City Council Bell Time Questions

1. **BPS Transportation Costs**
   a. **How many buses does the district currently own?**
      i. The district currently owns 757 buses. Of these, we keep approximately 15% as spares or to be used for athletics. Historically, we have routed about ~650 buses on a given day and used ~700 over the course of the day to cover severely delayed routes, athletics, and other issues. This year, thanks to the work of the Transportation Challenge, we have routed closer to 600 buses for most of this year while using closer to ~650 buses.

   b. **How many drivers carry out these routes, and can you confirm that the arrangement is still that drivers are not BPS employees but employed by a bus company on contract with the City?**
      i. We currently have 707 active drivers covering 605 routes, which includes 133 standby or citywide drivers, who fill in for absent drivers, provide support in the case of vehicle breakdowns or other emergencies, or help with day-to-day route problems.
      ii. An additional 150 drivers are on leave (e.g., personal, medical, paid administrative leave).
      iii. The drivers are not BPS employees and are employed by Transdev, a transportation vendor, on a contract with the city.

   c. **How many runs does each bus currently make each day, and what is the average length of each run? How do after school drop-offs differ from morning pick-ups?**
      i. Currently, our buses are making 4.8 trips per day. It is possible for a bus to make 6 trips per day -- 3 in the morning and 3 in the afternoon. Just over 30% of our buses are currently making 6 trips per day. By adjusting start times, we expected to be able to re-use and fill our buses more efficiently, thereby increasing the average number of trips per day and decreasing the number of buses (without, we believe, significantly increasing the length of trips or the number of students per trip).
      ii. The average student is routed to be on the bus for 23 minutes and 47 seconds. However, there is significant variation across rider types. For example, our riders who are attending an out-of-district private special education placement ride the bus for an average of 48 minutes while a BPS corner-bus-stop student rides the bus for an average of 21 minutes.
      iii. The average trip -- the time it takes to go from the first pick-up to the last drop-off -- lasts for 41 minutes. However, there is significant variation across trips. As we have some students who are traveling significant distances, our longest 10% of trips take an average of 68 minutes (many

of these have just one student -- and this is simply the time required to get them directly from home to school in a school bus). Meanwhile, our shortest 10% of trips take an average of just 16 minutes.

iv. Morning trips are slightly longer than the afternoon trips, on average (28 minutes compared to 25 minutes). This is partly because, on average, our buses have more time to perform their routes in the morning given that most of our school start-times are fixed along three tiers: 7:30, 8:30, and 9:30, giving our buses a full hour to pick up students. Conversely, because of different school day lengths in the district, our school dismissal times are much more variable than our start-times (e.g., schools dismiss at 2:30, 3:10, 3:30, 4:10, etc.) and often leave our buses with less time to perform routes.

v. Additionally, our research has found that, over a sustained stretch of time, our average traffic speed is generally slower across afternoon travel times than it is during morning travel. Despite this, it's worth noting that the slowest time of the day is during the 8-9am rush-hour window. As part of the process to adjust start times, we used traffic data to calculate this.

d. **What factors affect contract costs, i.e. is it based on hours worked, number of routes, or other outcomes?**

i. There are a number of factors that affect contract costs. Generally speaking, the largest factor is the number of routes that are run (keep in mind that a route is equal to a bus; individual trips are linked together to form routes). Every route that we add to the road comes with an additional driver. Each driver is guaranteed two and half hours each morning and afternoon if they are directed to report -- an annual base cost of about $80K per year per driver. Additionally, each route requires costs for the physical bus, including maintenance, fuel, and so on. We have estimated that each route comes with a fully loaded cost of approximately $100K annually.

ii. A secondary factor is the duration of our trips and, in composite, the total travel time and mileage of all of our routes. When building routes each year we take steps to keep these variables as low as possible, particularly this year as part of our work with the MIT Quantum Team to develop more efficient routes. A specific and important component of this work is to minimize deadhead time, which is the time during a route when a bus is empty (e.g., the portion of the route from the yard or school to the first stop). This can be described as unproductive time and has major cost implications.

iii. There are additional costs beyond the number of routes -- including driver hours beyond what is designated for each route, paid administrative leave, busyard management and maintenance, the vendor management fee, and other smaller costs.

