GRADO EN INGENIERÍA EN TECNOLOGÍAS INDUSTRIALES

TRABAJO FIN DE GRADO

NEWBERRY ELEMENTARY SCHOOL CAR-POOL PROCESS AND FACILITIES IMPROVEMENT

Autor: María Enriqueta Franch Mañas
Director: Katie LeAnne Basinger

Madrid
Junio de 2019

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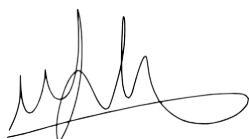Madrid, a 28 de junio de 2019

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Autorizada la entrega del proyecto

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Fdo.: Dr. Katie Basinger, PhD   Fecha: 23/ 04/ 2019

Dr. Katie L. Basinger

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Director: Basinger, Katie LeAnne

Entidad Colaboradora: Newberry Elementary School

RESUMEN DEL PROYECTO

Introducción

- Objeto del proyecto

El objetivo de este proyecto consiste en optimizar el proceso de recogida de alumnos del colegio Newberry Elementary School, eliminar el problema de seguridad que crean "walkers" que no van andando a casa, así como explorar diferentes alternativas para añadir espacios de aparcamiento dentro del territorio escolar.

- Planteamiento del problema

Durante los últimos años el colegio Newberry Elementary School ha sufrido un crecimiento de alrededor de 35 a 40 alumnos al año y se espera que este crecimiento se mantenga constante durante los próximos años (PEAR19). Debido a este crecimiento, los alumnos de quinto grado se han visto obligados a asistir a Oak View Middle School, ya que este colegio sí que dispone de los recursos necesarios para hacerse cargo del crecimiento de alumnos.

El mayor problema ocasionado por este crecimiento de alumnos son las quejas por el aumento del tiempo que han de esperar los padres para poder recoger a sus hijos del colegio. Cada día, los padres tienen que esperar en sus coches fuera del territorio escolar hasta que suena la campana de fin de clases y luego hacer la cola para poder entrar al colegio.

Otro problema que tanto la dirección del colegio como la Asociación de Padres y Profesores consideran una prioridad es la seguridad de los alumnos durante la salida del colegio. Hay alumnos que tienen permiso de sus padres para ir andando a casa, son los llamados "walkers". Hay

parte de estos "walkers" cuyos padres les esperan fuera del colegio para evitar hacer la cola. El conflicto de seguridad consiste en que al estar los niños fuera del territorio escolar no hay profesores supervisando en qué coche se montan.

Por último, la adición de nuevas plazas de aparcamiento supone un reto ya que el colegio dispone de un terreno muy limitado que ya usa casi en su totalidad y también porque el colegio quiere preservar en la medida de lo posible la zona arbolada que hay delante del colegio.

- Estado de la técnica

El sistema de colas es una de las cosas en las que se centran las empresas que hacen esperar a sus clientes antes de que se les atienda. Ya sea que el objetivo de la compañía sea hacer que la línea vaya rápido porque de esa manera pueden servir a más gente y obtener mayores ganancias o que sus clientes no se quejen de la larga espera, cada compañía presta especial atención a este asunto.

La mayoría de las empresas se inclinan por la primera opción, reduciendo el tiempo de espera. Las empresas realizan estudios de tiempo para conocer el "bottleneck" del proceso y reducir el tiempo que tarda en completarse esa acción. Empresas conocidas por mejorar continuamente su proceso interno son Starbucks o McDonald's. Sus procesos están constantemente siendo cronometrados y estudiados para eliminar cualquier ineficiencia.

Hacer que los clientes no se quejen de los largos tiempos de espera es más difícil que la primera opción, pero más gratificante porque no importa cuán larga sea la fila, sus clientes esperarán. Hay muchas maneras de lograrlo, pero la más eficiente es entretenerlos durante la línea. Disney es el líder de esta categoría, cada paseo dentro de un parque Disney está diseñado prestando atención a cada detalle y hace un viaje de 2 minutos que vale la pena esperar 40 minutos y todo para distraer a los clientes mientras están en la fila. Otra manera de hacer creer a los clientes que no están esperando es haciéndoles hacer algo. Un gran ejemplo es el Aeropuerto de Houston, en el que las puertas de llegada se alejaron de la terminal principal para hacer que los clientes pasaran casi todo el tiempo caminando por el aeropuerto en lugar de pasarlo esperando a su equipaje.

Metodología

A lo largo del proyecto se han usado métodos con distintos fines como entender el objetivo del proyecto, recopilar opiniones sobre el proceso, para obtener datos específicos y probar alternativas para la solución.

- Entrevistas con las partes interesadas

Durante el proyecto se han mantenido numerosas reuniones con la dirección del colegio y el profesorado para ver los puntos de vista del colegio y entender sus preocupaciones en cuanto al proceso de recogida. Fue explicado el proceso interno que lleva cada clase al sonar la campana de fin de día y el proceso externo que usaban diariamente para organizar a los padres.

- Encuestas a los padres

Los padres fueron encuestados dos veces a lo largo del semestre. Se mandó una encuesta inicial para recopilar sus pensamientos en cuanto al proceso existente y que explicasen las posibles causas de que el proceso de recogida fuese tan largo. La mayoría de los padres coincidían en que la razón de la tardanza eran los propios padres que no seguían las indicaciones del profesorado y la poca anticipación por parte del colegio para tener a los niños listos a la hora.

Una vez implementado el nuevo proceso se mandó una segunda encuesta sólo a los padres afectados por éste. Gran parte de los padres encuestados coincidían en que el proceso ahorraba tiempo.

- Consultas a terceros

Se realizaron consultas a trabajadores del condado para obtener información sobre el terreno del colegio y las restricciones sobre el mismo. También se realizaron consultas legales para entender la regulación establecida en cuanto al contacto entre alumnos, coches y autobuses y cómo se ha de señalizar una zona colegial. Por último, se contactó con PikmyKid, empresa líder de organización de procesos de recogida en colegios de Estados Unidos, para ver los servicios que ofrecían y recopilar ideas para aplicar a este proyecto.

- Recogida de datos

Durante las primeras semanas de proyecto se recopilaron datos durante distintos días de la semana tanto para usarlos en la simulación donde más tarde se probarían las posibles alternativas como para analizarlos y encontrar oportunidades de mejora del proceso. Se tomaron datos en cuatro puntos distintos del proceso: Entrada de un coche al colegio, entrada del coche en el proceso, momento en el que el niño sube al coche y salida del coche del proceso.

Tras la implementación del nuevo proceso se recopilaron datos a lo largo de una semana tomando como referencia los mismos cuatro puntos para comprobar que se había recortado un tiempo considerable.

- Simulación en Arena

La simulación realizada con el programa Arena fue usada para probar alternativas y descartar hasta reducirlas a una que se implementaría al final del semestre bajo la supervisión del profesorado.

La simulación no se consideró una herramienta del todo fiable en el proyecto pues daba resultados no del todo posibles, pero resultó ser útil a la hora de descartar propuestas.

- Medidas de áreas potenciales para aparcamiento

Una vez discutido con los trabajadores del condado qué zonas del terreno escolar podrían ser utilizadas para nuevo aparcamiento y los costes estimados de algunas opciones que se les propusieron, se procedió a tomar medidas de dichas zonas con una rueda de medir. Estas mediciones fueron usadas posteriormente para estimar las plazas que añadiría cada alternativa.

Resultados

- Proceso antiguo

Los alumnos de segundo, tercer y cuarto curso son recogidos en la curva este y los de primer curso y jardín de infancia son recogidos en la curva oeste. Cuando suena la campana los padres comienzan a entrar en la curva este mientras los autobuses recogen a los niños en la curva oeste. Los padres de los niños de segundo curso y jardín de infancia no pueden entrar en el colegio hasta que todos los autobuses hayan salido, lo que provoca nerviosismo entre los padres de dichos cursos.

A todos los padres se les pide que lleven un cartel en el coche con el nombre del alumno que vienen a recoger. Una vez entran en la curva, avanzan hasta la zona con techo donde las profesoras al ver el cartel llaman a los correspondientes alumnos.

Tras el análisis de datos se pudo observar que el "bottleneck" del proceso era el tiempo que los niños tardaban en subirse al coche correspondiente. Reducir este tiempo se convirtió en la prioridad del nuevo diseño.

- Nuevo proceso

Tras establecer como objetivo la reducción del tiempo que los niños tardaban en subirse al coche se diseñó un nuevo modelo para el proceso. En la zona con techo de cada curva se establecerían 6 plazas seguidas, cada una con un color y un número designado. Se diseñarían roles específicos que todos los profesores deberían saber como desempeñar. Un profesor iría al principio de la curva para dictar a través de un altavoz el nombre de los doce primeros niños y el número al que deberían ir, varios profesores estarían supervisando que cada niño va al sitio que le corresponde. Los padres solo estarán permitidos pasar a la zona con techo en tandas de 6 en 6 para no romper el proceso. La profesora que dicta los nombres continuaría nombrando a los niños de 6 en 6 indicándoles el número al que deberían ir.

En el caso en que un niño no estuviese preparado cuando el padre llegase a la zona techada se le enviaría a una plaza reservada para este tipo de ocasiones y al niño se le indicaría que fuese a esa plaza. Todo esto con el objetivo de no alterar el proceso.

Tras la recopilación de datos se pudo comprobar que el tiempo objetivo fue reducido en un 46%.

- Aparcamiento

Fueron presentadas varias opciones de nuevo aparcamiento al colegio.

Una opción consistía en mover la valla que separaba el recreo de la calle y mover la zona de juegos hacia el final del recreo. Habría que pavimentar esa zona que queda libre y crear una salida a la carretera.

La segunda opción consiste en rediseñar la carretera de la curva oeste para que tenga una salida y una entrada distintas, pavimentar la zona interior y convertirla en aparcamiento. También incluiría pavimentar la zona de hierba que actualmente se usa como aparcamiento.

Por último, exploramos una opción que fue sugerida en las primeras reuniones con la dirección. Se trataba de usar el terreno que había al otro lado de la calle, perteneciente a Oak View Middle School, para hacer un aparcamiento que pudiese ser utilizado por ambos colegios.

Conclusiones

El proceso solo pudo ser implementado en la curva oeste ya que la única semana en la que se pudo iniciar el proceso, los niños de tercer y cuarto curso tenían exámenes estatales que aumentaban el estrés de los profesores de dichas clases y no estaban dispuestos a colaborar en el nuevo proceso.

Al ser la curva oeste en la que más volumen de coches había además de tener que lidiar con los autobuses, hicimos la suposición de que, si funcionaba el nuevo proceso en esta curva, funcionaría en la curva este.

El proceso implementado supone una reducción del tiempo total del proceso de un 10%. Tras la implementación se envió una nueva encuesta a los padres de los alumnos de segundo grado e infantil para conocer su opinión. Los padres consideraban el proceso más eficiente y más seguro.

El problema de seguridad de los "walkers" se decidió apartar a un segundo plano en el momento en que se descubrió que los padres recogían a sus hijos fuera del colegio para evitar la cola. Se les sugeriría a los padres de dichos alumnos que se uniesen al proceso cuando se consiguiese acelerar para eliminar toda deficiencia de seguridad, la dirección del colegio se mostró de acuerdo con esta idea.

La dirección del colegio sopesó las opciones de nuevo aparcamiento y decidió explorar más a fondo dos de ellas para implementarlas conjuntamente. Se escogieron la opción del recreo y la de la curva oeste como opciones más realistas y enfocadas a sus necesidades.

NEWBERRY ELEMENTARY SCHOOL CAR-POOL PROCESS AND FACILITIES IMPROVEMENT

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Collaborating Entity: Newberry Elementary School

ABSTRACT OF THE PROJECT

Introduction

- Purpose of the project

    The purpose of this project is to eradicate any inefficiency in the carpool pick-up line at Newberry Elementary School, to eliminate the safety issue created by the "walkers" whose parents pick them up outside the school grounds and to explore different options to increase parking availability within the school grounds.

- Problem statement

    Over the past few years the number of students had grown significantly and was expected to continue growing at a rate of 2 classes (about 35 to 40 students) per year. Due to space limitations, fifth grade students have to attend Oak View Middle School instead of Newberry Elementary School because they have enough resources to take care of this growth of students.

    The major problem cause by this growth of students is the slow pick-up process the parents have to go through. Every day, parents must wait outside the school until dismissal starts and then enter the pick-up process which takes a lot of time.

    Another issue that the principal and the PTO considered a priority was the safety of the "walkers" during the pick-up process. These walkers are students who have their parent's permission to go home walking. However, some of these walkers are students whose parents are waiting for them outside them outside the school property, so they don't have to enter the process. The issue is that during the pick-up process there is no

teacher supervising what car each kid gets into, as they are off school grounds.

Finally, the addition of new parking spots is a challenge because the school owns a very limited territory which is mostly used by the main building, the curves and the playing ground. It is also a challenge because the school wants to preserve as much as possible the trees in front of the main building.

- State of art

The queuing systems is one of the things that the companies that make their clients wait before they are served focus on. Either if the goal of the company is making the line go fast because that way they can serve more people and make greater profits or that their clients don't complain about the long wait, every company pays particular attention to this matter. The majority of companies fall on the first option, reducing the waiting time. Companies carry out time studies to find out the bottleneck of the process and reduce the time that that action takes be completed. Companies well known for being continually improving the internal process are Starbucks or McDonald's. Their processes are constantly being timed and studied to eliminate any inefficiency

Making the clients not complain about the long waiting times is harder than the first option but more rewarding because no matter how long the line is, your clients will wait. There are many ways to achieve this but the most efficient is by entertaining them during the line. Disney is the leader of this category, every ride inside a Disney park is designed paying attention to every detail and makes a 2-minute trip worth waiting 40 minutes and all for distracting customers while they're in line.

Another way of making the clients think they are not waiting is by making them do something. A great example is the Airport of Houston in which the arrival gates were moved away from the main terminal to make the customers spend almost all the time walking through the airport rather than just waiting for their baggage

Methodology

During the semester, many methods have been used to understand the scope of the project, to gather opinions about the old and new process, to obtain data and to test the different alternatives for the new process.

- Interviews with stakeholders

     During the project many interviews have been held with the principal and teachers to understand what they expected of this project and also to gather their worries about the pick-up process and the needs the new parking had to meet. The staff explained the internal process of each class during dismissal and the external process that parents have to go through every day.

- Survey to parents

     The parents received two surveys along the semester. The first survey was sent during the first week of March and the goal of this survey was to gather their thoughts and opinions on the current process. They were also asked to explain the reason the process was so slow. Almost all parents agreed that some parents made the process slow because they did not pay attention to the staff indications and also because of the poor performance of teachers when getting the kids ready to go.
     Another survey was sent to the parents with kids on Kindergarten and first grade once the new process was implemented, during mid-April. A great percentage of the parents surveyed agreed that the new process was more efficient and safer.

- Third party consultations

     Consultations were made to County Facilities Officials that worked with the school to obtain information about the school grounds and the legal restrictions about it. Legal consultations were also made to understand the regulations behind the contact between school buses, cars and kids. Finally, a consultation was made to PikmyKid, a leader company focused on the school dismissal process field, to gather information about their product and ideas to use on the project

- Data collection

     During the first weeks of the project data collection was made for each day of the week. The main goal of this data collection was to be able to find the bottleneck of the process as well as to be used in the simulation. There were four data points in the process: car entering the school property, car entering the process, kid entering the car, car leaving the process.

After the implementation of the new process data collection was made again to prove that the new process was faster. During this data collection the data points used were the same.

- Arena simulation

A simulation was developed using the Arena software. The aim of this simulation was to try new alternatives, discarding the ones that made the process longer or infeasible and finally choosing the one that provided the shortest process.

This simulation was not considered a very liable tool during the project as some of the results given by the software were not possible. It helped as an indicative tool when discarding options.

- Measurement of potential parking areas

Once discussed with the County Facilities Officials which parts of the school ground could be used for additional parking and the approximate costs of some things that would had to be taken into account, measurements of those areas were taken with a measuring wheel. Those measures were later used to calculate the approximate parking spots that could be added.

Results

- Old process

The second, third and fourth graders are picked up in the east loop and the first graders and kindergartens are picked up in the west loop. When the bell rings the parents are allowed to enter the school property and the process starts in the east loop. In the meantime, the buses pick up the kids in the west loop. The parents of first graders and kindergartens are let into the school when all the buses leave the west loop, which causes them to get irritated.

All the parents are asked to have a tag with the name of the kid they come to pick up hanged in the car. When parents reach the part of the curve which has roof the teachers try to read the names hanged to prepare the kids.

After data analysis it was discovered that the bottleneck of the process was the time that students took to get to their parents' cars once they had already pulled up to their designated spot. The new goal of the new process was to reduce this time as much as possible.

- New process

    After setting the goal of reducing the load time, a new model for the pick-up process was designed. The area under the roof in each loop would be divided in 6 spots, each of them with a designated color and number.

    There would be specific jobs that every teacher should know how to perform. One teacher would be positioned at the start of the curve to call out names of the kids in batches of 6 through the speaker. At the beginning of the process the teacher would call out the names of the first 12 kids to avoid any obstruction in the process and help it run smoother. The parents would only be allowed in and out the school in batches of 6.

