment, address, special education accommodations, etc.)
- Schools data (school ID, address, current bell times, etc.)
- Bus stop data (address)
- Bus data (lot assignments, capacity data, etc.)
- Districtwide rules (dwell times, route-length maxima, walk-to-stop maxima, street-crossing limitations, etc.)

Phase 2 – Bell Times Optimization will require the following additional information:

- Objectives, conditions, and constraints for each bell-time analysis

More detailed information on all of the above can be provided upon request.

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It is essential that we receive complete and fully accurate, precise data in order to conduct the sophisticated route optimizations and analyses required by this project. Errors or gaps in the data can lead to flawed results and misinformed projections and decisions.

6. Costs

Jefferson County Public Schools will be considered a **VIP customer**, as part of the product launch phase of Dynamic Ideas Routing. As such, the costs below reflect discounted rates than what should be expected in future years or for other clients.

Phase 1 – Routing as a Service:

- **Total Cost: \$346,667**

Despite the enormous complexity and urgency in this project, the cost above is calculated solely as a function of the number of routed students. During our extended free demonstration period, the number we used in our analysis was approximately 68,000. For these purposes, we have lowered that to 65,000. If the actual number of routed students used in our proposed analyses is lower than 60,000 or higher than 70,000 then the costs would change proportionately.

Invoices for Phase 1 will be issued to Jefferson County Public Schools according to the following schedule:

- \$50,000 upon execution of contract
- \$100,000 at the end of June 2021
- \$150,000 at the end of July 2021
- \$46,667 at the end of the 2021-22 school year

The schedule above reflects the extent of work expected within each timeframe, from the preparation of our models and tools with newly loaded JCPS data at the outset of the project, to the substantial work necessary in June and July to deliver final routing plans with anticipated route reductions, through the additional route optimizations available during the 2021-22 school year.

Option for continued Routing as a Service work in subsequent years:

Dynamic Ideas Routing would reduce the Routing as a Service cost above by 50% for up to four years beyond the initial year of this agreement (through the 2025-26 school year), provided that additional complexities do not present themselves which would create a material difference in the expected work (e.g., further reduction in the number of drivers available by

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15% or more; significant changes to district policies regarding transportation eligibility, school choice, etc.).

Phase 2 – Bell Times Optimization:

- **Option A – Up to two bell-time analyses: \$162,500**
- **Option B – Up to four bell-time analyses: \$227,500**

As with Phase 1, the costs above are a byproduct of the number of routed students, again using 65,000 as the basis. As in Phase 1 above, if the actual number is higher or lower by 5,000 or more then the costs would change proportionately. The costs above also reflect a 25% reduction from our standard costs for such a project, given that this is follow-on work, albeit very different work, subsequent to Phase 1 above.

JCPS does not need to determine which bell-times option it wishes to consider until the beginning of Phase 2.

Invoices for Phase 2 will be issued to Jefferson County Public Schools according to the following schedule:

- 25% of Phase 2 total on September 1, 2021
- 50% of Phase 2 total on December 1, 2021
- 25% of Phase 2 total on March 1, 2022

As with Phase 1, the schedule is derived so as to match the relevant extent of work expected within each timeframe.