2. **Details of December 7, 2017, Proposal**
   a. **How many high school students would have a later start time under this proposal?**
      i. 75% of secondary (7-12) students would have experienced a later start time -- 18,380 students to be exact. Roughly 15% of secondary students would have moved earlier and 10% would not have seen their time change. Overall, we would have expected under 1,500 secondary students to be starting before 8am out of 24,500 secondary students. Currently, 17,200 secondary students start before 8am.

   b. **How many elementary school students would experience a schedule change of greater than one hour?**
      i. We would have expected roughly 12,500 elementary *seats* would move by more than one hour, including 6,000 who would move by two hours or more. However, roughly 30% of elementary school students change their school each year (either through switching schools or aging out of their current one) so the actual number of students who would experience this change would be smaller.

3. **What is the exact projection of cost savings from the plan as currently proposed?**
   a. **Where are these savings anticipated to come from, and what specific operational plans can you share that would lead to greater confidence of successful implementation given recent underperformance on projected transportation efficiencies?**
      i. Note: Although there would have been cost savings from this initiative, these savings would have been reinvested in our schools. BPS always framed this as a reallocation of funds not as a spending cut and, primarily, as a move which would align our schools with what research suggests is appropriate school start-times. The reinvestment potential was secondary but substantial.
      ii. Estimating the specific amount for reinvestment is never easy. Generally speaking, we have divided our costs into fixed costs (such as a bus yard, some central office costs, and some vehicle costs) and variable costs (driver costs, some maintenance costs). For our variable costs, we have historically estimated that each new or removed bus will cost approximately $100K. The remaining $60K in fixed costs should change over time and in line with a significant change in the number of buses. For example, if we were able to reduce 100 buses we would expect to be able to close a bus yard, reduce related management and maintenance positions, and potentially negotiate a lower management fee from Transdev.

      iii.   We should note that, until recently, we have never before seen significant reductions in the number of buses. Therefore while these numbers have generally reflected additions in costs, we are not precisely sure how a change in the number of buses will affect total costs. There may be externalities that are difficult to model (e.g. if we closed a bus yard, it would likely increase the total time a bus drives to its first stop or if we reduce a trip, we may increase overtime elsewhere).

      iv.   With that caveat, we estimated that the total reduction in routes from our proposed solution would be 74 trips over the long term. This would likely lead to a reduction of $7.5M in the short term and up to $12M in the long term, assuming that we are able to reduce fixed costs in line with the reduction in the total number of buses.

           1.   However, for a number of reasons, we do not believe we would have achieved $7.5M in short term savings which we viewed as a theoretical maximum. Instead, we estimated that it would take us several years to reach this savings level and instead estimated that the adoption of the proposed plan could produce near-term annual savings of $3-4M.

      v.   In terms of any factors that would have given us confidence that we could produce the projected savings, we have three things in our favor that we did not have prior to implementing the route reductions from last year:

           1.   We have been working hard this year to adjust our map speeds in the transportation software we use to more accurately reflect actual traffic patterns and speeds in Boston.

           2.   By assigning schools to different start times, we would be optimizing the system which results in not only lower costs but also increased predictability.

           3.   After having conducted this major effort to reduce our routes, we now know better what to expect and how to better develop a model for projecting the potential savings.

b. Are there any non-transportation costs that are affected by changes to bell times?

      i.   Other than potential short term collective bargaining costs, there were no other expected non-transportation cost changes due to this change.