    In the case that one kid is not ready when the parent arrived at the designated spot, the parent would be sent to the waiting spot, where the kid will be sent.

    After data collection it was proved that the load time was reduced by 46%.

- Parking

    Many alternatives for additional parking were presented to the school.

    The first option would involve relocating the chain-linked fence as well as moving the playground equipment to the back of the playground area. That area would have to be levelled and paved and an exit to the main road would have to be constructed.

    The second option would involve redesigning the west loop so it could have an entrance and an exit completely independent from each other. The new parking would be the area inside the loop that would have to be levelled and paved. This option would also include paving the area on the right-hand side of the west loop which is currently used as a grassy parking.

    The third option suggested to the school was to use the area on the other side of the main road which is property of Oak View Middle School. The goal of using this land would be making a big parking that could be used by both schools on special events.

Conclusions

    The process was only implemented on the west loop because during the implementation week third and fourth graders had state examinations which

increased the level of stress of the teachers correspondent to those classes and therefore, they were not eager to collaborate on the new process.

The west loop was the one with higher volume of kids and the one that the buses used, making this loop the most complicated one. A supposition was made, if the new process worked in the west loop, it would definitively work in the east loop.

The data analysis showed that the total process time was reduced by 10% with the new process.

The safety issue of the "walkers" was left apart since the main reasons that these parents did not join the process was because it took a lot of time. Those parents would be suggested to join the loop in the future if the new process worked, this way the safety issue would be completely eliminated. The principal and teachers agreed with this idea.

The school staff thought of the different parking alternatives and made to the decision of implementing the first two options that were offered as these options were the ones that best fulfilled the schools' needs.

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Introduction

Purpose of the Project

The purpose of this project was to optimize the carpool pick-up line at Newberry Elementary School to reduce waiting times, to eliminate the safety issue created by the "walkers" whose parents pick them up outside the school grounds and to explore different options to increase parking availability within the school grounds.

Problem Statement

Over the past few years the number of students in Newberry Elementary School had grown significantly and was expected to continue growing at a rate of 2 classes (about 40 students) per year. Due to space limitations, fifth grade students had to attend Oak View Middle School instead of Newberry Elementary School.

This growth of students led to parents complaining about the long waiting times to pick up their children. Every day, parents had to wait in line outside the school until dismissal and then wait even more time before they could enter the loop. The goal of this project was to eliminate any inefficiency in the pickup process by implementing small changes so it would run smoother and quicker [SMIT19].

Another issue asked to improve was the safety of the "walkers". The walkers were students who had permission from their parents to walk home by themselves. However, most of these "walkers" were students whose parents were waiting outside the school to pick them up, avoiding the long waits in the car-pool line. These walkers did not have any teachers supervising which car they got into, as they were technically off school property, which was a major safety concern. It was assumed that if the process time was greatly reduced, these parents would end up joining the loop, therefore eliminating this safety concern.

The major problem with parking was the current distribution of the school's land, which made it difficult to fit the staff and parents for occasions such as class performances, sporting events, or graduations. The challenge to be faced was making the most out of the school's land

while creating a new parking option which was both convenient for the teachers and safe for the kids.

As mentioned before, the school's population had been growing for the past few years and was expected to continue expanding. For this reason, a sustainable solution that would fulfill current and future needs of the school, while prioritizing the safety of the increasing student body had to be found.

State of Art

The project could be resumed as a queuing model and how to make it run smoother. Queuing models have been analyzed mathematically for years. As Wikipedia defines it, "classic Queuing Theory involves complex calculations to determine waiting time, service time, server utilization and other metrics that are used to measure queuing performance." [WIKI10].

Queuing is not only standing in the line waiting for something, psychology plays an important role in the queuing theory. Nobody likes to wait and a great percentage of people waiting a line can get frustrated really easily. In order to avoid the frustration of clients it should be a fast, fair queue when possible, if not, it should make the client as happy as possible during that time.

In order to be a fair queue, it should follow the rule of FIFO, first in first out, claiming that the person who has been waiting the most should be the first to be served. With the rule of the FIFO clients in lines only have to worry about how many people are in front of them, not behind.

Disney is the leader of how to make your clients happy if you cannot reduce the queue. As an example, Disney World handles over 30 million annual visitors and even though every client spends most of the day waiting in a line when they get out of the park the majority of them would repeat. Disney World has interns all over the park monitoring the lines and making time studies to reduce the waiting time. But the secret of how Disney makes its clients forget about the lines is by entertaining them during the process. Every ride is designed paying attention to every detail and with features along the line to distract both, the kids and the parents.

Every company that offers the service of delivery has done a research on its own model and tries to improve it all the time. There are famous cases like Starbucks or McDonald's that are constantly changing its way to operate inside

their stores to be able to serve the greatest number of clients as possible. Improving the queuing model not always has the goal of serving as much clients as possible, usually it is focused on the client's satisfaction when receiving a service. If your clients have to go through a long, boring queue they won't feel as satisfied when they get served as they should, meaning that it takes satisfaction off your product.

As said earlier, psychology plays a critical part on the length of the queue. In the Houston Airport case, they received hundreds of complaints from clients saying that they had to wait too long for their baggage. The executives decided to hire more baggage handlers which reduced to waiting time down to 8 minutes, but the complaints persisted. An analysis was carried out and it was found that passengers only took 1 minute to get from the gate to the baggage claim and had to wait 7 minutes to get their baggage, which is roughly 88 percent of the whole process. This time the executives decided to move the arrival gates away from the main terminal, this way when they got to baggage claim the bags were almost at the same time, reducing the complaints to zero. What we can take out of this example is that they waited the same amount of time in both cases but initially the long wait was stopped and at the end that time was used walking through the airport.

Another characteristic of queues that influences the clients is the length of que queue. If they see an extremely long line, many of the potential customers will not join the line. Long lines, even if they imply short wait times, make customers feel frustrated and if you ask them, they will tell you that they have waited way more than they actually have. A great example of long lines of short waits is the system Whole Foods implemented in all its stores around Manhattan. Whole Foods charges high prices and therefore can afford a high number of cashiers, that is why even though there may be a huge line, you can be out of the supermarket in 4 minutes.

A the end, the only way to have happy customers is either by reducing the waiting times, which is what most companies try to do by looking at the bottleneck of their process and reducing it or by making you forget that you are waiting for something, which is more complicated to achieve but the companies that do this have a great advantage over the rest because, no matter how long is the queue, if your customers don't remember it when they get out that is a great success.

Methods

- <u>Interviews with stakeholders</u>

During the project, meetings were held with the principal and the teachers at least once a month to check on the progress made and to make the necessary adjustments.

The first meeting was held in January to clarify the goals of the project as well as to understand their needs, which could constraint the design. The internal and external process that the teachers and parents have to go through every day was explained during that meeting and was shown along that week. In order to address the additional parking request, the principal suggested to contact the County Facilities Officials to gather information about the school's land and its restrictions.

There was a second meeting held is February to discuss with the principal the base of the new process and if it would be able to implement it along the semester to test it and confirm the hypothesis that it would save time. During that meeting the idea of sending a survey to the parents was suggested and a draft was made under the supervision of the principal.

The third meeting was during mid-March, right before spring break, and involved all the teachers. The main goal was to explain the new process and listen to their opinions to make the adjustments, which they thought to be necessary for it to work and actually save time. Since teachers played a critical role on the internal process and were the ones that would have to deal with the final process their opinions were highly important. During this meeting the date to start implementing the final process was set, and it would be a week after spring break, two weeks before the end of the project. The reason behind the date chosen was that the week after spring break the school held several acts that could affect the process. Another reason that also affected the date was that two weeks were needed to implement it correctly, one week of training and another of data collection.

A final meeting was held on the 29th of April with the principal, the teachers, the director of the project and the County Facilities Officials that work alongside the school. This meeting was to present the final process,

the results of the time studies and the proposed solutions for the additional parking.

- Survey to parents

    As detailed before, two surveys were sent to the parents regarding the initial process and the final process. The first survey was sent during the first week of March and the goal of this survey was to gather the thoughts and opinions of the parents on the current process. They were also asked to explain the reason the process was so slow and to rate it in terms of efficiency and safety. Finally, they were asked to give recommendations to make it faster.

    Another survey was sent to the parents with kids on Kindergarten and first grade once the new process was implemented, during mid-April. The goal of this survey was to analyze their reactions to the new process.

    These surveys helped to set a global view of the process and everyone involved in it. Parents were the main part of the external process and their collaboration was essential for the process to work. When designing the process many of the recommendations were taken into account as it was a way of encouraging the parents to cooperate.

- Third party consultations

    During the first meeting, the principal offered the help of the County Facilities Officials. Several meetings were held along the semester with them. They offered the ideas that they thought to be better and cheaper for the school. They clarified which areas of the school could not be used for parking because they had other uses for example the fire loop which was at the end of the playground, and it was mandatory for the school to have one. Also, the area inside the east loop could not be used because it was used as drainage for heavy rains. They also explained how much would it cost the school to move the basketball court there was in the playground, and indicated that it was not an option as it was a high budget option [WYNN19].

    Legal consultations were made to better understand the regulations behind the dismissal process. Laws protect students who are getting off and on a school bus by making it illegal for drivers to pass a school bus

while dropping off or picking up passengers, regardless of the direction of approach. In all the possible solutions given to the school, this regulation had to be taken into account by preventing the contact between vehicles and school buses.

Finally, as part of the research done, a company focused on dismissal process field was contacted. PikmyKid is one of the leading companies in the U.S. that works alongside the schools to better organize the dismissal process. They offer personalized solutions to each school and train teachers and parents to make it easier. They explained how to get parents and teachers engaged in the process and eager to collaborate, and they helped us to gather information and ideas to use on the development of the new process.

- Data collection

Data collection was carried out throughout the semester. To model the current process time studies of the pick-up process were carried out during the first weeks in both, in the older kids and the younger kids loops. The second batch of time studies were carried out at the end of the semester and the goal of these time studies was to prove that the new process saved time. Several data points along the process were needed to compare times. Data collection consisted in these four data points:

1.- Time a car entered the loop

2.- Time a car entered the process

3.- Time a kid entered the car

4.-Time a car exited the process
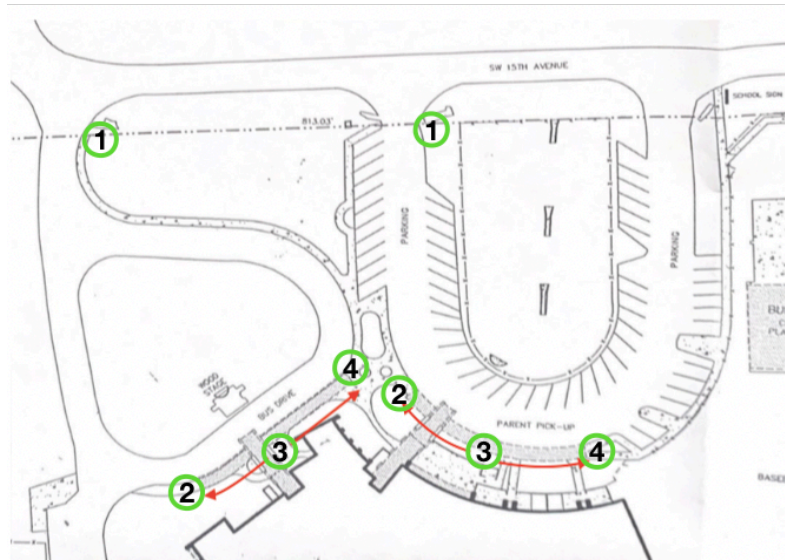
Figure 1: Map of the Four Data Points in Each Loop

The analysis and results of these time studies will be explained after the description of each of the processes and on the conclusions of this document.

- Arena simulation

An Arena Simulation model was originally developed to process the collected data and was attempted to come up with a better resulting solution. However, because the uniqueness of the situation, the solution designed was able to be implemented and tested. This post-implementation data offered real, accurate data to use in formulating results rather than just simulated data. With that said the simulation did serve two main purposes; it assisted in accurately modeling and restructuring the process, and it affirmed the hypothesis that implementing the new process in both loops combined should decrease the total process time.
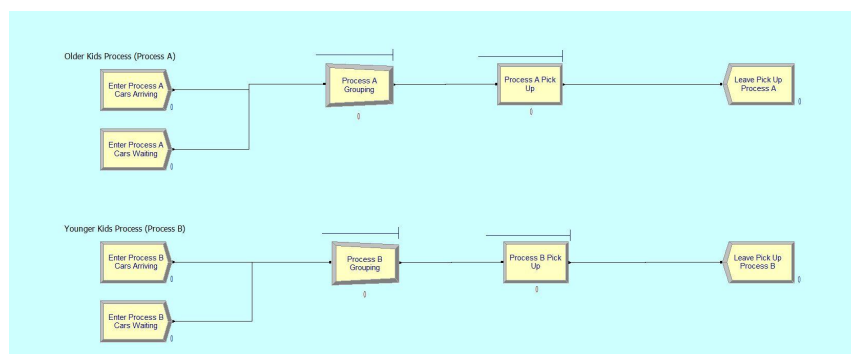
Figure 2: Arena Simulation

The simulation combined two types of arrivals: random arrivals and a set number of average arrivals at T=0. Six vehicles were batched together then proceeded through a single resource process which was based on our calculated process times. These vehicles then left the process as a batch.

The total time for the simulation to run through was around 10.2 minutes. This data showed that the west loop should decrease to at least 10.2 minutes with the proposed process (from a process time of 12-15 minutes on average). After this, the ultimate conclusions were reached by using real data and calculations.

- <u>Measurements of potential parking areas</u>

After selecting several areas and presenting them to the school, measurements of this areas were taken to calculate the approximate number of spots that they could add. A research had to be done to find the dimensions of one parking spot and the calculations as the school needed the number of spots to make the final decisions. All the numbers offered to the school were approximate as the measurements were taken with a measuring wheel, which is not as precise as it should be.

Also, some of the costs involved in turning those areas into parking had to be searched and were not precise. These costs include paving, removing trees, levelling the ground, among others which will be specified in each parking proposal.

Initial process

Description

Below is a map of the initial process in place at Newberry Elementary School. The process involved the following three parts: 2nd-4th grade pick-up (Green Line), Kindergarten – 1st grade (Red Line), and "Walkers" (Yellow Depiction of a Person). The blue dots represent the 6 pickup car slots for each loop.

In the initial process, before dismissal started, parents with kids from 2nd- 4th grade were told to wait on the east side of the school and parents with kids in Kindergarten and 1st grade were told to wait on the west side of the school. When the first bell rang at 1:45pm, 2nd through 4th graders were released, and the pick-up process started in the east loop. Meanwhile, the buses entered the other loop to pick up bus- riding kids. The second bell rang at 1:52pm, and kindergarten and 1st grade students were released and joined by their siblings. Teachers were responsible for dropping each kid to their designated area while the rest of the class stayed with them. The process in the west loop could not start until the buses left which was around 2pm. Due to the higher volume of kids, the second loop had a longer process time.
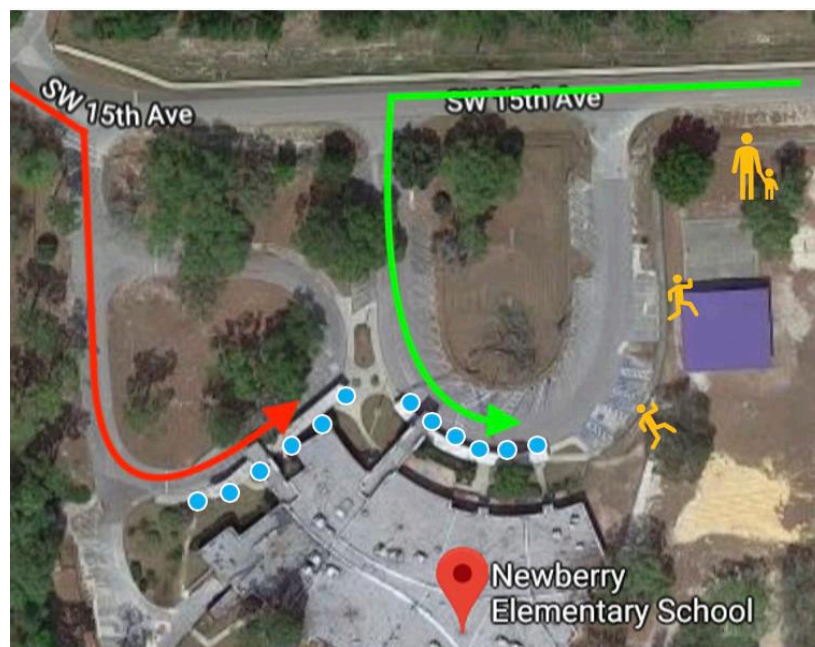
Figure 3: Newberry Elementary School Process Map

One of the issues noticed when observing the process during the first weeks was that even though the school had the covered pick-up area divided in 6 spots in each loop, there were never 6 cars loading. Parents either got too close to each other so they would load before their turn (turning them into the seventh car) or wait to be the first in line because they did not pay enough attention to the teachers' indications. The fact that most parents did not follow the indications made the process run slower.