4. **Alternatives - High School Changes Only**
   a. **What would the projected cost be of shifting high schools to later times as proposed, but keeping all other school schedules the same as currently?**
   b. **How many additional buses and/or bus drivers would be required for this, and how many runs would the buses be making?**

i. We currently have 500 bus trips per day to and from BPS high schools (250 in the morning and 250 in the afternoon)[1]. These trips serve over 7,500 students. Many of these are shuttles, but we also serve a significant number of door to door high school students (i.e., students who are picked up at their address due to an accommodation in an IEP or 504 Plan). A full 25% of our riders each day are high school students: 19% are shuttle riders and 6% are door to door students.

ii. The 7:30-8:30am timeframe is our peak time during the day, meaning it is when we have the largest number of buses on the road, serving the largest number of schools (the vast majority of these are 8:30 start-time schools). If we were to add even one school to the 8-9am window, without moving another school out of that window, then we would at a minimum need to add however many buses that school needs. This would increase our costs at roughly $100K per bus.

iii. A scenario in which only the high school start-times change, moving to the 8-9am window, is therefore cost-prohibitive. As such, we did not spend a significant amount of time exploring this option but have attempted to provide an estimate of the cost impacts below.

　　1. For example, if one high school currently was served by 17 trips at 7:20am and we moved that school to 8:30am (peak time), we would expect to add 17 buses which, at a cost of $100K each, would work out to $1.7M in annual transportation costs.

iv. Simply moving the high schools from an off-peak time (7:30am) to a peak time (8:30) would potentially require us to need 250 additional buses, which could cost as much as $25M in annual bus costs alone. This would also necessitate adding 1-2 new bus yards, which may cost $4-8M each annually (lease payments, maintenance and management staff, etc.).

v. Theoretically, we could reduce the potential costs above if we were to split these 250 trips to 125 at 8am and 125 at 9am. This would bring the cost estimate to a much lower figure of about $15M plus the cost of one new bus yard. However, this would also lead to other concerns as a significant number of our high school students would then be starting as late as 9am and dismissing as late as 4pm. This was something we tried to avoid, knowing the concerns involving after-school work and internship opportunities, child-care responsibilities, and sports or other program commitments. The proposed start times from last month ensured that the majority of our high schools would start after 8am, but only 4 would have started at 9am or later, and only 2 would have dismissed after 4pm.

5. **Alternatives - High School Changes & Less Extreme Elementary School Changes**

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[1] Bear in mind that trips are different from routes in that multiple trips combine to form a route. We have 605 routes every day, accounting for more than 1,400 trips; 500 of these trips are to or from high schools.

a. **What would be the projected cost of shifting all high schools to the later times as proposed, and changing elementary school schedules to a start time no more than one hour earlier or later than their current time, and with no start before 7:45AM?**

b. **How many additional buses and/or bus drivers would be required to accommodate this, and how many runs would the buses be making?**

    i. This scenario would still produce substantial cost increases over our current system, but by allowing for the possibility of some elementary schools changing times, this would likely lead to lower costs than simply changing only high school start-times. However, in order to make this change feasible, we would likely need to dramatically increase the number of elementary school students starting at 9:30am and dismissing after 4pm. Because one of our policy goals was to *decrease* the number of late start and end schools, we did not explore this extensively.

    ii. Furthermore, limiting the length of time that schools can change severely limits the flexibility of the model and will result in much lower cost savings which could be reinvested in schools. Also, it would require that nearly all schools starting at the more favorable 8-9am time slot would need to move to 7:45 or 9:30am.

    iii. BPS schools currently start between 7:15am and 9:30am, meaning we have that window of time to complete our morning bus trips. This gives us 10 possible school start-times, along 15-minute increments. If we narrowed this window to 7:45 to 9:30am, we would decrease our range of start-times from 10 to 8, or a 20% decrease. Further, it should be noted that currently more than one-third of our students start school before 7:45, and 20% start before 7:30 (e.g., at schools that start at 7:15). Incorporating the constraint of having no schools start before 7:45, therefore, would prove extremely costly. This could increase costs by as much as $25M annually (roughly 20% of our budget), although the actual cost impacts would depend on how exactly we construct a set of start times to meet the goals in the request above.

    iv. We see three possible ways to approach this request:

        1. Move all high schools to later start-times; ensure that no school starts before 7:45 and changes by no more than an hour; minimize the number of elementary school changes: We believe that this is what is being described in the request, but this is also the scenario where we could approach the $25M cost increase mentioned above. Moving all high schools to a time slot after 8am (but before 9am to avoid conflicts with after-school activities) would require us to shift 250 bus trips to that time slot. Shifting the earliest possible start-time from 7:15 to 7:45 would require us to change 16 elementary schools that already start before 7:45. Because we could not move these schools two hours later, this too would

crowd our peak time of 8-9am, adding significant costs. Also, in order to make room for the high schools in that range of times, we would need to move more elementary schools to start-times after 9am, which is something we know that the broader community does not want. Lastly, using 7:45 as our earliest possible time not only limits our flexibility and adds costs as mentioned previously, but it also creates the potential for many schools being at an "off-tier" time slot: currently many schools start at 7:15 or 7:30 so that our buses have enough time to perform routes for 8:30 schools. With many schools starting at 7:45 we would then limit the amount of time the buses have for those 8:30 trips -- again increasing costs as more buses would be needed to run those trips. Alternatively, we could shift the 8:30 start-time to 8:45, but then that would create the same conflict by having limited time for the 9:30 trips.

2. Move all high schools to later start-times; ensure that no school starts before 7:45 and changes by no more than an hour; allow for as many school start-time changes as necessary to control costs: The key difference in this approach is that we would not attempt to minimize the number of schools changing their times. This could allow us to somewhat limit the cost increases above, but they would still be significant: possibly as much as $15M. We would benefit from some greater flexibility to optimize the system as a whole, but the 7:45 threshold and the requirement that no schools could change by more than an hour are significant constraints which would produce dramatic costs. Again, the 8-9am peak time would be crowded, with many more buses on the road at that time, and there would be many more elementary schools starting after 9am and dismissing after 4pm.

3. Move all high schools to later start-times; ensure that no school changes by no more than an hour; minimize the number of elementary school changes; allow some schools to start at 7:15: Obviously the key difference here is the earliest possible start-time. Because the 7:45 threshold is such a severe limitation, we believe that we might be able to produce a scenario that adds minimal costs (possibly less than $5M) if we seek to achieve the goals above and allow for 7:15 and 7:30 start-times. Additionally, we could likely accomplish this without increasing the percentage of BPS students already attending school before 7:30 (20%). Again, though, in order to accommodate the high schools moving into the 8-9am range, this scenario would require us to add more elementary schools to the 9:30 time slot -- potentially 20-plus schools.

v.   The above should be treated as rough estimates only. We believe they are directionally accurate and could model the scenarios further if needed, though it could take several days to generate firmer cost projections.

6. **Alternatives - Moratorium on Changes until 2019-2020 School Year**
    a. **If the district paused any changes for the upcoming school year, what would your plan be for a process to assess feedback and recommend changes for the 2019-2020 school year?**
        i.   We are actively working to shape our future community engagement on this initiative. There are three elements which we know will underpin our future work in this area:
            1. More engagement: We had an extensive engagement process before, based on family and staff surveys, neighborhood focus groups, and community meetings, but we know that this was not enough, particularly in how we engaged our school leaders.
            2. More education: It was evident throughout many of our community discussions and in the feedback we heard after the announcement of the proposed new start-times that we need to do a better job educating all stakeholders involved on the many complexities of this issue. For example, we heard from many people that schools should start no earlier than 7:45 and no later than 8:45, but the cost and traffic implications of this move -- likely $100M-plus in added costs and 800-plus more buses on the road -- would be so severe as to make the idea unrealistic. Our next efforts in this work will need to begin with an extensive education campaign.
            3. More time: Although we spent 18 months engaging the public, we realize now that a project of this enormity requires even more time.
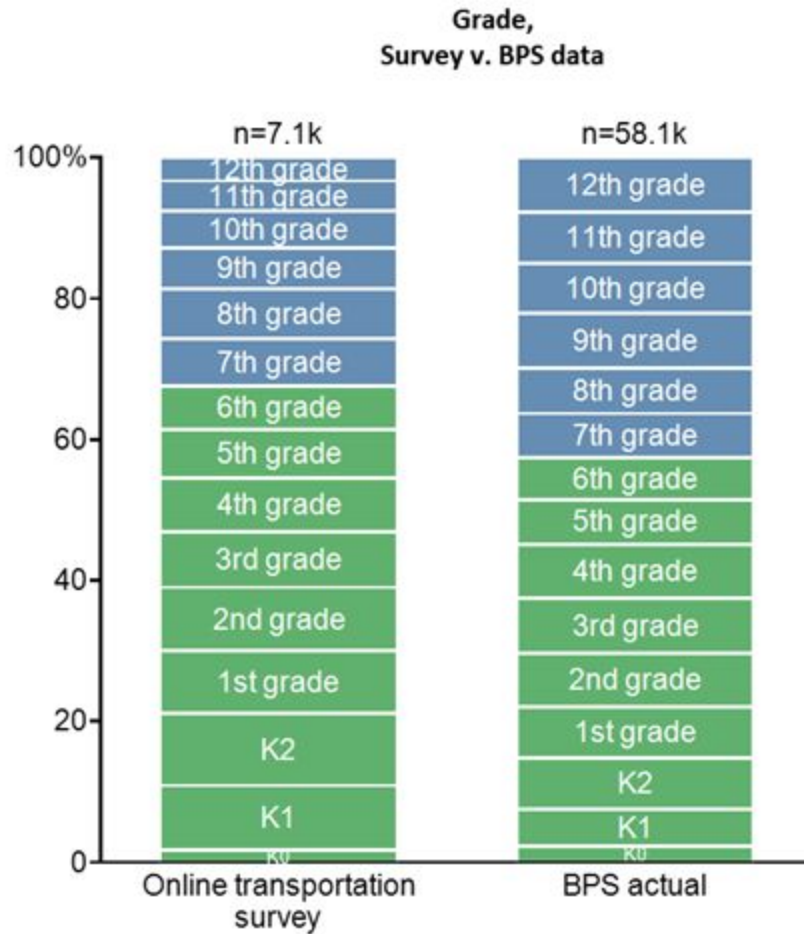
7. **Family Preferences**
    a. **How many families were included in the bell times surveys conducted over the last year, and what is the breakdown by student grade, neighborhood, students with an IEP, racial demographics, and language preference?**
        i.   The following is in regards to the large districtwide survey we conducted last spring. BPS conducted a number of other outreach efforts over the last year, including an open-ended questionnaire on our website, which we believe is irrelevant to this question.
        ii. The spring survey was emailed to every BPS family for whom we had an email address on file and staff member and was translated into ten different languages. The survey asked about transportation and bell time preferences. Through this online survey, we heard from 5,441 parents. Additionally, we called 2,500 families in their home language who we

identified as higher need in that they did not have an email address in the system, were eligible for direct certification (a measure of economic need), and were attending a school with a low response rate. We received responses from just under 1,000 of these families. Many families have multiple students within BPS, so the total number of students represented in the survey is over 7,000, roughly 13% of the district.
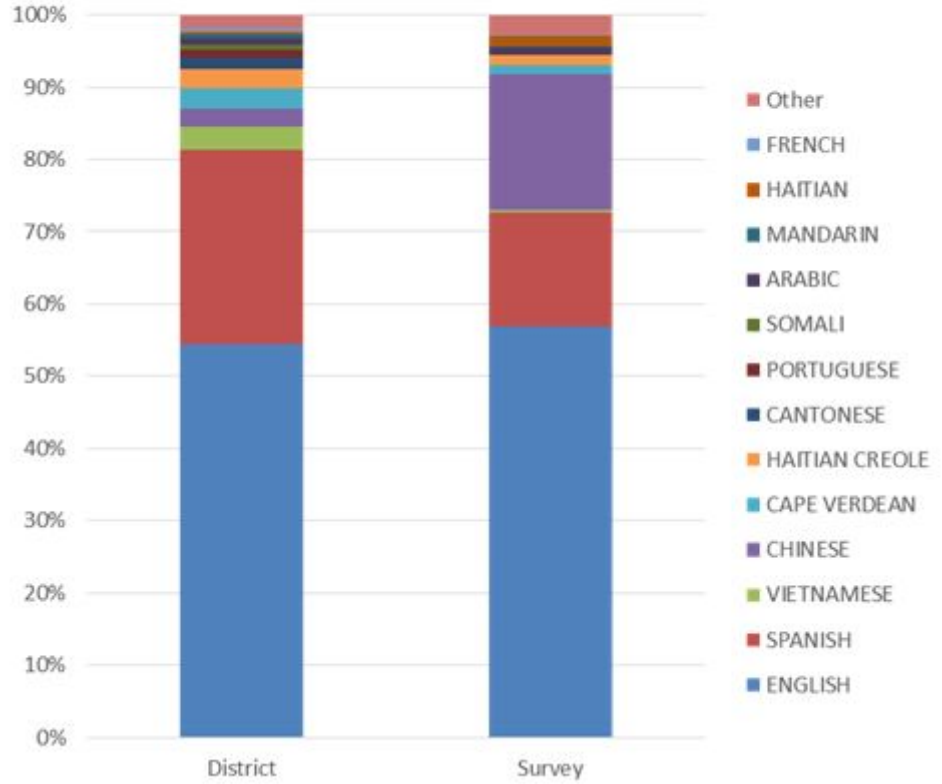
iii. We did ask all survey-responders for the grade of their children. Those results are below.