Another thing noticed was that teachers did not call off the name of the kid that was about to be picked-up until the parent was almost on the

designated spot. This behavior made the parent wait on the spot until the kid got ready to go and as a result, the whole process was delayed.

Finally, we noted that some parents started getting in the waiting line around 40 minutes before dismissal time.

Data Analysis

After a full week of data collection on the existing process, enough data was acquired to make accurate calculations for process times. The east loop process took on average 4 minutes longer than the west loop process, even though it saw on average 20 fewer cars (see Appendix A.1 and Appendix A.2).
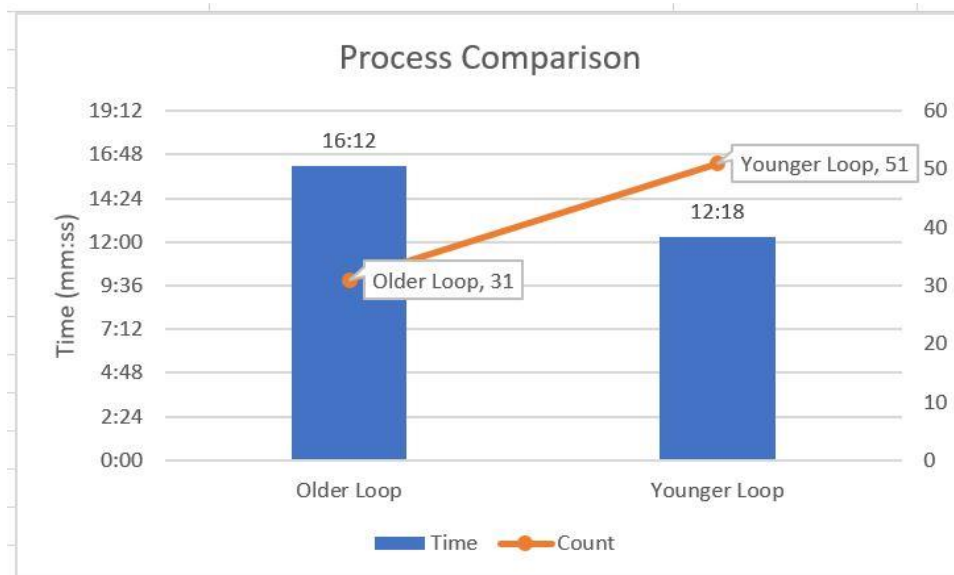
Graph 1: Average dismissal duration times and car counts.

After further analysis it was discovered that the bottleneck within the dismissal process was the time it was taking for children to get from the waiting area to their designated vehicle (load time). In the east loop were observed load times as high as 2 minutes, while the west loop averaged between 30 and 60 seconds per car. This was wasted time from an engineering perspective as well as source of frustration for parents. Therefore, when we designed a new process, we sought to eliminate this bottleneck.

Loop	Avg. Total Time per Car	Avg. Child to Car
K-1st	00:52	00:26
2nd – 4th	1:57	1:44

Table 1: Time Data of the Initial Process

Initial Survey Results

The goal of this survey was to gather their thoughts and opinions on the existing process [RODR19]. They were also asked how they picked up their kids every day, and if they did not join the loop to give the reason why. (see Appendix D.1.)
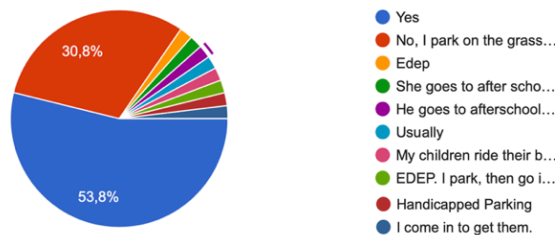
Graph 2: Survey Results of Where Parents Pick-Up Their Kids

The majority of the parents that replied that they preferred to park outside the school and have their kids walk to them (called fake "walkers") said that they did this because the process was extremely long.

The parents were asked to rate the existing process on terms of efficiency and safety, being 1 the most efficient or safe and 5 the least efficient or safe. The average rating of efficiency was 3'15, therefore stating that the parent's opinion was that it was highly inefficient. The average rating of safety was 2,56 which is almost average but still, on the unsafe part. Our goal was to change those averages to be on the safe and efficient part.

How efficient do you feel the pick-up process is?

52 respuestas
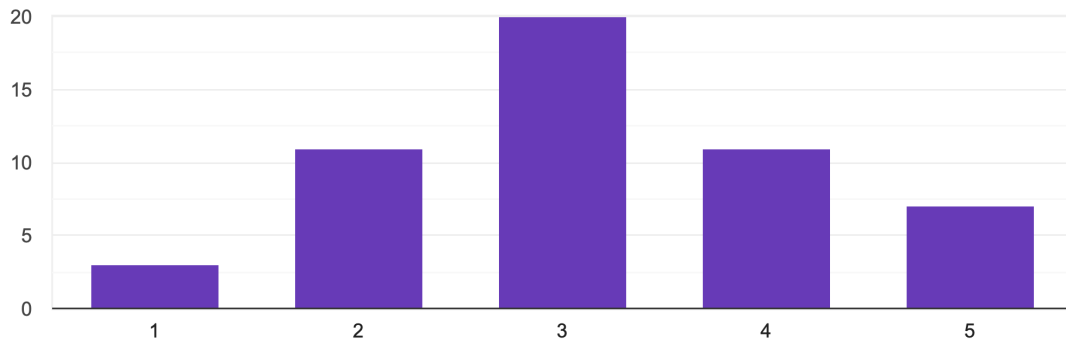
Graph 3: Survey Results of the Efficiency of the Initial Process

How safe do you feel your children are during the pick-up process?

52 respuestas
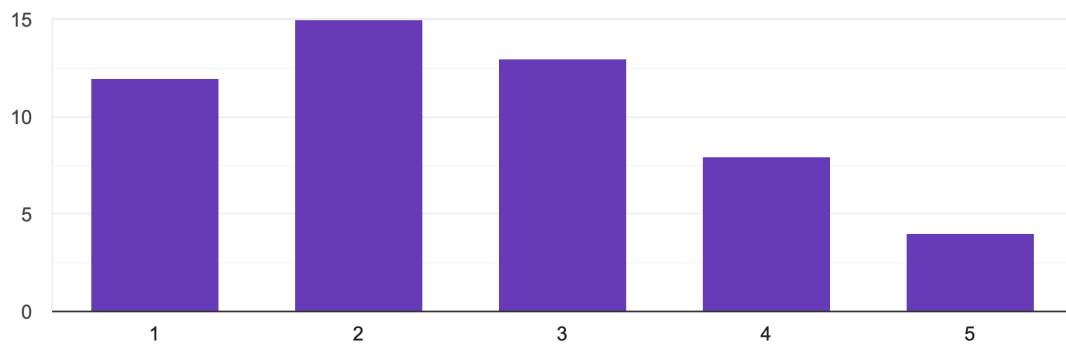
Graph 4: Survey Results of the Safety of the Initial Process

On the first survey, one of the things asked was to give reasons why they thought the process was so slow. A vast majority of parents blamed it on other parents, the teacher's lack of anticipation and the buses.

One of the reasons parents made the process run slower was because some of them did not pay enough attention. Once they had already picked up their kids, they started talking with their kids without moving the car and therefore, preventing the process from continuing.

Another reason parents were involved in this situation was because they felt the need of helping their kids get into the car denying the help of the safety patrols who should be doing that. Parents helping their kids

slowed the process because they took a long time to get out of the car, help their kids and get back in the car.

The last reason was that some parents tried to skip the line by entering the school and pretending to go to a parking spot, then they would skip the line. This behavior made other parents angry and disrupted the little anticipation that teachers had as kids would be waiting in the wrong spot.

Another issue noticed when analyzing the survey was that one of the main frustrations for parents was the time it took for the buses to get loaded. That is why it was discussed with the principal to change the time slot of the buses and start the process on the west loop with the parents instead of the buses. This was not an option to implement during this school year as the time slots for school buses were already full but would be thought for the following year.

Assumptions and Design Constraints

For the new design of the pick-up process, it was necessary to formulate assumptions during our data collection and simulation design phases. For the simulation to be as accurate as possible, it was required to make justified and correct assumptions in the way the process at hand had to be conceptualized.

- The first assumption dealt with modeling the arrivals for both pick-up processes. Many parents arrived up to 45 minutes before the final bell rings to release the students. There is no set order in the location or time of these arrivals. To keep this accurate for modeling purposes it was made the following assumption: **vehicles that were already waiting, prior to the bell, all enter the process at the same time (time 0).** Following from this, it was also assumed that after the bell rang, an arrival was time stamped once a vehicle entered the line. These decisions were made so that it could most accurately be simulated a reasonable average time that the parents spent in the process. If the process was efficient, there would be no reason for parents to arrive 45 minutes early to pick up their child. This issue was also addressed in our process solutions.

- A second important assumption for modeling and data collection dealt with the "Pick-Up Process", where the child gets into their parents' vehicle.The following assumptions were made: **the process began at the beginning of the 6 vehicle slots (when the first car passed through slot 6). The process ended when the vehicle left that 6-slot section with their child (when the last car passed through slot 1).** These assumptions provided reasonable parameters to achieve an accurate measure of how long the pick- up process took.

Assumptions were also made regarding the conclusions drawn to determine the final recommendation.

- It was assumed that because the only difference between the two loops was geographical location and average number of cars, **the process would behave the same in the east loop as it did in the west loop** (where the new process was implemented and analyzed), and thus the improvement to the east loop could be accurately calculated based on previously collected data.

- It was assumed that in switching the dismissal times, **the average number of cars for each age group would remain the same.**

- Due to a natural learning curve, it was assumed that the **process would continue to improve with time** as teachers and parents got used to the new process.

- It was assumed that **dismissal would not start immediately when the bell rang**, as teachers and students need time to get outside and get prepared. For this we provided a 2-minute buffer in the calculations.

- Finally, it was assumed that since it was able to improve the efficiency of the system with the new process, the parents of the "walkers" that did not actually walk home would **join the pickup process** and these unnecessary walkers would **no longer pose a safety concern**.

In developing and implementing the new process and alternative parking solutions, several design constraints had to be considered as well.

- Parents were the main constraint for the proposed solution, as they were the entities moving through the system. They were free to make decisions as they pleased, so there was human error involved that had to be

considered. Communication via a handout was crucial to ensure that the parents moved through the new system properly (see Appendix C.2.).

- Teachers/ faculty constrained the solution in that they were the operators and managers of the process. Teachers had a very important role in the success of the improved process as the change was entirely internal. It was attempted to limit their ability to cause error by standardizing their role in the process through individual training. However, since the school continually rotated through which teachers performed each role, there was a need to train new teachers almost daily, which limited the ability to truly standardize the process.

- The layout of the two loops the school utilized was also a constraint. This constraint affected the way the smaller scale parking solutions could be implemented. In some of the higher-level solutions, the physical facility would need to be adjusted.

- Due to scheduling conflicts, the implementation of the improved process was constrained as it could only be implemented in the west loop [PEARMAR19]. Since the new process was not able to be implemented in the east loop, to determine how it would perform with the new process, the calculations had to be based on our previous data collection.

Final Process

Description

After initial observations and data analysis, many opportunities for small and easily implementable changes were noted. The proposed solutions involved dedicating time to dismissal training for staff. It was observed that the bottleneck of the dismissal process occurred when cars were waiting for students that should already have been lined up in their designated spots. It was determined that the staff member responsible for collecting students and lining them up should plan *at least* 1-2 students ahead of time to expedite the process. This training would only take one day and could have a significant impact on the efficiency of the process. The safety of students during dismissal was a high priority so eliminating the "walkers" was the main goal when implementing this solution. They would join the green loop process which initially took roughly 15 minutes from start to finish. An average of 24 vehicles awaiting "walkers" per day

were recorded. It was considered that the school could receive complaints from the parents of these "walkers," but it was determined that the safety of the students should take priority over the stakeholder's satisfaction in this circumstance.

The new process focused on three principles of Industrial Engineering: 5S, Lean, and Standardized Work.

To systemize the new process, 5S strategies were implemented on the pick-up area. These changes were primarily cosmetic modifications to the area made by sectioning off the six waiting areas with unique, brightly colored tape that captured the attention of the children. The size of the numbers was dramatically increased to make it clear to both parents and children where the pick-up spot was so that the child would wait at the correct spot.

The second principle the process focused on was Lean. To achieve the goal of a more efficient pick-up process, the strategy was to eliminate wasted time. It was accomplished by introducing stacking to the process. In the improved process, the teacher would call the names of children and their designated spot with enough time for the children to be stacked at the appropriate pick-up spot, waiting for their parents. When a parent pulled up to the spot, their child would be ready to enter the vehicle immediately. In comparison to the old process, the new process eliminated the waste of time that was a product of waiting for the child to walk to and enter the vehicle.

Lastly, the process also focused on the principle of Standardized Work. For the new process to remain sustainable, the process was standardized so that with a single day of training, any teacher could tackle a role and achieve optimal results. Each of the three roles were broken down into where they were to stand and how to perform their role and compiled it into a simple handout that could be referred to whenever needed (Appendix C.1.).

For standardized process implementation, the process was broken down into three assigned roles and three sets of resources. The first role was Teacher 1 (Name Caller) who stood at the head of the pick- up area with a headset and called off the names of the children (from where they hung in the car window) and their respective spot number from 1 to 6. They would then repeat this process for the next set of six cars. For example, the teacher would say, "John Smith: one, Jane Doe: two, ..., Bill Hubbard: six". The second role was Teacher 2 (Director) who stood at the head of

the child-waiting area to direct the children to their respective spots after they were called over the speaker. The final role, Teacher 3 (Floater), walked up and down the different pick-up areas to assist the children in getting to their spots accurately and efficiently. On the handout created for the administration, it was clear to see where each role should be placed and what their role entailed (Appendix C.1.). This standardized process required a single day of training for each role to be executed properly and ensure an efficient pick-up process. The resources required were three teachers, six safety patrol students, and a headset and speaker set. These were necessary in that the three teachers would assume their roles, the safety patrols would signal the cars to pull forward completely and ensure that the children were a safe distance from cars, and the headset and speaker set would provide clear and constant communication between T1 and T2. The standardization of this process was crucial to ensure that it was sustainable and would work efficiently when interchanging teachers for each role.

Data Analysis

The new process was implemented for several days before data collection began to give teachers, students, and parents the chance to adjust to the new process. Despite a constantly changing host of faculty executing the new process, all involved were comfortable with the process. This allowed us to collect data the following week. Data was collected identically for the new process as the previously existing process – using time stamps of all major points of the process to pinpoint vehicle activity (see Appendix A.3.).

The average total process time for the existing system in the west loop was 12:02 (mm:ss) for 51 vehicles, while the new process had an average total process time of 11:44 for 53 vehicles. The average load time also decreased to 20 seconds.

Loop	Avg. Total Time per Car	Avg. Child to Car
K-1st	00:47	00:20

Table 2: Time Data of the Final Process

Final Survey Results

This survey was sent to parents whose children go to kindergarten, first and second grade (see Appendix D.2.). Even though only 7 parents replied to the survey, the results received were significant and helped to prove that the new process had accomplished its goals. 71,4% of parents thought the process ran smoother than the initial one.

How efficient do you feel the new pick-up process is?

7 respuestas
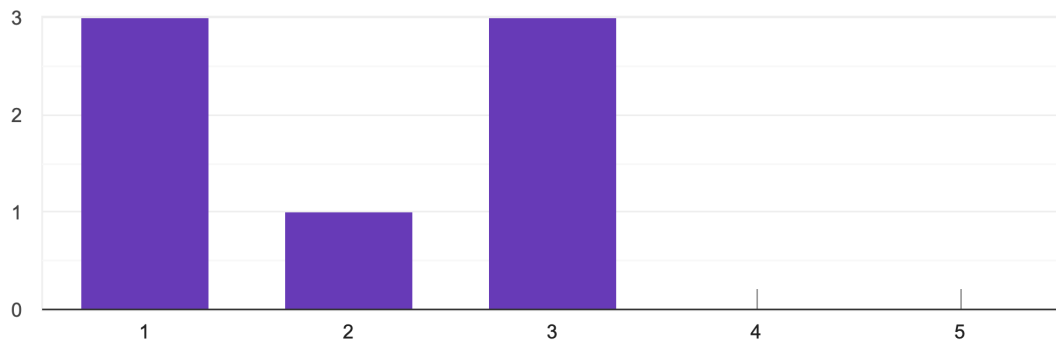
Graph 5: Survey Results of the Efficiency of the Final Process

How safe do you feel your children are during the new pick-up process?