**Grade,
Survey v. BPS data**

n=7.1k   n=58.1k

Online transportation survey	BPS actual
12th grade	12th grade
11th grade	11th grade
10th grade	10th grade
9th grade	9th grade
8th grade	8th grade
7th grade	7th grade
6th grade	6th grade
5th grade	5th grade
4th grade	4th grade
3rd grade	3rd grade
2nd grade	2nd grade
1st grade	1st grade
K2	K2
K1	K1
K0	K0

iv. We also asked families if they receive special education services: 19.6% of respondents said they do, compared to 19.6% of the district overall.

v. For the purposes of brevity and anonymity, we did not ask for identifying information in the online bell time survey. However, we did give families the option to not take the survey anonymously. Most families did not choose this option, however nearly 800 did. Those results are below. *Note: this does not include demographic information from the families we*
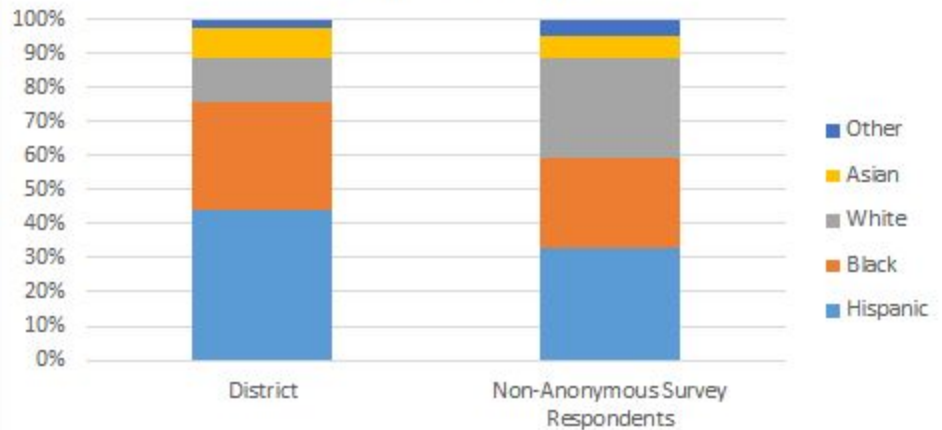
called. While we do not have this information, this skews much more heavily towards our higher needs population.