7 respuestas
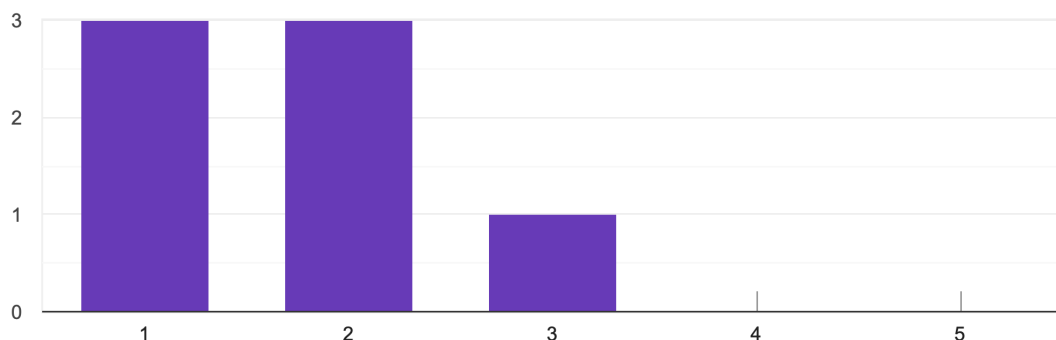
Graph 6: Survey Results of the Safety of the Final Process

The parents were asked to rate the new process in terms of efficiency and safety, just like in the first survey. The average rating of

efficiency was 2, therefore stating that the parent's opinion had changed from inefficient to efficient. The average rating of safety was 1,7 which had been greatly reduced from the first survey to the second.

Parents were also asked to give their opinions on the new process and even though some of them thought it was complicated all of them thought it was an improvement and that it saved time.

Additional Factors

There were several additional factors to consider when developing an alternative process. The factor with the most impact was the "walkers", or the group of students escorted to the edge of campus by a teacher. A few students did walk home from the drop point, but between 20-25 vehicles could be found waiting at the edge of campus to pick up the rest of these students [PEARJAN19]. This presented a safety concern, as these students were not supervised and could be a liability to the school should anything happen. The proposed solutions incorporated these vehicles into the pick-up loop, which would significantly improve the safety of all students involved in the future.

The biggest factor to consider was parent cooperation. Parents had previously been uncooperative when new procedures were put in place, with responses to change ranging from complaints emailed to the principal, to defying the procedures through loopholes (i.e. checking children out before dismissal, parking in the loop instead of joining the car-pool, or parking along the road and having their children walk to them [PEARMAR19]). This had to be taken into account when planning the new process by making as few changes to the parent process as possible, instead the new process had to focus on streamlining the process from the faculty and student side. Parent training handouts were also made to help the parents understand the system, as well as to discourage behavior that adds wasteful time to the process, such as exiting the vehicle to assist their child, or being inattentive to car movement in front of them and causing an accordion effect of delay throughout the rest of the line (appendix C.2.).

Parking proposals

Three proposals for parking additions were developed for Newberry Elementary School. These proposals would benefit the Newberry Elementary School parents and teachers while allowing for sustainable growth. Through research, facility observation, Lean facility waste principals, and parent/ teacher discussion these three proposals were developed to fit the collective needs of all stakeholders. While all the cost estimates have been included for informative purposes, these are only roughly estimated ranges. "Additional Costs" have been included to give some buffer for unknown obstacles or unforeseen additions (e.g. security cameras). "Additional Costs" also includes minimal maintenance for the lot and lighting. However, for accurate and formal estimates as well as water treatment/ civil concerns, a contractor would need to be contacted.

Proposal 1- West Loop Additions

About: Re-route bus loop into a single "U-shaped" loop, pave parking in center area and along the cemetery

Size: 75,42m x 7,62 (574,7 m^2), 41,27m x 46m (1898,42 m^2): 2473,12 m^2 total.
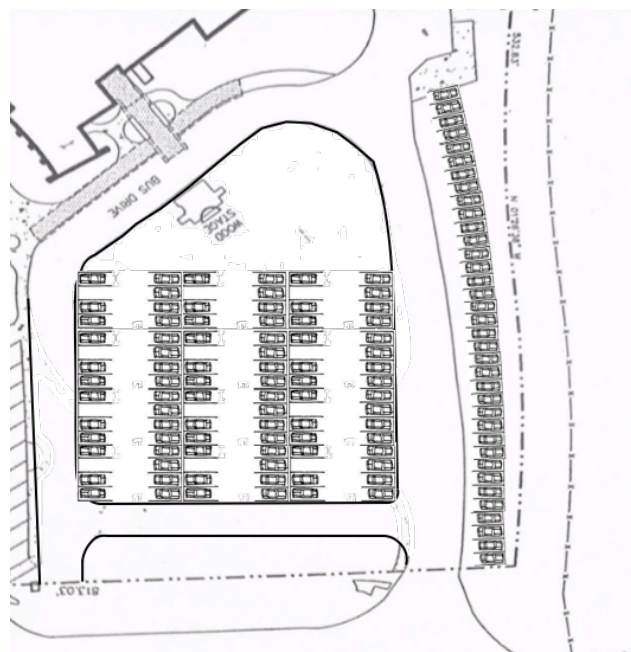
Figure 4: Proposal 1 Map

Requirements: Clear existing concrete end of loop, remove single trees, pave and level the lot and new end of loop

Benefits: 100 – 105 additional spots added (see below), close and easy proximity parking for teachers, minimizes bus car interference with separate entrance and exit

Costs:

Remove Existing Concrete (End of Loop) [HOME18]	$7,680
Clear Existing Trees (x10 trees + labor) [TREE12]	$6,650 - $10,400
Level/ Pave Lot [HOME16] [OHIO]	$36,574 - $54,861
Paint Lot [BRAH15]	$1,635 - $2,000
Install Lighting (x8 lights) [LEDL]	$3,200
Additional Costs (maintenance, security, etc.) [PROM18]	$5,000 - $10,000
Estimated Total Cost:	**$60,739.00 - $86,341.00**

Table 3: Proposal 1 Costs

Parking Spot Calculations:
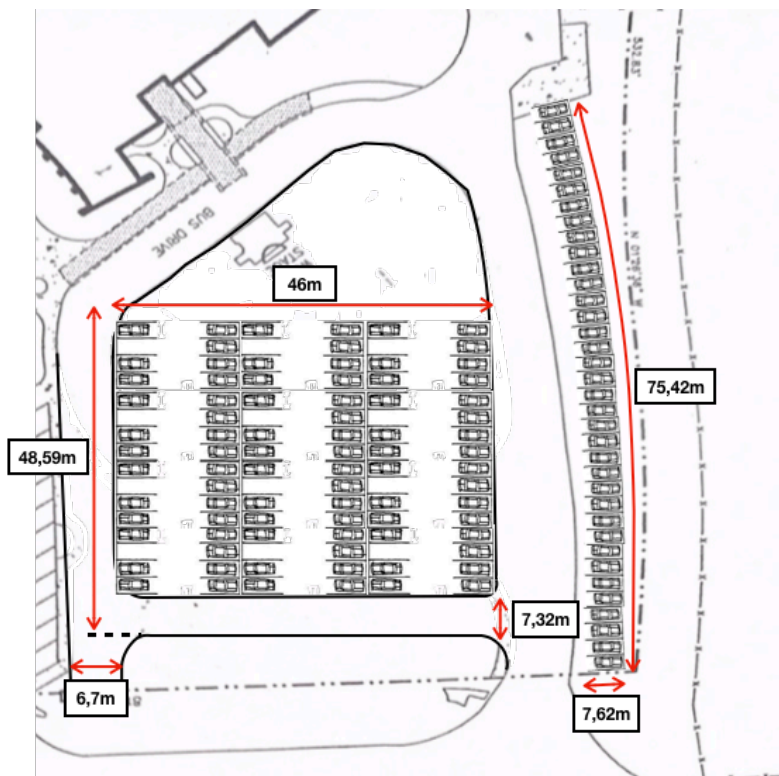
Figure 5: Proposal 1 Measurements

This parking option was designed using the 90º parking information (Appendix B [TEME]). The decision was based on the width of the loop road, which was wide enough for us to implement this parking.

Right hand side of the loop

The depth of this area is more than the depth required to install a 90º parking, which is 5,49m. Using measure C=2,74m of the 90º parking design, the number of spots that could be added would be:

$$\text{number of spots}= \frac{247}{9} =27$$

Central area of the loop

Given the dimensions of this area it was calculated that a 90º parking with two main aisles could be installed inside of it. There would be a total of 5 rows of parking spots, two of them connected to the loop and the other 4 connected to the main aisles of the parking.

Using dimensions E=5,49m, depth of parking spot, and F=7,32m, width of the aisle, of the 90º parking information, the width needed for the desired parking would be:

$$\text{Total width}=5,49*5+7,32*2=42,09m$$

Since the total width available was 46m, the parking would be able to be implemented.

The road that would have to be paved to connect the aisles and the loop would have a width of 7,32m, which will leave a total length for the parking rows of:

Total length of parking rows=48,46-7,32=41,14m. The parking spots that could be added would be:

$$\text{number of parking spots per row}= \frac{41,14}{2,74} =15$$

total parking spots in central area=15*5=75

Proposal 2- East Loop Additions

About: Adding a single, diagonal row of concrete parking spots to the Northeast corner of the school's lot.

Size: 14,02m x 75,42m (1057,39 m^2).
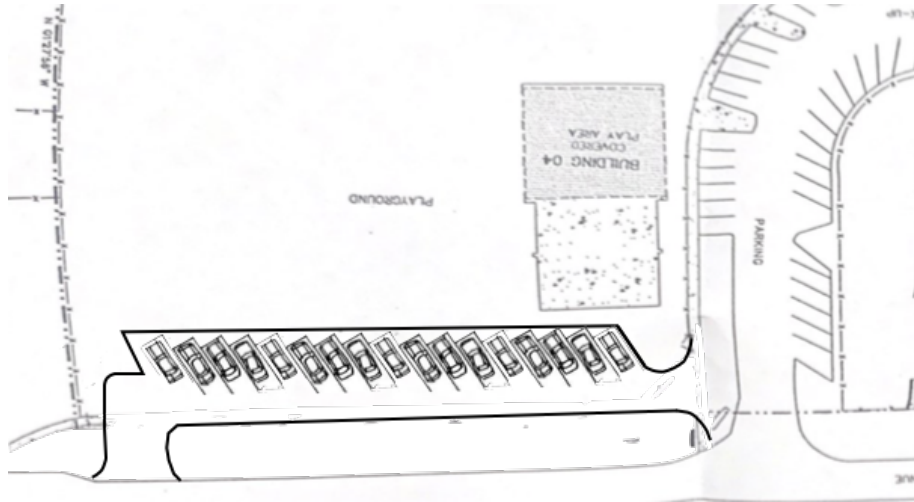
Figure 6: Proposal 2 Map

Requirements: Moving playground equipment, relocation of chain-linked fence, multiple tree removal, leveling, lot construction

Benefits: 20-25 parking spaces added (see below), removes ability for parents to park along the side of the road, close parking for easy access to school facilities

Costs:

Move Playground Equipment [HOME19]	$400
Clear Existing Trees (x5 trees + labor) [TREE12]	$3,650 - $5,400
Relocation of Existing Chain-link Fence [HOME15]	$2,000
Level/ Pave Lot [HOME16] [OHIO]	$27,709 - $41,685
Paint Lot [BRAH15]	$200 - $300
Install Lighting (x4 lights) [LEDL]	$1,600
Additional Costs (maintenance, security, etc.) [PROM18]	$5,000 - $10,000
Estimated Total Cost:	**$40,559.00 - $61,385.00**

Table 4: Proposal 2 Costs

Parking Spot Calculations:
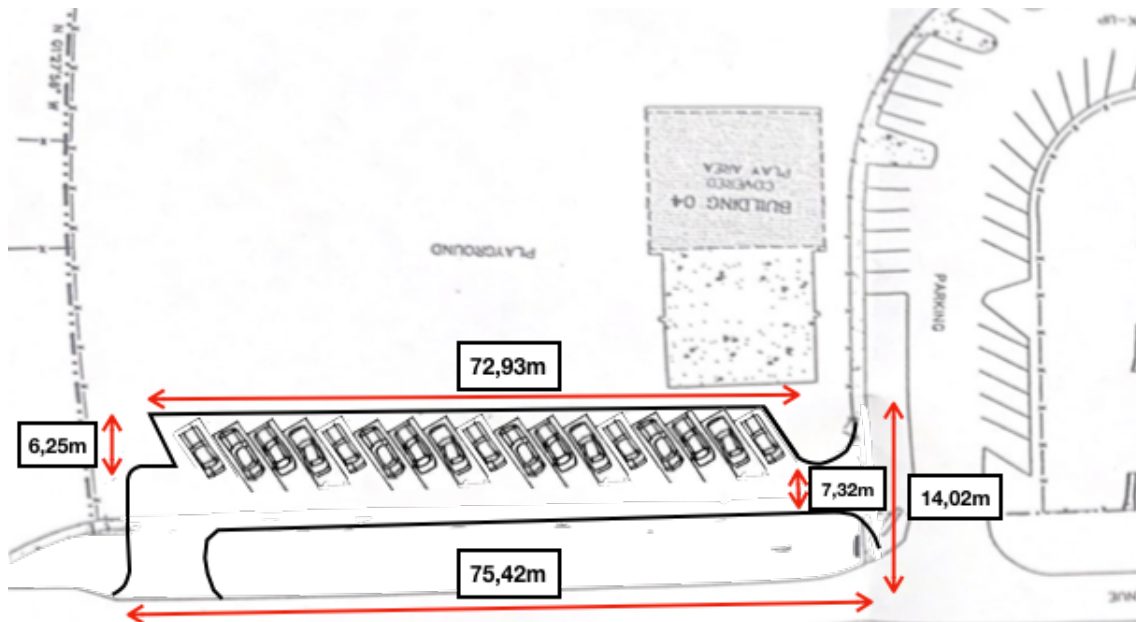
Figure 7: Proposal 2 Measurements

This parking option was designed using the 60º parking spot information (Appendix B, [TEME]). It was believed this option would not take as much space as a 90º parking spot design but still added more parking spots than the 30º and 45º.

It was decided to leave a 2,49m space at the entrance of the parking. Therefore, the actual space for parking spots would be 72,92m.

Using measure C=3,17m in the 60º parking design, the number of spots that could be added would be:

$$\text{number of spots} = \frac{72,92}{3,17} = 23 \text{ spots}$$

Since space had to be left in the end of the parking, it was decided that 22 spots could be added without problems.

Proposal 3- County Lot Additions

About: Utilize County Lot across the street from the school for a large parking lot.

Size: Arbitrary depending on desired number of spots.
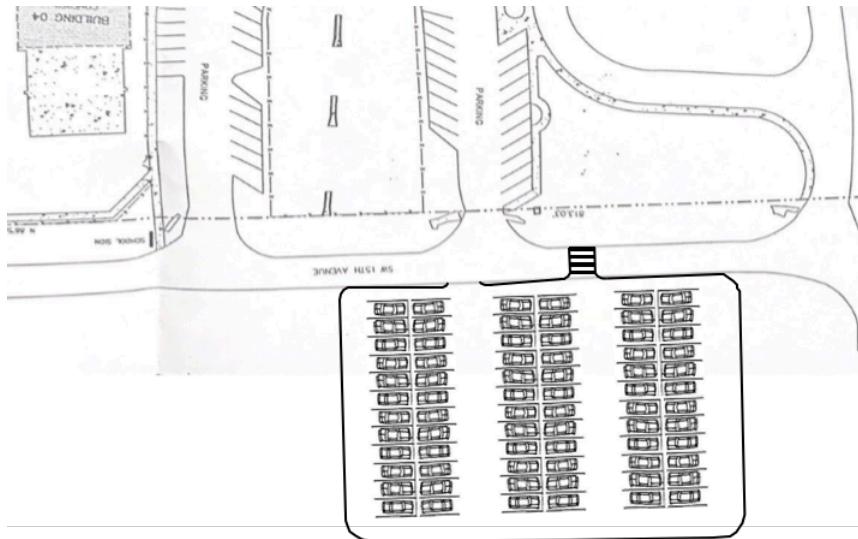
Figure 8: Proposal 3 Map

Requirements: clearing dense tree land, leveling/ paving, adding a safe cross walk, working with county and high school for land use purposes.

Benefits: 150 additional spots estimated (see below), supports elementary and high school, large lot for extracurricular events.

Costs:

Clear Existing Trees [HOME17]	$2,400 - $3,400
Level/ Pave Lot [HOME16] [OHIO]	$54,861 - $82,291.50
Paint Lot [BRAH15]	$1,785 - $2,000
Crosswalk [BRAH15]	$150 - $200
Install Lighting (x10 lights) [LEDL]	$4,000
Additional Costs (maintenance, security, etc.) [PROM18]	$5,000 - $10,000
Estimated Total Cost:	**$68,196.00 - $100,091.50**

Table 5: Proposal 3 Costs

Parking Spot Calculations:

Due to the poor information about the dimensions of this area, the calculations below would be for a 150-spot parking. This parking would have a 90º design, four main aisles and 25 spots per row (Appendix B, [TEME]).

The area needed to build this parking using the 90º parking design information would be:

Total length of the parking would take into account the length of the rows as well as the road at the end of the parking to access the other aisles.

Length of the rows would be calculated with measurement C=2,44m

$$Length=2,44*25=61m$$

A measurement F=7,32m to account for the road to get to the other aisles would have to added.

Total length=61+7,32=68,32m

Total width of the parking would take into account the depth of the 6 parking rows and the width of the 4 aisles.