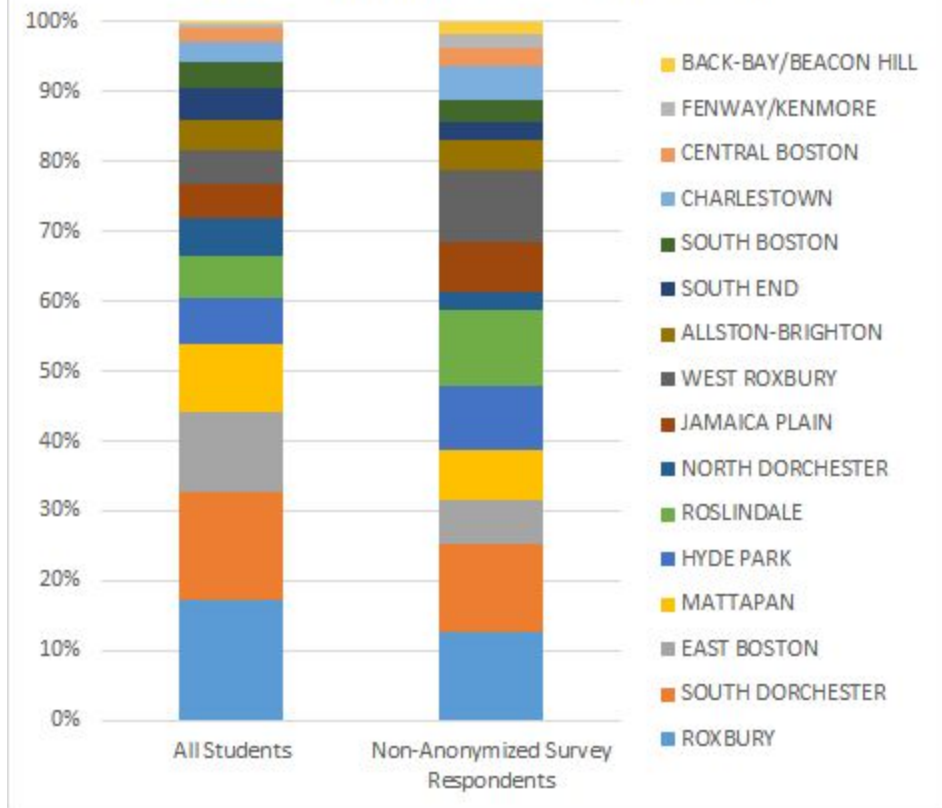**Reported Home Language for Families We Could Match Data To**

vi.

vii.

Neighborhood Distribution of Non-Anonymized Survey Respondents (Online Survey Only)

viii.

b. Could you share data on how many families preferred which start times, broken down by student grade, neighborhood, students with an IEP, racial demographics, and language preference?