Depth of the parking spots would be 5,49m. Therefore, the space 6 parking rows would take would be:

$$Depth\ of\ 6\ rows=6*5,49=32,94m$$

The width of the 4 aisles would be calculated using measurement F=7,32m

$$Width\ of\ 4\ aisles=4*7,32=29,28m$$

Therefore, total width of the parking would be:

Total width=32,94+29,28=62,22m

Generic Cost Metrics Used for Calculations:

Moving Playground Equipment [HOME19]	$400 estimate for minimal equipment
Removing a Single Tree [TREE12]	Average of $650 - $1000 per tree, $400 labor
Clearing a Lot of Trees [TREE12]	Average of $4,000 - $6,000 per acre, $400 labor
Relocation of a Fence [HOME15]	$2,000 estimate for 300ft+ of fence
Leveling/ Paving of Lot [HOME17]	$2 per 0,09 m^2, $110 - $245 per hour for labor
Painting a Lot [BRAH15]	$4 for lines, $25 for handicapped, $15 arrows
Lighting a Parking Lot [LEDL]	$400 per light, covers 4,65 m^2
Clearing Existing Concrete [HOME18]	$2 per 0,09 m^2 cleared
Crosswalk Installation [HOME16]	$35 - $75 paint, $115 - $125 signage
Additional Costs (maintenance, security, obstacles) [PROM18]	$5,000 - $10,000

Table 6: Parking Calculation Cost Metric

Conclusions

Conclusions About the Final Process

As can be seen in the table, a comparison between the two processes was made. Days with comparable vehicle throughput (57 cars through existing process, and 56 cars through new process) were compared and resulted in an overall process time improving from 14:07 to 12:40, and the average load time decreasing from 00:31 to 00:18. Overall, the range of improvement of the total process time seen was of 8-10%, and a range of improvement for the load time of 30-50%.

	Cars	Avg Process Time	Avg Load Time	Avg Load to Leave	Avg Total Process Time
Existing Process	57	00:00:55	00:00:34	00:00:22	00:14:07
Proposed Process	56	00:00:38	00:00:18	00:00:20	00:12:40
% Improvement		30%	46%	9%	10%

Tabla 7: Data Analysis Comparison

After talking with the principal about her opinion on the new process she was completely satisfied with the results. As assumed, the process would get better with time because teachers and parents would get used to it.

Long-term Proposal: Single Pick-Up Loop

Once implementation and data collection for the modified process concluded, data analysis on the new numbers acquired was completed. Because the only difference between the two dismissal loops was geographical location, it was assumed that the process would work the same in both loops. With this in mind, it was calculated how long the process would take if all car pool dismissal was combined into one loop; the east loop. The choice of this loop is because the buses can only fit in the west loop, and the east loop is currently being underutilized. With the calculations it was confirmed that the most time efficient dismissal schedule involves dismissing all children from one loop. The new average

total process time acquired was 11:40 for 53 cars. Because the process was not continuous and ran in batches of 6, this average was taken and was divided by the number of batches (9), to get the average time per batch. This time was 1:18. With this number and the distribution of grade levels and car pool students, it was accurately calculated how long dismissal would take with the proposed changes. The results are summarized in Table 7.

The first change proposed was to switch the dismissal times for the older and younger students, with the younger students being released at 1:45pm and the older students at 1:52pm. This was due to the distribution of the volume of students and the bus schedule. Because there were more younger students participating in the pick-up process, having their dismissal occur first would work out perfectly with the timing for the buses to leave campus without interfering in the pickup line. It was assumed that dismissal would not start right when the bell rang, as teachers and students needed time to get outside and get prepared. For this it was provided a 2-minute buffer. The older student's dismissal would start 8 minutes after their bell, so no buffer was required there. With the proposed process the K – 1st dismissal would end at 1:59pm, right before buses leave. This allows for the buses to leave the school without interfering in car pool pickup. Once buses leave, the process would continue with the 2nd - 4th dismissal from the same loop. This process only took 6 to 7 minutes, which would lead to dismissal ending at 2:07pm instead of the current 2:12 – 2:15pm end time.

In the future, if buses are ever delayed, the 2nd - 4th grade children would still be ready for dismissal and can start cycling through the loop. Because their dismissal should only take 6 to 7 minutes it is likely that they would be done dismissing by the time the delayed buses would be ready to depart the bus loop.

1:45PM	First bell rings
1:47PM	K – 1st dismissal begins
1:52PM	Second bell rings
1:59PM	K – 1st dismissal ends
1:59PM	Buses leave
2:00PM	2nd - 4th dismissal begins
2:07PM	2nd - 4th dismissal ends

Table 8: Timing of Proposed Single Loop Dismissal

Other Suggestions

- PikMyKid- Third Party Software Solution

    PikMyKid is a third-party company which provides a software solution to automate a school's dismissal process. It was concluded that the PikMyKid software would be a way to further improve the standardized process that was already able to be implemented, through automation. This software would not only affect the parent pick-up, but it would also simplify the entire internal dismissal process. PikMyKid also offers extra features that would increase safety and communication, and therefore peace of mind. Outlined below are key features, components of the software system, a cost/benefit analysis, and key information for moving forward with the recommendation.

- Features

    1. Dismissal Automation

        i. Automated Pick-Up Queue: The software would use parent and teacher apps to automate the queuing process, previously accomplished by manually calling out the names of the children as the car pulled up. With PikMyKid, the parent would use a smartphone to check into the line and the queue would automatically be ordered on the teacher's app who oversees sending each kid to their spot. This allows for some flexibility with roles and organization as the software does the most important job, creating the queue, in place of a teacher. If a parent or adult who is picking up a student does not have the app, there would be a staff person on standby at the check-in sign to ensure the adult gets checked into the queue [ALMO19]. Overall, this would further increase the efficiency of the pick-up process.

        ii. Automated Internal Dismissal Process: The Teacher App and School Dashboard would automate the whole class-by-class dismissal process and allow for efficient changes and real time tracking. Currently, Newberry Elementary uses a check system with clipboard and check sheets filled out by

the teacher of each class to confirm that students end up where they need to be. This paper work is then turned into the office and kept on file for safety and record purposes [PEARJAN19]. The PikMyKid software system would eliminate the paper system and create an online database that would be able to track the students' status in "real-time". This would allow for the whole internal dismissal process to be fully automated. This would increase safety and efficiency in the process.

2. Daily Attendance/ Dismissal Changes

The process of switching a student's dismissal type would also be automated and able to happen in real-time up to a certain cut off time each day. The system would be able to keep track of the attendance for each day and if an authorized parent needed to, they could switch their student from "Bus" to "Pick-Up" through their app, provided that this happens before a cut-off time determined by the school's dismissal time [ALMO19]. This would save the school from having to keep track of loose notes and random visits and phone calls from parents [PEARJAN19]. It would be a safer and more reliable option to organize attendance and dismissal status.

3. Parent Notification System

The PikMyKid software allows for a unified and open form of communication between all stakeholders involved in the dismissal process. Parents would be able to manage notifications that would ensure their children's safety and where-abouts in "real-time". Some of these notifications include: a notification when the child has been dropped off at their dismissal area, a notification when they have been dropped off at their bus stop, or even a notification when they have been picked up by another (authorized) individual. This system also would create an easy and open emergency notification system for parents. Authorized guardians could also have the app and access to notifications and check-in ability [ALMO19]. Additional features in the parent's app serve as a better connection to Newberry Elementary and their students experience at the school. The notification feature is one of the main reasons there is an 85% adoption rate with parent and PikMyKid schools have a solid safety record [ALMO19].

4. Additional Features

PikMyKid software is fully customizable for the school that is using it. They have additional features like late bus dismissal organization, rainy day protocols, and general dismissal procedure consulting that it was believed that would benefit Newberry Elementary. PikMyKid offers 24/7 support year-round, even past the initial implementation period [PIKM].

- Software Components

    1. School Dashboard – for front desk and administration's computers.
    2. Parent App - for a parent's smartphone or tablet.
    3. Teacher/ Staff App - for a teacher's smartphone, tablet, or school laptop.

- Benefits for Newberry

    - The standardized process proposed would be automated. This would further decrease the process time via the automated car check-in queue.

    - The internal dismissal process for teachers and administration would be automated. This would eliminate wasted time and increase process efficiency while accounting for overall student organization and safety.

    - Communication between parents, teachers, and staff would be in "real-time" and allow for a safer and more informed overall environment.

    - The additional consultation provided would be useful for Newberry as they continue to adapt and grow looking towards the future.

    - PikMyKid is designed to be very simple to use while effectively achieving the purpose of an efficient pick-up process.

- Costs for Newberry

    - $ 2600 annual subscription (includes implementation and tech support, no hardware) [ALMO19].

- Implementation and Details

    - Contact: Chase (PikMyKid Consultant)
    - Phone: +1 (813) 452 – 5278
    - Implementation: The customization and implementation process would start with back and forth consultation between the school and Chase. In this, Chase would learn the ins and outs of the school's procedures and dismissal process and customize the software to best fit the needs of the school. Chase would work with the school to ensure that the software fits their needs according to his efficiency expertise. Following the consultation period, PikMyKid is ready to be implemented. There would be a 10- 20-day implementation process. This process would include all software installations, procedure consulting, and training for parents, teachers, and staff. Overall this process would be simple and could be fully implemented in less than two months with no major complications [ALMO19][PIKM].

Conclusions About Additional Parking

After the meeting with the Principal and the teachers they decided to explore more exhaustively the first two proposal. They liked to idea of implementing the two proposals simultaneously because they were easily implementable and fulfilled the school needs.

References

[PEARJAN19] Pearlman, B., "Personal Interview", January 2019.

[ALMO19] Almonte, A., Chase, "PikMyKid Information Consultation", March 2019.

[RODR19] Rodriguez, G., "NES Pick-Up Process Thoughts and Opinions". Survey, March 2019.

[WYNN19] Wynn, S. "Meeting with County Facilities Officials.", February 2019.

[PEARMAR19] Pearlman, B., "Personal Interview", March 2019.

[FRAN19] Franch, M., "NES Pick-Up Process Follow Up Survey". Survey, April 2019.

[HOME19] Home Advisor, "Learn How Much It Costs to Install a Playground or Swing Set.", www.homeadvisor.com/cost/outdoor-living/install-a-playground-or-swing-set/, 2019.

[TREE12] Tree Removal, "Guide to Tree Removal Costs & Prices.", www.treeremoval.com/costs/#.XMYdU5NKgWo, 2012.

[HOME15] Home Advisor, "Learn How Much It Costs to Install a Chain Link Fence.", www.homeadvisor.com/cost/fencing/install-a-chain-link-fence/, 2015.

[HOME17] Home Advisor, "Learn How Much It Costs to Clear Land or Prepare a Construction Site.", www.homeadvisor.com/cost/landscape/clear-land-or-prepare-a-construction-site/#treeremoval, 2017

[BRAH15] Brahney, S. "What's the Average Cost to Line Stripe a Parking Lot?" Fix Asphalt, www.fixasphalt.com/blog/cost-to-line-stripe-a-parking-lot, May 2015.

[HOME18] Hometown Demolition, "How Concrete Is Removed and How Much It Costs.", www.hometowndemolitioncontractors.com/blog/how-concrete-is-removed-and-how-much-it-costs, October 2018.

[HOME16] Home Advisor, "Learn How Much It Costs to Install Asphalt Paving." www.homeadvisor.com/cost/outdoor-living/install-asphalt-paving/#concrete, 2016.

[OHIO] Ohio Paving, "Asphalt Paving Costs in Cleveland | Maintenance, Construction & Paving.", www.ohiopaving.com/asphalt-paving-costs/

[PIKM] PikMyKid, "PikMyKid Software Features.", www.pikmykid.com/features/.

[LEDL] Led Light Expert, "LED Parking Lot Lights Buyer's Guide.", www.ledlightexpert.com/LED- Parking-Lot-Lights-Buyers-Guide_ep_46-1.html.

[PROM18] ProMatcher, "Parking Lots Costs & Prices.", www.parking-lots.promatcher.com/cost/, 2018.

[SMIT19] Smith, C. R., "Meeting with Parent Teacher Organization Head.", January 2019.

[TEME] Temecula Municipal Code, "17.24.050 Parking facility layout and dimensions.", www.qcode.us/codes/temecula/view.php?topic=17-17_24-17_24_050.

[WIKI19] Wikipedia, "Queuing Theory", www.en.wikipedia.org/wiki/Queueing_theory, 2019

Appendix

A. Data Table

A.1. Initial Process- Older Kids Loop

Date	Car Enters Loop Description	Car Enters Loop TimeStamp	Car Enters Process TimeStamp	Car Leaves Process TimeStamp	Child entered car	Queue Time	Process Time	Process Start to Child Entering	Child Entering to Process Leave
2/12/19	Burgandy Merrcury	1:40:26 p. m.	1:44:54 p. m.	1:46:30 p. m.		0:04:28	0:01:36		
2/12/19	Silver Jeep	1:40:26 p. m.	1:44:54 p. m.	1:46:38 p. m.		0:04:28	0:01:44		
2/12/19	Black Toyota	1:40:26 p. m.	1:44:54 p. m.	1:46:50 p. m.		0:04:28	0:01:56		
2/12/19	Red Toyota	1:40:26 p. m.	1:44:54 p. m.	1:50:58 p. m.	1:50:40 p. m.	0:04:28	0:06:04	0:05:46	0:00:19
2/12/19	Black Chevy Tahoe	1:40:26 p. m.	1:44:54 p. m.	1:49:50 p. m.	1:49:41 p. m.	0:04:28	0:04:56	0:04:47	0:00:08
2/12/19	Grey Ford Explorer	1:40:26 p. m.	1:47:05 p. m.	1:51:11 p. m.	1:51:03 p. m.	0:06:39	0:04:07	0:03:58	0:00:09
2/12/19	Black Cadillac	1:40:26 p. m.	1:47:09 p. m.	1:51:47 p. m.	1:51:36 p. m.	0:06:43	0:04:39	0:04:27	0:00:11
2/12/19	Silver Ford Car	1:40:26 p. m.	1:47:11 p. m.	1:51:51 p. m.	1:48:37 p. m.	0:06:45	0:04:40	0:01:26	0:03:13
2/12/19	Silver Dodge Truck	1:40:26 p. m.	1:50:05 p. m.	1:53:47 p. m.	1:53:30 p. m.	0:09:39	0:03:42	0:03:25	0:00:17
2/12/19	Red Jaguar Car	1:40:26 p. m.	1:50:05 p. m.	1:52:30 p. m.	1:50:54 p. m.	0:09:39	0:02:25	0:00:49	0:01:36
2/12/19	Black Honda Pilot	1:40:26 p. m.	1:51:40 p. m.	1:52:58 p. m.		0:11:15	0:01:17		
2/12/19	White Dodge (Large) Truck	1:40:26 p. m.	1:52:08 p. m.	1:53:07 p. m.		0:11:43	0:00:59		
2/12/19	Silver-Green Toyota Van	1:40:26 p. m.	1:52:19 p. m.	1:53:14 p. m.		0:11:53	0:00:55		
2/12/19	Grey Ford Truck	1:43:13 p. m.	1:52:33 p. m.	1:53:17 p. m.	1:52:56 p. m.	0:09:20	0:00:44	0:00:22	0:00:22
2/12/19	Blue Ford Explorer	1:44:04 p. m.	1:52:44 p. m.	1:53:49 p. m.	1:53:38 p. m.	0:08:40	0:01:05	0:00:54	0:00:11
2/12/19	Blac Chrysler Van	1:45:48 p. m.	1:53:12 p. m.	1:55:02 p. m.	1:54:59 p. m.	0:07:23	0:01:50	0:01:47	0:00:03
2/12/19	White BMW Car (in loop after suzuki)	1:45:51 p. m.	1:53:31 p. m.	1:54:55 p. m.	1:54:49 p. m.	0:07:40	0:01:24	0:01:18	0:00:06
2/12/19	<mark>Silver Suzuki (entered from Left)</mark>	1:48:42 p. m.	1:53:21 p. m.	1:54:14 p. m.		0:04:39	0:00:53		
2/12/19	White Toyota Car	1:49:05 p. m.	1:53:55 p. m.	1:54:42 p. m.		0:04:50	0:00:47		
2/12/19	Brown-Grey Cadillac	1:49:45 p. m.	1:54:04 p. m.	1:55:09 p. m.		0:04:19	0:01:05		
2/12/19	Tan Kia van	1:52:55 p. m.	1:54:20 p. m.	1:55:16 p. m.	1:54:59 p. m.	0:01:24	0:00:57	0:00:39	0:00:17
2/12/19	White Nissan Car	1:52:58 p. m.	1:54:31 p. m.	1:55:20 p. m.		0:01:33	0:00:50		

Date	Vehicle	Time 1	Time 2	Time 3	Time 4				
2/12/19	Red Kia Van	1:53:20 p. m.	1:55:10 p. m.	1:55:59 p. m.	1:55:45 p. m.	0:01:51	0:00:49	0:00:35	0:00:14
2/12/19	Black Hatch Back	1:53:22 p. m.	1:55:15 p. m.	1:56:37 p. m.	1:55:41 p. m.	0:01:53	0:01:22	0:00:26	0:00:56
2/12/19	Red Jeep	1:55:54 p. m.	1:56:11 p. m.	1:57:08 p. m.	1:56:50 p. m.	0:00:17	0:00:56	0:00:39	0:00:17
2/12/19	Navy Ford Explorer	1:56:11 p. m.	1:56:23 p. m.	1:57:11 p. m.	1:56:42 p. m.	0:00:12	0:00:48	0:00:18	0:00:30
2/12/19	black nissan		1:57:59 p. m.	1:58:17 p. m.			0:00:18		
2/12/19	white car		1:58:42 p. m.	1:59:09 p. m.	1:58:46 p. m.		0:00:27	0:00:04	0:00:23
2/14/19	black infiniti crossover	1:37:47 p. m.	1:44:57 p. m.	1:47:27 p. m.	1:47:15 p. m.	0:07:10	0:02:30	0:02:18	0:00:12
2/14/19	dirty gray ford	1:45:09 p. m.	1:46:05 p. m.	1:50:29 p. m.	1:50:00 p. m.	0:00:57	0:04:23	0:03:54	0:00:29
2/14/19	black pickup	1:45:09 p. m.	1:46:09 p. m.	1:48:56 p. m.	1:48:47 p. m.	0:01:01	0:02:46	0:02:37	0:00:09
2/14/19	gray kia	1:45:09 p. m.	1:46:12 p. m.	1:51:27 p. m.	1:50:24 p. m.	0:01:03	0:05:15	0:04:12	0:01:03
2/14/19	gray truck	1:45:09 p. m.	1:46:20 p. m.	1:51:55 p. m.		0:01:12	0:05:35		
2/14/19	black cadillac	1:45:09 p. m.	1:47:53 p. m.	1:55:34 p. m.	1:55:26 p. m.	0:02:44	0:07:41	0:07:33	0:00:08
2/14/19	gold cadillac	1:45:09 p. m.	1:49:13 p. m.	1:55:37 p. m.	1:54:49 p. m.	0:04:04	0:06:24	0:05:36	0:00:47
2/14/19	silver kia crossover	1:45:09 p. m.	1:49:23 p. m.	1:51:59 p. m.		0:04:14	0:02:36		
2/14/19	white pickup - Ram	1:45:09 p. m.	1:49:39 p. m.			0:04:30			
2/14/19	green pickup	1:45:09 p. m.	1:51:41 p. m.	1:52:30 p. m.	1:52:14 p. m.	0:06:32	0:00:49	0:00:33	0:00:16
2/14/19	silver hyundai	1:45:09 p. m.	1:51:49 p. m.	1:52:54 p. m.		0:06:40	0:01:06		
2/14/19	white pickup	1:45:09 p. m.	1:51:54 p. m.	1:52:57 p. m.	1:52:20 p. m.	0:06:45	0:01:03	0:00:26	0:00:37
2/14/19	black chevy tahoe	1:45:09 p. m.	1:52:04 p. m.	1:52:59 p. m.	1:52:27 p. m.	0:06:55	0:00:55	0:00:23	0:00:33
2/14/19	white ford SUV	1:45:09 p. m.	1:52:49 p. m.	1:54:06 p. m.	1:53:32 p. m.	0:07:40	0:01:17	0:00:44	0:00:34
2/14/19	black gmc truck	1:45:09 p. m.	1:52:56 p. m.	1:55:40 p. m.	1:54:45 p. m.	0:07:48	0:02:44	0:01:49	0:00:55
2/14/19	tan pickup	1:45:09 p. m.	1:53:06 p. m.		1:53:31 p. m.	0:07:58		0:00:24	
2/14/19	tan van (cadillac?)	1:50:14 p. m.	1:54:16 p. m.	1:55:50 p. m.		0:04:02	0:01:34		
2/14/19	red jeep	1:50:18 p. m.	1:54:22 p. m.	1:56:00 p. m.		0:04:04	0:01:38		
2/14/19	white gmc crossover	1:52:06 p. m.	1:54:36 p. m.	1:56:02 p. m.		0:02:30	0:01:26		
2/14/19	gray lexus	1:52:10 p. m.	1:55:07 p. m.	1:56:10 p. m.	1:55:21 p. m.	0:02:58	0:01:02	0:00:14	0:00:49
2/14/19	white camry	1:52:15 p. m.	1:55:53 p. m.	1:57:03 p. m.	1:56:59 p. m.	0:03:38	0:01:10	0:01:06	0:00:04
2/14/19	royal blue ford	1:53:14 p. m.	1:55:58 p. m.	1:56:33 p. m.	1:56:28 p. m.	0:02:44	0:00:35	0:00:30	0:00:05
2/14/19	gray ford crossover	1:53:16 p. m.	1:56:05 p. m.	1:56:47 p. m.		0:02:49	0:00:42		
2/14/19	white ram truck	1:54:08 p. m.	1:56:10 p. m.	1:56:49 p. m.		0:02:03	0:00:39		
2/14/19	tan cadillac	1:54:28 p. m.	1:56:31 p. m.	1:56:53 p. m.	1:56:37 p. m.	0:02:03	0:00:21	0:00:06	0:00:16
2/14/19	white chevy truck	1:54:38 p. m.	1:56:48 p. m.	1:57:55 p. m.	1:57:31 p. m.	0:02:10	0:01:06	0:00:43	0:00:23

Date	Vehicle	Time 1	Time 2	Time 3	Time 4			
2/14/19	blue suv	1:55:08 p. m.	1:56:54 p. m.	1:57:29 p. m.	1:57:18 p. m.	0:01:46	0:00:35	0:00:24	0:00:11
2/14/19	gold van	1:56:31 p. m.	1:57:04 p. m.	1:57:59 p. m.	1:57:42 p. m.	0:00:34	0:00:55	0:00:37	0:00:17
2/14/19	black gmc crossover	1:56:32 p. m.	1:57:11 p. m.	1:58:02 p. m.	1:57:31 p. m.	0:00:39	0:00:51	0:00:20	0:00:31
2/14/19	bur	1:56:34 p. m.	1:57:16 p. m.	1:58:05 p. m.	1:57:30 p. m.	0:00:42	0:00:50	0:00:14	0:00:36
2/15/19	Burgandy Mercury	1:44:55 p. m.	1:44:55 p. m.	1:49:25 p. m.	1:49:18 p. m.		0:04:30	0:04:24	0:00:07
2/15/19	tan kia	1:44:55 p. m.	1:44:59 p. m.	1:52:55 p. m.	1:51:59 p. m.	0:00:04	0:07:56	0:07:01	0:00:55
2/15/19	red crossover	1:44:55 p. m.	1:45:00 p. m.	1:49:20 p. m.	1:49:07 p. m.	0:00:05	0:04:21	0:04:07	0:00:13
2/15/19	black infinity	1:44:55 p. m.	1:45:01 p. m.	1:49:38 p. m.		0:00:06	0:04:37		
2/15/19	black truck	1:44:55 p. m.	1:45:03 p. m.	1:49:39 p. m.		0:00:08	0:04:36		
2/15/19	grey ford explorer	1:44:55 p. m.	1:49:27 p. m.	1:50:23 p. m.	1:50:11 p. m.	0:04:32	0:00:56	0:00:44	0:00:12
2/15/19	greenish mini van toyota	1:44:55 p. m.	1:49:38 p. m.	1:50:15 p. m.		0:04:43	0:00:37		
2/15/19	black chevy tahoe SUV	1:44:55 p. m.	1:49:47 p. m.	1:50:25 p. m.		0:04:52	0:00:38		
2/15/19	black caddy car	1:44:55 p. m.	1:49:54 p. m.	1:54:56 p. m.	1:54:40 p. m.	0:04:59	0:05:02	0:04:46	0:00:15
2/15/19	silver blue hyunday car	1:44:55 p. m.	1:50:18 p. m.	1:50:40 p. m.	1:50:20 p. m.	0:05:23	0:00:22	0:00:02	0:00:20
2/15/19	torquise chevy truck	1:44:55 p. m.	1:50:36 p. m.	1:52:52 p. m.	1:52:31 p. m.	0:05:41	0:02:15	0:01:55	0:00:20
2/15/19	black GMC SUV	1:44:55 p. m.	1:50:43 p. m.	1:53:10 p. m.		0:05:48	0:02:27		
2/15/19	silver ford car	1:44:55 p. m.	1:50:50 p. m.	1:53:12 p. m.	1:51:09 p. m.	0:05:55	0:02:22	0:00:20	0:02:02
2/15/19	black GMC truck	1:44:55 p. m.	1:51:30 p. m.	1:53:13 p. m.	1:51:40 p. m.	0:06:35	0:01:43	0:00:10	0:01:33
2/15/19	blue nissan car	1:44:55 p. m.	1:52:56 p. m.	1:53:39 p. m.		0:08:01	0:00:43		
2/15/19	silver toyota car	1:44:55 p. m.	1:53:09 p. m.	1:53:52 p. m.	1:53:46 p. m.	0:08:14	0:00:43	0:00:38	0:00:06
2/15/19	white ford suv	1:44:55 p. m.	1:53:21 p. m.	1:54:08 p. m.	1:53:54 p. m.	0:08:26	0:00:47	0:00:33	0:00:15
2/15/19	silver chevy crossover	1:44:55 p. m.	1:53:28 p. m.	1:54:13 p. m.	1:53:54 p. m.	0:08:33	0:00:45	0:00:26	0:00:19
2/15/19	white dodge truck large	1:44:55 p. m.	1:53:46 p. m.	1:54:33 p. m.	1:54:13 p. m.	0:08:51	0:00:47	0:00:27	0:00:20
2/15/19	silver ford truck	1:44:55 p. m.	1:54:19 p. m.	1:54:52 p. m.	1:54:46 p. m.	0:09:24	0:00:33	0:00:27	0:00:06
2/15/19	Navy blue van (Skipped the line :( )	1:51:41 p. m.	1:54:26 p. m.	1:55:01 p. m.		0:02:45	0:00:35		
2/15/19	navy bluve ford explorer	1:44:55 p. m.	1:54:32 p. m.	1:55:06 p. m.		0:09:37	0:00:34		
2/15/19	white dodge truck	1:44:55 p. m.	1:54:38 p. m.	1:55:14 p. m.	1:55:02 p. m.	0:09:43	0:00:36	0:00:24	0:00:12
2/15/19	grey toyota car	1:44:55 p. m.	1:54:45 p. m.	1:55:38 p. m.	1:55:28 p. m.	0:09:50	0:00:53	0:00:43	0:00:10
2/15/19	grey nissan suv	1:44:55 p. m.	1:55:24 p. m.	1:55:47 p. m.	1:55:35 p. m.	0:10:29	0:00:23	0:00:12	0:00:12
2/15/19	Black toyota tundra truck (Skipped)	1:54:01 p. m.	1:55:25 p. m.	1:55:52 p. m.		0:01:24	0:00:27		

2/15/19	white ford SUV	1:49:29 p. m.	1:55:28 p. m.	1:55:59 p. m.	1:55:43 p. m.	0:05:59	0:00:30	0:00:15	0:00:15
2/15/19	black car	1:50:32 p. m.	1:55:52 p. m.	1:58:34 p. m.	1:58:12 p. m.	0:05:20	0:02:42	0:02:20	0:00:22
2/15/19	black ford focus car	1:51:17 p. m.	1:55:58 p. m.			0:04:41			
2/15/19	white chevy truck	1:52:25 p. m.	1:56:03 p. m.	1:57:02 p. m.	1:56:31 p. m.	0:03:37	0:00:59	0:00:28	0:00:31
2/15/19	Grey chrysler van	1:54:35 p. m.	1:56:11 p. m.	1:57:06 p. m.		0:01:36	0:00:55		
2/15/19	tan kia van	1:54:59 p. m.	1:56:17 p. m.	1:57:09 p. m.	1:56:29 p. m.	0:01:18	0:00:53	0:00:12	0:00:41
2/15/19	white toyota car	1:56:32 p. m.	1:56:41 p. m.	1:57:19 p. m.		0:00:09	0:00:38		

A.2. Initial Process- Younger Kids Loop

Date	Car Enters Loop Description	Car Enters Loop TimeStamp	Car Enters Process TimeStamp	Car Leaves Process TimeStamp	Child enters car	Queue Time	Process Time	Process Start to Child Entering	Child Entering to Process Leave
2/12/19	Red Ford Truck	1:59:45 p. m.	2:00:28 p. m.	2:01:27 p. m.		00:43	00:59		
2/12/19	Navy Ford Truck	1:59:45 p. m.	2:00:30 p. m.	2:01:28 p. m.		00:45	00:58		
2/12/19	Silver Cadillac Car	1:59:45 p. m.	2:00:32 p. m.			00:47			
2/12/19	White Honda Van	1:59:45 p. m.	2:00:36 p. m.	2:01:32 p. m.		00:50	00:57		
2/12/19	White Honda Van 2	1:59:45 p. m.	2:00:46 p. m.	2:01:53 p. m.		01:01	01:07		
2/12/19	Red Mini Hatchback	1:59:45 p. m.	2:01:00 p. m.	2:01:55 p. m.		01:15	00:55		
2/12/19	Grey Jeep	1:59:45 p. m.	2:01:25 p. m.	2:02:12 p. m.		01:40	00:47		
2/12/19	Blue Nissan Car	1:59:45 p. m.	2:01:40 p. m.	2:02:20 p. m.		01:55	00:40		
2/12/19	TOyota Car Greenish	1:59:45 p. m.	2:01:46 p. m.	2:02:50 p. m.		02:00	01:04		
2/12/19	White GMC	1:59:45 p. m.	2:01:51 p. m.	2:02:52 p. m.	2:02:27 p. m.	02:06	01:01	00:36	00:25
2/12/19	Dark Kia Van	1:59:45 p. m.	2:01:58 p. m.	2:03:04 p. m.	2:02:39 p. m.	02:12	01:07	00:41	00:26
2/12/19	Tan toyota car	1:59:45 p. m.	2:02:31 p. m.	2:03:36 p. m.		02:46	01:05		
2/12/19	Black Mazda SUV	1:59:45 p. m.	2:02:59 p. m.	2:03:43 p. m.		03:14	00:44		
2/12/19	White Toyota rav 4	1:59:45 p. m.	2:03:06 p. m.	2:03:50 p. m.		03:21	00:44		
2/12/19	SIlver gmc suv	1:59:45 p. m.	2:03:11 p. m.	2:03:56 p. m.		03:26	00:45		
2/12/19	Huge white van	1:59:45 p. m.	2:03:17 p. m.	2:04:20 p. m.	2:03:54 p. m.	03:31	01:04	00:37	00:26
2/12/19	Tan tcadillac	1:59:45 p. m.	2:03:24 p. m.	2:04:24 p. m.	2:03:57 p. m.	03:39	00:59	00:33	00:27
2/12/19	White Sequia toyota SUV	1:59:45 p. m.	2:03:44 p. m.	2:05:10 p. m.		03:58	01:26		
2/12/19	Blue chevy truck	1:59:45 p. m.	2:04:16 p. m.	2:05:16 p. m.		04:30	01:00		
2/12/19	white older van	1:59:45 p. m.	2:04:28 p. m.	2:05:19 p. m.		04:43	00:51		
2/12/19	Blue nissan car 2	1:59:45 p. m.	2:04:35 p. m.	2:05:32 p. m.		04:50	00:57		
2/12/19	Tan toyota crossover	1:59:45 p. m.	2:04:42 p. m.	2:05:39 p. m.	2:05:09 p. m.	04:57	00:57	00:27	00:30
2/12/19	Tan chrysler Van	1:59:45 p. m.	2:04:53 p. m.	2:05:51 p. m.	2:05:13 p. m.	05:07	00:58	00:21	00:37
2/12/19	Silver toyota car	1:59:45 p. m.	2:04:59 p. m.	2:06:07 p. m.		05:13	01:08		
2/12/19	burgandy ford	1:59:45 p. m.	2:05:34 p. m.	2:06:18 p. m.		05:48	00:45		
2/12/19	White dodge SUV	1:59:45 p. m.	2:05:45 p. m.	2:06:22 p. m.		06:00	00:37		
2/12/19	White nissan SUV	1:59:45 p. m.	2:05:50 p. m.	2:06:28 p. m.	2:06:14 p. m.	06:04	00:39	00:24	00:14