    i. We do not believe that we have sufficient non-anonymized data to present each of these graphs. However, we are able to share with you the distribution of responses by grade.
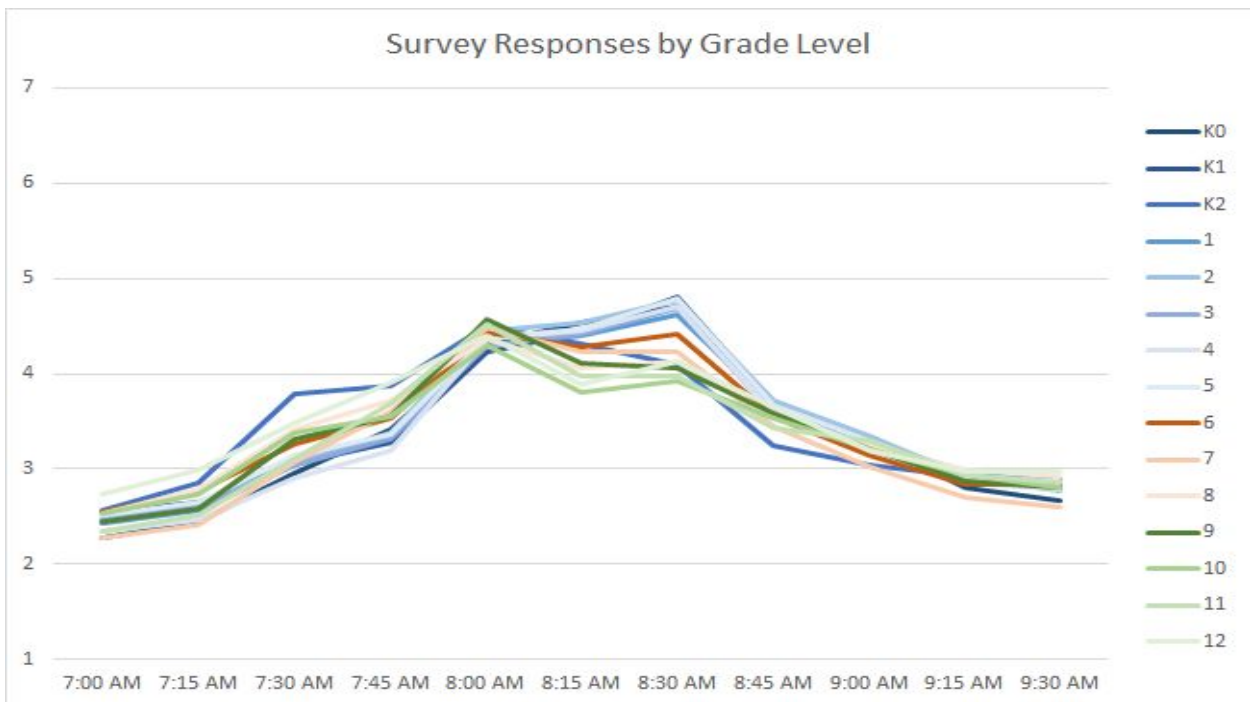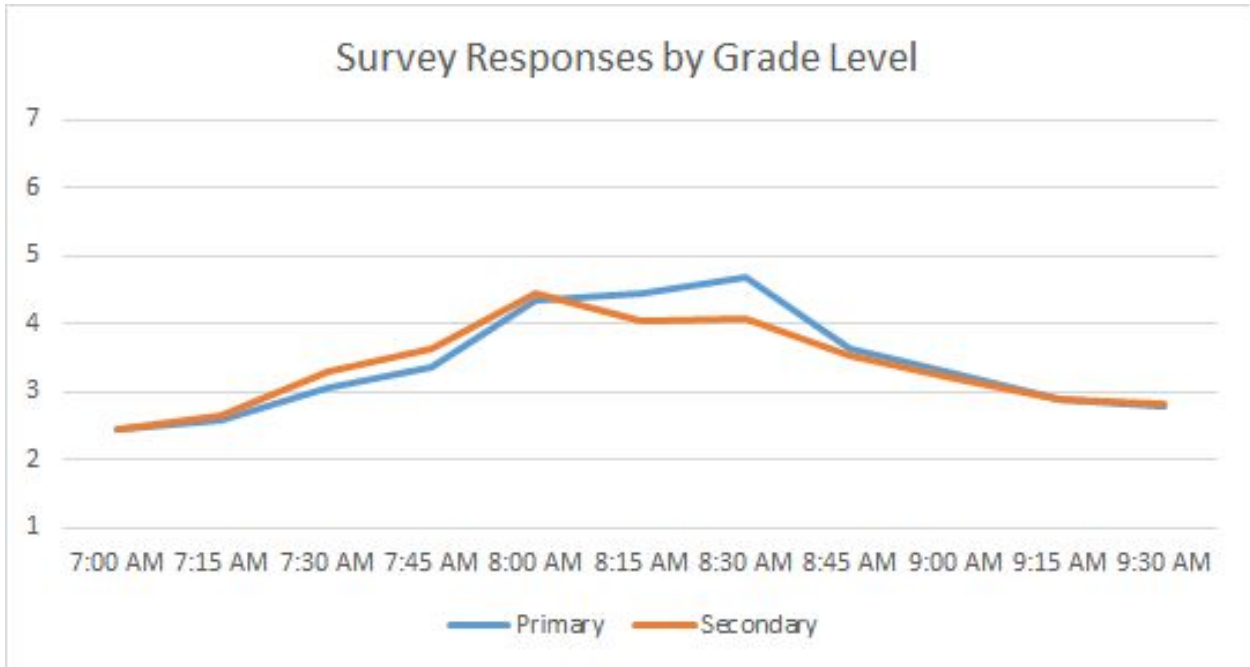
c. The fact is that within every school there is a range of start-time preferences and there is often a distinction between what most of our staff might prefer compared to what most of our parents might prefer. All of this makes it difficult to use the survey data as a primary decision-making tool, although it is clear that, on average, people prefer start-times in the 8-9am range. To be clear, there is a way to use the data in our next models; there are simply caveats in using it which people should be aware of.