Date	Vehicle								
2/12/19	Black Ford truck	1:59:45 p. m.	2:05:59 p. m.	2:06:35 p. m.	2:06:12 p. m.	06:14	00:36	00:13	00:22
2/12/19	Red chevy car	1:59:45 p. m.	2:06:02 p. m.	2:06:51 p. m.	2:06:24 p. m.	06:17	00:48	00:22	00:26
2/12/19	White dodge Van	1:59:45 p. m.	2:06:08 p. m.	2:07:16 p. m.		06:23	01:08		
2/12/19	Tan Chevy SUV	1:59:45 p. m.	2:06:43 p. m.	2:07:28 p. m.		06:58	00:45		
2/12/19	White dodge Truck	1:59:45 p. m.	2:07:00 p. m.	2:08:16 p. m.		07:15	01:16		
2/12/19	white kia van	1:59:45 p. m.	2:07:07 p. m.	2:08:19 p. m.	2:07:22 p. m.	07:22	01:11	00:14	00:57
2/12/19	Grey-blue nissan truck	1:59:45 p. m.	2:07:12 p. m.	2:08:21 p. m.	2:07:27 p. m.	07:26	01:09	00:15	00:54
2/12/19	tan honda van	2:03:59 p. m.	2:07:30 p. m.	2:08:32 p. m.	2:07:46 p. m.	03:31	01:02	00:16	00:47
2/12/19	Silver GMC SUV	2:04:01 p. m.	2:07:32 p. m.	2:08:48 p. m.		03:31	01:16		
2/12/19	Black Honda Van	2:05:14 p. m.	2:08:07 p. m.	2:08:58 p. m.		02:53	00:50		
2/12/19	Silver Hyunay Car	2:05:18 p. m.	2:08:26 p. m.	2:09:06 p. m.		03:09	00:40		
2/12/19	Silver ford Cross over	2:05:45 p. m.	2:08:33 p. m.	2:09:52 p. m.		02:48	01:18		
2/12/19	Red dodge	2:05:52 p. m.	2:08:41 p. m.	2:09:54 p. m.	2:08:53 p. m.	02:49	01:12	00:12	01:01
2/12/19	Silver Dodge Van	2:06:42 p. m.	2:08:44 p. m.	2:09:57 p. m.	2:08:58 p. m.	02:02	01:13	00:13	01:00
2/12/19	Black saturn?	2:06:58 p. m.	2:08:49 p. m.	2:10:19 p. m.		01:51	01:30		
2/12/19	White chevy car	2:07:00 p. m.	2:09:57 p. m.	2:10:22 p. m.		02:57	00:25		
2/12/19	Tan ford F150 truck	2:07:26 p. m.	2:10:01 p. m.	2:10:37 p. m.	2:10:19 p. m.	02:35	00:35	00:17	00:18
2/12/19	Silver Dodge truck	2:08:21 p. m.	2:10:10 p. m.	2:10:47 p. m.	2:10:24 p. m.	01:49	00:37	00:14	00:23
2/12/19	White Kia Van	2:08:31 p. m.	2:10:14 p. m.	2:10:57 p. m.	2:10:26 p. m.	01:42	00:43	00:12	00:31
2/12/19	Silver chevy impala (car from before)	2:05:12 p. m.	2:10:53 p. m.	2:11:17 p. m.		05:41	00:24		
2/14/19	black nissan that shouldnt be here?????	2:01:32 p. m.	2:02:18 p. m.	2:02:41 p. m.		00:46	00:23		
2/14/19	red pickup	2:01:32 p. m.	2:02:19 p. m.	2:02:41 p. m.	2:02:22 p. m.	00:47	00:22	00:02	00:19
2/14/19	silver van	2:01:32 p. m.	2:02:20 p. m.	2:02:48 p. m.	2:02:25 p. m.	00:48	00:28	00:05	00:23
2/14/19	white van	2:01:32 p. m.	2:02:24 p. m.	2:02:57 p. m.	2:02:31 p. m.	00:52	00:33	00:08	00:26
2/14/19	blue pickup	2:01:32 p. m.	2:02:25 p. m.	2:03:01 p. m.	2:02:39 p. m.	00:53	00:36	00:14	00:22
2/14/19	gray pickup	2:01:32 p. m.	2:02:28 p. m.	2:03:13 p. m.	2:02:56 p. m.	00:56	00:45	00:27	00:18
2/14/19	white passenger van	2:01:32 p. m.	2:02:42 p. m.	2:03:26 p. m.	2:03:05 p. m.	01:10	00:44	00:23	00:20
2/14/19	Silver toyota car	2:01:32 p. m.	2:03:12 p. m.	2:04:06 p. m.	2:03:53 p. m.	01:40	00:54	00:41	00:13
2/14/19	white car	2:01:32 p. m.	2:03:18 p. m.	2:04:09 p. m.	2:03:56 p. m.	01:46	00:51	00:38	00:13

Date	Vehicle								
2/14/19	white van	2:01:32 p. m.	2:03:24 p. m.	2:04:16 p. m.	2:03:51 p. m.	01:52	00:52	00:27	00:25
2/14/19	white hyundai crossover	2:01:32 p. m.	2:03:29 p. m.	2:04:27 p. m.	2:04:03 p. m.	01:57	00:58	00:34	00:24
2/14/19	red fiat	2:01:32 p. m.	2:03:47 p. m.	2:04:46 p. m.		02:15	00:59		
2/14/19	blue van	2:01:32 p. m.	2:03:51 p. m.	2:05:19 p. m.	2:05:03 p. m.	02:19	01:27	01:11	00:16
2/14/19	black crossover	2:01:32 p. m.	2:04:42 p. m.	2:05:35 p. m.	2:05:17 p. m.	03:10	00:52	00:35	00:17
2/14/19	tan pikcup	2:01:32 p. m.	2:04:45 p. m.	2:05:37 p. m.	2:05:13 p. m.	03:13	00:52	00:28	00:24
2/14/19	white gmc	2:01:32 p. m.	2:04:49 p. m.	2:05:43 p. m.		03:18	00:53		
2/14/19	silver honda van	2:01:32 p. m.	2:04:58 p. m.	2:06:12 p. m.	2:06:02 p. m.	03:26	01:15	01:04	00:11
2/14/19	tan van	2:01:32 p. m.	2:05:45 p. m.	2:06:17 p. m.	2:06:06 p. m.	04:13	00:32	00:21	00:11
2/14/19	tan crossover	2:01:32 p. m.	2:05:47 p. m.	2:06:33 p. m.	2:06:11 p. m.	04:15	00:46	00:24	00:22
2/14/19	white cadillac	2:01:32 p. m.	2:05:50 p. m.	2:06:35 p. m.		04:18	00:46		
2/14/19	white van	2:01:32 p. m.	2:05:57 p. m.	2:06:40 p. m.	2:06:21 p. m.	04:25	00:44	00:25	00:19
2/14/19	silver honda crv	2:01:32 p. m.	2:06:00 p. m.	2:06:50 p. m.	2:06:31 p. m.	04:28	00:50	00:31	00:20
2/14/19	red sedan	2:01:32 p. m.	2:06:06 p. m.	2:07:12 p. m.	2:07:03 p. m.	04:34	01:06	00:56	00:09
2/14/19	white corssover	2:01:32 p. m.	2:06:34 p. m.	2:07:20 p. m.	2:07:08 p. m.	05:02	00:46	00:34	00:12
2/14/19	gray/blue crossover	2:01:32 p. m.	2:06:47 p. m.	2:07:37 p. m.	2:07:18 p. m.	05:15	00:50	00:31	00:18
2/14/19	gold honda	2:01:32 p. m.	2:06:55 p. m.	2:07:43 p. m.	2:07:25 p. m.	05:23	00:48	00:30	00:18
2/14/19	silver sedan	2:01:32 p. m.	2:06:57 p. m.	2:07:47 p. m.		05:26	00:50		
2/14/19	black chevy	2:01:32 p. m.	2:07:02 p. m.	2:07:55 p. m.		05:30	00:53		
2/14/19	white old car	2:01:32 p. m.	2:07:05 p. m.	2:08:37 p. m.	2:08:24 p. m.	05:33	01:32	01:19	00:13
2/14/19	red car	2:01:32 p. m.	2:07:10 p. m.	2:08:12 p. m.	2:07:40 p. m.	05:38	01:02	00:30	00:32
2/14/19	white crossover	2:01:32 p. m.	2:07:21 p. m.	2:08:45 p. m.	2:08:28 p. m.	05:49	01:24	01:07	00:17
2/14/19	silver chevy sedan	2:01:32 p. m.	2:08:04 p. m.			06:32			
2/14/19	White nissan SUV	2:01:32 p. m.	2:08:07 p. m.	2:08:49 p. m.	2:08:32 p. m.	06:35	00:43	00:25	00:17
2/14/19	tan suv	2:01:32 p. m.	2:08:15 p. m.	2:08:55 p. m.		06:43	00:40		
2/14/19	black nissan	2:01:32 p. m.	2:08:19 p. m.	2:09:13 p. m.	2:08:53 p. m.	06:47	00:54	00:34	00:20
2/14/19	white van	2:01:32 p. m.	2:08:27 p. m.	2:09:55 p. m.	2:09:35 p. m.	06:55	01:28	01:08	00:20
2/14/19	white crossoer	2:01:32 p. m.	2:09:06 p. m.	2:09:42 p. m.	2:09:33 p. m.	07:34	00:36	00:26	00:10
2/14/19	silver pickup	2:01:32 p. m.	2:09:09 p. m.	2:10:02 p. m.	2:09:44 p. m.	07:38	00:53	00:35	00:18
2/14/19	gray honda van	2:01:32 p. m.	2:09:14 p. m.	2:10:06 p. m.		07:42	00:52		
2/14/19	gold pikcup ford	2:01:32 p. m.	2:09:28 p. m.	2:10:12 p. m.	2:09:49 p. m.	07:56	00:45	00:21	00:23
2/14/19	gold van	2:01:32 p. m.	2:09:36 p. m.	2:11:08 p. m.	2:10:29 p. m.	08:04	01:32	00:53	00:39
2/14/19	white toyota crossover	2:01:32 p. m.	2:10:12 p. m.	2:11:20 p. m.	2:10:32 p. m.	08:40	01:08	00:20	00:48

Date	Vehicle								
2/14/19	navy van	2:01:32 p. m.	2:10:14 p. m.	2:11:21 p. m.	2:10:35 p. m.	08:42	01:07	00:20	00:47
2/14/19	royal blue car	2:01:32 p. m.	2:10:20 p. m.	2:11:25 p. m.	2:10:37 p. m.	08:48	01:05	00:17	00:49
2/14/19	red weird car	2:01:32 p. m.	2:10:22 p. m.	2:11:29 p. m.	2:10:39 p. m.	08:50	01:06	00:16	00:50
2/14/19	blue pickup	2:01:32 p. m.	2:10:39 p. m.	2:11:34 p. m.	2:10:56 p. m.	09:07	00:55	00:17	00:38
2/14/19	silver hyundai	2:08:08 p. m.	2:10:43 p. m.	2:11:55 p. m.	2:11:47 p. m.	02:34	01:12	01:04	00:08
2/14/19	black crossover thing	2:08:42 p. m.	2:10:50 p. m.	2:12:06 p. m.	2:11:49 p. m.	02:08	01:16	00:59	00:17
2/14/19	silver crossover	2:09:01 p. m.	2:11:43 p. m.	2:12:46 p. m.	2:12:21 p. m.	02:42	01:03	00:38	00:26
2/14/19	black pickup	2:09:03 p. m.	2:11:47 p. m.	2:12:53 p. m.	2:12:11 p. m.	02:43	01:06	00:24	00:42
2/14/19	silver toyota sub	2:09:05 p. m.	2:11:57 p. m.	2:13:01 p. m.		02:52	01:05		
2/14/19	white van	2:09:06 p. m.	2:11:58 p. m.	2:13:08 p. m.	2:12:19 p. m.	02:52	01:10	00:21	00:49
2/14/19	tan chevy SUV	2:09:56 p. m.	2:12:11 p. m.	2:13:29 p. m.	2:13:23 p. m.	02:15	01:19	01:12	00:07
2/14/19	silver pickup	2:10:41 p. m.	2:12:26 p. m.	2:13:48 p. m.	2:13:32 p. m.	01:44	01:22	01:07	00:16
2/14/19	silver honda	2:13:05 p. m.	2:13:24 p. m.	2:14:03 p. m.	2:13:45 p. m.	00:20	00:39	00:21	00:18
2/14/19	silver ford car	2:14:10 p. m.	2:14:22 p. m.	2:14:47 p. m.	2:14:32 p. m.	00:12	00:25	00:09	00:15
2/14/19	gold car	2:14:45 p. m.	2:14:54 p. m.	2:15:39 p. m.	2:15:25 p. m.	00:09	00:45	00:31	00:14
2/15/19	silver chrysler van	2:00:51 p. m.	2:01:25 p. m.	2:02:00 p. m.	2:01:43 p. m.	00:34	00:35	00:18	00:17
2/15/19	white kia van	2:00:51 p. m.	2:01:29 p. m.	2:02:07 p. m.	2:01:51 p. m.	00:39	00:38	00:22	00:16
2/15/19	grey ford truck	2:00:51 p. m.	2:01:37 p. m.	2:02:13 p. m.	2:01:57 p. m.	00:46	00:36	00:20	00:16
2/15/19	silver toyota prius car	2:00:51 p. m.	2:01:42 p. m.	2:02:33 p. m.	2:02:21 p. m.	00:51	00:51	00:40	00:11
2/15/19	dark ford truck	2:00:51 p. m.	2:02:01 p. m.	2:02:36 p. m.	2:02:25 p. m.	01:10	00:35	00:25	00:11
2/15/19	bluelexus	2:00:51 p. m.	2:02:39 p. m.	2:03:30 p. m.	2:03:21 p. m.	01:48	00:52	00:42	00:10
2/15/19	white minivan honda	2:00:51 p. m.	2:02:45 p. m.	2:03:34 p. m.	2:03:18 p. m.	01:54	00:49	00:34	00:16
2/15/19	white kia minivan 2	2:00:51 p. m.	2:02:49 p. m.	2:04:16 p. m.	2:04:02 p. m.	01:58	01:27	01:13	00:14
2/15/19	white minivan 3 honda	2:00:51 p. m.	2:03:29 p. m.	2:04:48 p. m.	2:04:29 p. m.	02:38	01:19	01:01	00:19
2/15/19	tan caddy car	2:00:51 p. m.	2:03:33 p. m.	2:04:51 p. m.	2:03:49 p. m.	02:42	01:18	00:16	01:01
2/15/19	white cross over	2:00:51 p. m.	2:03:40 p. m.	2:04:56 p. m.	2:04:07 p. m.	02:49	01:17	00:28	00:49
2/15/19	grey borwn ford truck	2:00:51 p. m.	2:03:48 p. m.	2:05:04 p. m.	2:04:10 p. m.	02:57	01:15	00:22	00:53
2/15/19	silver GMC SUV	2:00:51 p. m.	2:03:57 p. m.	2:05:10 p. m.	2:04:26 p. m.	03:07	01:12	00:29	00:43
2/15/19	Grey brown kia van	2:00:51 p. m.	2:05:04 p. m.	2:05:32 p. m.	2:05:22 p. m.	04:13	00:28	00:19	00:09

2/15/19	black mazda SUV	2:00:51 p. m.	2:05:09 p. m.	2:05:40 p. m.	2:05:29 p. m.	04:18	00:31	00:20	00:11
2/15/19	HUGE ASS white van	2:00:51 p. m.	2:05:16 p. m.	2:06:00 p. m.	2:05:37 p. m.	04:25	00:44	00:21	00:23
2/15/19	tan nissan small suv	2:00:51 p. m.	2:05:24 p. m.	2:06:15 p. m.	2:05:50 p. m.	04:33	00:51	00:26	00:26
2/15/19	silver GMC SUV	2:00:51 p. m.	2:05:39 p. m.	2:06:21 p. m.	2:05:53 p. m.	04:48	00:42	00:14	00:28
2/15/19	black jeep	2:00:51 p. m.	2:06:06 p. m.	2:06:39 p. m.	2:06:30 p. m.	05:15	00:34	00:25	00:09
2/15/19	silver GMC SUV	2:00:51 p. m.	2:06:19 p. m.	2:06:49 p. m.	2:06:35 p. m.	05:28	00:29	00:15	00:14
2/15/19	blue nissan car	2:00:51 p. m.	2:06:21 p. m.	2:07:06 p. m.	2:06:45 p. m.	05:30	00:45	00:24	00:22
2/15/19	grey ford crossover	2:00:51 p. m.	2:06:25 p. m.	2:07:34 p. m.	2:06:42 p. m.	05:34	01:09	00:17	00:52
2/15/19	white toyota large suv	2:00:51 p. m.	2:06:32 p. m.	2:07:40 p. m.	2:06:54 p. m.	05:41	01:08	00:22	00:46
2/15/19	red PT CRUISER (weird car)	2:00:51 p. m.	2:06:34 p. m.	2:07:44 p. m.	2:06:56 p. m.	05:43	01:10	00:22	00:47
2/15/19	white dodge SUV	2:00:51 p. m.	2:06:48 p. m.	2:07:47 p. m.	2:07:09 p. m.	05:57	00:59	00:21	00:38
2/15/19	white old gross van	2:00:51 p. m.	2:07:39 p. m.	2:08:06 p. m.	2:07:57 p. m.	06:49	00:26	00:18	00:08
2/15/19	silver toyota car	2:00:51 p. m.	2:07:42 p. m.	2:08:15 p. m.	2:08:02 p. m.	06:51	00:33	00:20	00:13
2/15/19	white ford truck large	2:00:51 p. m.	2:07:46 p. m.	2:08:35 p. m.	2:08:04 p. m.	06:55	00:49	00:19	00:31
2/15/19	white dodge van	2:00:51 p. m.	2:07:51 p. m.	2:08:40 p. m.	2:08:13 p. m.	07:00	00:49	00:22	00:28
2/15/19	White nissan SUV	2:00:51 p. m.	2:07:56 p. m.	2:08:44 p. m.	2:08:09 p. m.	07:05	00:48	00:14	00:34
2/15/19	tan honda car	2:00:51 p. m.	2:08:01 p. m.	2:08:48 p. m.	2:08:25 p. m.	07:11	00:46	00:23	00:23
2/15/19	tan minivan chrysler	2:00:51 p. m.	2:08:09 p. m.	2:09:33 p. m.	2:09:02 p. m.	07:18	01:23	00:53	00:30
2/15/19	white dodge hatchback	2:00:51 p. m.	2:08:46 p. m.	2:09:37 p. m.	2:09:09 p. m.	07:55	00:51	00:23	00:28
2/15/19	black chevy suv	2:00:51 p. m.	2:08:49 p. m.	2:09:40 p. m.	2:09:05 p. m.	07:58	00:51	00:16	00:35
2/15/19	silver honda minivan	2:00:51 p. m.	2:08:54 p. m.	2:09:43 p. m.	2:09:07 p. m.	08:03	00:49	00:13	00:37
2/15/19	tan chevy suv	2:00:51 p. m.	2:08:57 p. m.	2:09:49 p. m.	2:09:11 p. m.	08:06	00:52	00:14	00:38
2/15/19	red dodge crossover	2:00:51 p. m.	2:09:04 p. m.	2:09:53 p. m.	2:09:17 p. m.	08:13	00:49	00:14	00:36
2/15/19	white toyota suv	2:00:51 p. m.	2:09:53 p. m.	2:10:59 p. m.	2:10:12 p. m.	09:03	01:06	00:18	00:48
2/15/19	brownish chevy suv	2:00:51 p. m.	2:09:57 p. m.	2:10:51 p. m.	2:10:10 p. m.	09:06	00:54	00:13	00:41
2/15/19	red kia car	2:00:51 p. m.	2:09:58 p. m.	2:10:57 p. m.	2:10:25 p. m.	09:07	00:59	00:27	00:31
2/15/19	silver dodge minivan	2:00:51 p. m.	2:10:06 p. m.	2:11:03 p. m.	2:10:24 p. m.	09:15	00:57	00:18	00:39
2/15/19	white ford explorer suv	2:00:51 p. m.	2:10:10 p. m.	2:11:09 p. m.	2:10:30 p. m.	09:19	00:59	00:20	00:39
2/15/19	white kia van	2:06:14 p. m.	2:10:18 p. m.	2:11:12 p. m.	2:10:31 p. m.	04:03	00:54	00:13	00:41

Date	Vehicle								
2/15/19	silver toyota forrunnner	2:06:16 p. m.	2:11:00 p. m.	2:11:40 p. m.	2:11:29 p. m.	04:44	00:40	00:29	00:11
2/15/19	black honda minivan	2:07:40 p. m.	2:11:05 p. m.	2:11:45 p. m.	2:11:30 p. m.	03:25	00:40	00:25	00:15
2/15/19	black saturn crossover	2:07:41 p. m.	2:11:12 p. m.	2:11:51 p. m.	2:11:35 p. m.	03:30	00:39	00:23	00:15
2/15/19	silver hyunday car	2:08:00 p. m.	2:11:16 p. m.	2:11:55 p. m.	2:11:33 p. m.	03:16	00:40	00:18	00:22
2/15/19	silver chevy truck	2:08:56 p. m.	2:11:23 p. m.	2:12:03 p. m.	2:11:42 p. m.	02:27	00:40	00:19	00:20

A.3. Final Process

Date	Car Enters Loop Description	Car Enters Loop TimeStamp	Car Enters Process TimeStamp	Child Enters Car	Car Leaves Process TimeStamp	Queue Time	Process Time	Process Start to Child Entering	Child Entering to Process Leave
4/12/19	Silver Chrysler Van	2:02:18 p. m.	2:02:49 p. m.	2:03:09 p. m.	2:03:30 p. m.	0:00:30	0:00:41	0:00:21	0:00:20
4/12/19	Silver Toyota Tundra	2:02:18 p. m.	2:02:54 p. m.	2:03:18 p. m.	2:03:34 p. m.	0:00:36	0:00:39	0:00:24	0:00:16
4/12/19	Red Ford Truck	2:02:18 p. m.	2:03:05 p. m.	2:03:35 p. m.	2:04:00 p. m.	0:00:47	0:00:55	0:00:29	0:00:26
4/12/19	White Honda Van	2:02:18 p. m.	2:03:10 p. m.	2:03:27 p. m.	2:04:05 p. m.	0:00:52	0:00:54	0:00:17	0:00:37
4/12/19	Dark Chevy Truck	2:02:18 p. m.	2:03:53 p. m.	2:04:24 p. m.	2:06:10 p. m.	0:01:35		0:00:31	
4/12/19	Silver Cadillac Car	2:02:18 p. m.	2:04:03 p. m.	2:04:36 p. m.	2:05:22 p. m.	0:01:45	0:01:19	0:00:33	0:00:46
4/12/19	Silver SUV	2:02:18 p. m.	2:04:09 p. m.	2:04:27 p. m.	2:05:29 p. m.	0:01:51	0:01:20	0:00:19	0:01:01
4/12/19	Black Ford Crossover	2:02:18 p. m.	2:04:15 p. m.	2:04:24 p. m.	2:05:33 p. m.	0:01:56	0:01:18	0:00:10	0:01:09
4/12/19	White Honda Van 1	2:02:18 p. m.	2:04:20 p. m.	2:04:35 p. m.	2:05:38 p. m.	0:02:02	0:01:18	0:00:14	0:01:03
4/12/19	White Honda Van 2	2:02:18 p. m.	2:04:25 p. m.	2:04:57 p. m.	2:05:47 p. m.	0:02:07	0:01:22	0:00:32	0:00:49
4/12/19	Red Dodge Truck	2:02:18 p. m.	2:05:35 p. m.	2:05:52 p. m.	2:06:02 p. m.	0:03:17	0:00:27	0:00:17	0:00:10
4/12/19	Grey Ford Truck	2:02:18 p. m.	2:05:39 p. m.	2:05:59 p. m.	2:06:17 p. m.	0:03:21	0:00:38	0:00:20	0:00:19
4/12/19	Silver Mazda Crossover	2:02:18 p. m.	2:05:44 p. m.	2:06:01 p. m.		0:03:25		0:00:18	
4/12/19	Black Toyota Car	2:02:18 p. m.	2:05:48 p. m.	2:06:13 p. m.	2:06:23 p. m.	0:03:29	0:00:35	0:00:25	0:00:10
4/12/19	Silver toyota hatchback	2:02:18 p. m.	2:05:52 p. m.	2:06:10 p. m.	2:06:55 p. m.	0:03:34	0:01:03	0:00:18	0:00:45
4/12/19	Silver Hyunda Car	2:02:18 p. m.	2:06:01 p. m.	2:06:32 p. m.	2:07:01 p. m.	0:03:42	0:01:01	0:00:31	0:00:29
4/12/19	Little Red Fiat	2:02:18 p. m.	2:06:01 p. m.	2:06:17 p. m.	2:07:05 p. m.	0:03:42	0:01:05	0:00:17	0:00:48
4/12/19	Dark Kia Van	2:02:18 p. m.	2:06:58 p. m.	2:07:17 p. m.	2:07:24 p. m.	0:04:40	0:00:26	0:00:19	0:00:07
4/12/19	Tan Chrysler Van	2:02:18 p. m.	2:06:59 p. m.	2:07:30 p. m.	2:07:50 p. m.	0:04:41	0:00:51	0:00:31	0:00:21
4/12/19	White Dodge Truck	2:02:18 p. m.	2:07:03 p. m.	2:07:21 p. m.	2:07:59 p. m.	0:04:45	0:00:56	0:00:18	0:00:38
4/12/19	Tan Chevy Truck	2:02:18 p. m.	2:07:07 p. m.	2:07:16 p. m.	2:08:01 p. m.	0:04:49	0:00:54	0:00:09	0:00:45
4/12/19	White buick SUV	2:02:18 p. m.	2:07:13 p. m.	2:07:31 p. m.	2:08:09 p. m.	0:04:55	0:00:56	0:00:18	0:00:38
4/12/19	Blue Nissan Car	2:02:18 p. m.	2:07:21 p. m.	2:07:26 p. m.	2:08:11 p. m.	0:05:02	0:00:50	0:00:06	0:00:45
4/12/19	Large Ass Family Van	2:02:18 p. m.	2:08:00 p. m.	2:08:17 p. m.	2:08:39 p. m.	0:05:41	0:00:39	0:00:17	0:00:22
4/12/19	White Toyota SUV	2:02:18 p. m.	2:08:03 p. m.	2:08:24 p. m.	2:09:01 p. m.	0:05:45	0:00:58	0:00:21	0:00:37
4/12/19	White Acura Crossover	2:02:18 p. m.	2:08:09 p. m.	2:08:33 p. m.	2:09:05 p. m.	0:05:51	0:00:56	0:00:24	0:00:31

4/12/19	White Dodge Hatchback	2:02:18 p. m.	2:08:14 p. m.	2:08:28 p. m.	2:09:10 p. m.	0:05:55	0:00:57	0:00:15	0:00:42
4/12/19	White Chevy Truck	2:02:18 p. m.	2:08:24 p. m.	2:08:32 p. m.	2:09:23 p. m.	0:06:06	0:00:58	0:00:08	0:00:50
4/12/19	White Dodge Van	2:02:18 p. m.	2:08:36 p. m.	2:08:45 p. m.	2:09:27 p. m.	0:06:17	0:00:51	0:00:10	0:00:42
4/12/19	Silver Buick SUV	2:02:18 p. m.	2:09:14 p. m.	2:09:32 p. m.	2:09:46 p. m.	0:06:56	0:00:32	0:00:18	0:00:14
4/12/19	White Kia Van	2:02:18 p. m.	2:09:17 p. m.	2:09:37 p. m.	2:10:03 p. m.	0:06:59	0:00:46	0:00:20	0:00:26
4/12/19	White Toyota crossover	2:02:18 p. m.	2:09:21 p. m.	2:09:43 p. m.	2:10:11 p. m.	0:07:03	0:00:50	0:00:22	0:00:28
4/12/19	White Hyunda Crossover	2:02:18 p. m.	2:09:30 p. m.	2:09:39 p. m.	2:10:18 p. m.	0:07:12	0:00:47	0:00:09	0:00:38
4/12/19	Navy Nissan Truck	2:02:18 p. m.	2:09:35 p. m.	2:09:50 p. m.	2:10:22 p. m.	0:07:16	0:00:48	0:00:16	0:00:32
4/12/19	Tan Toyota Crossover	2:02:18 p. m.	2:09:51 p. m.	2:09:57 p. m.	2:10:35 p. m.	0:07:33	0:00:44	0:00:06	0:00:38
4/12/19	White Old Van	2:02:18 p. m.	2:10:15 p. m.	2:10:42 p. m.	2:10:57 p. m.	0:07:57	0:00:42	0:00:27	0:00:15
4/12/19	Silver GMC SUV	2:02:18 p. m.	2:10:19 p. m.	2:10:44 p. m.	2:11:09 p. m.	0:08:01	0:00:50	0:00:25	0:00:25
4/12/19	Another Giant Ahh Van	2:02:18 p. m.	2:10:26 p. m.	2:10:46 p. m.	2:11:19 p. m.	0:08:08	0:00:53	0:00:20	0:00:33
4/12/19	Silver Grey Chevy SUV	2:02:18 p. m.	2:10:34 p. m.	2:10:56 p. m.	2:11:28 p. m.	0:08:16	0:00:54	0:00:22	0:00:32
4/12/19	Silver Dodge Van	2:02:18 p. m.	2:10:37 p. m.	2:10:51 p. m.	2:11:32 p. m.	0:08:19	0:00:55	0:00:14	0:00:41
4/12/19	All Black Dodge Truck	2:02:18 p. m.	2:10:43 p. m.	2:12:02 p. m.	2:12:10 p. m.	0:08:25			
4/12/19	Tan/ Camo Chevy SUV	2:02:18 p. m.	2:10:43 p. m.		2:12:23 p. m.	0:08:25			
4/12/19	Tan/ Brown Chevy SUV	2:02:18 p. m.	2:11:30 p. m.	2:11:57 p. m.	2:12:25 p. m.	0:09:12	0:00:55	0:00:27	0:00:28
4/12/19	White Ford Truck Large	2:02:18 p. m.	2:11:37 p. m.	2:11:55 p. m.	2:12:30 p. m.	0:09:19	0:00:53	0:00:18	0:00:35
4/12/19	Red Chevy Car	2:02:18 p. m.	2:11:43 p. m.	2:12:35 p. m.	2:13:01 p. m.	0:09:25			
4/12/19	Red WEIRD CAR	2:02:18 p. m.	2:12:33 p. m.	2:12:43 p. m.	2:13:09 p. m.	0:10:15	0:00:36	0:00:10	0:00:27
4/12/19	Golf Cart Lady	2:02:18 p. m.	2:12:02 p. m.			0:09:44			
4/12/19	Tan Nissan SUV	2:02:18 p. m.	2:12:57 p. m.	2:13:28 p. m.	2:13:44 p. m.	0:10:39	0:00:47	0:00:31	0:00:16
4/12/19	Silver Toyota SUV (nice)	2:02:18 p. m.	2:13:03 p. m.	2:13:37 p. m.	2:13:49 p. m.	0:10:44	0:00:46	0:00:34	0:00:12
4/12/19	White Kia Van	2:02:18 p. m.	2:13:11 p. m.	2:13:30 p. m.	2:13:58 p. m.	0:10:53	0:00:46	0:00:18	0:00:28
4/12/19	Black Honda Van	2:02:18 p. m.	2:13:16 p. m.	2:13:27 p. m.	2:14:04 p. m.	0:10:58	0:00:47	0:00:11	0:00:36
4/12/19	White Lincoln SUV	2:02:18 p. m.	2:13:24 p. m.	2:13:35 p. m.	2:14:08 p. m.	0:11:06	0:00:44	0:00:11	0:00:33
4/12/19	Navy Honda Van	2:10:44 p. m.	2:13:30 p. m.	2:13:42 p. m.	2:14:13 p. m.	0:02:47	0:00:43	0:00:12	0:00:31
4/12/19	Silver Hyunda SUV	2:11:15 p. m.	2:14:02 p. m.	2:14:26 p. m.	2:15:18 p. m.	0:02:47	0:01:16	0:00:25	0:00:51
4/12/19	White Jeep SUV	2:11:32 p. m.	2:14:04 p. m.	2:14:38 p. m.	2:15:22 p. m.	0:02:32	0:01:18	0:00:34	0:00:44

4/15/19	white honda van 1	1:59:57 p. m.	2:00:30 p. m.	2:00:38 p. m.	2:00:54 p. m.	0:00:33	0:00:24	0:00:08	0:00:16
4/15/19	white honda van 2	1:59:57 p. m.	2:00:31 p. m.	2:00:52 p. m.	2:01:02 p. m.	0:00:34	0:00:31	0:00:20	0:00:11
4/15/19	dark ford truck	1:59:57 p. m.	2:00:36 p. m.	2:00:49 p. m.	2:01:13 p. m.	0:00:39	0:00:37	0:00:13	0:00:24
4/15/19	white ford crossover	1:59:57 p. m.	2:00:41 p. m.	2:01:05 p. m.	2:01:24 p. m.	0:00:44	0:00:43	0:00:23	0:00:20
4/15/19	red ford truck	1:59:57 p. m.	2:00:45 p. m.	2:01:07 p. m.	2:01:38 p. m.	0:00:48	0:00:53	0:00:22	0:00:31
4/15/19	dark nissan car	1:59:57 p. m.	2:00:59 p. m.	2:01:41 p. m.	2:02:03 p. m.	0:01:01	0:01:04	0:00:43	0:00:22
4/15/19	white honda van	1:59:57 p. m.	2:02:00 p. m.	2:02:16 p. m.	2:02:29 p. m.	0:02:03	0:00:30	0:00:16	0:00:13
4/15/19	silver toyota crossover	1:59:57 p. m.	2:02:02 p. m.	2:02:24 p. m.	2:02:42 p. m.	0:02:04	0:00:41	0:00:22	0:00:18
4/15/19	toyota car	1:59:57 p. m.	2:02:06 p. m.	2:02:26 p. m.	2:02:52 p. m.	0:02:09	0:00:46	0:00:19	0:00:27
4/15/19	chevy SUV	1:59:57 p. m.	2:02:12 p. m.	2:02:30 p. m.	2:02:55 p. m.	0:02:14	0:00:43	0:00:18	0:00:25
4/15/19	black toyota car	1:59:57 p. m.	2:02:20 p. m.	2:02:45 p. m.	2:03:00 p. m.	0:02:23	0:00:40	0:00:25	0:00:15
4/15/19	red fiat	1:59:57 p. m.	2:02:28 p. m.		2:03:09 p. m.	0:02:30	0:00:41		
4/15/19	silver gmc suv	1:59:57 p. m.	2:03:04 p. m.	2:03:20 p. m.	2:03:34 p. m.	0:03:07	0:00:30	0:00:16	0:00:14
4/15/19	orange dodge car	1:59:57 p. m.	2:03:11 p. m.	2:03:26 p. m.	2:03:42 p. m.	0:03:14	0:00:32	0:00:16	0:00:16
4/15/19	red dodge crossover	1:59:57 p. m.	2:03:16 p. m.	2:03:38 p. m.	2:03:50 p. m.	0:03:19	0:00:34	0:00:22	0:00:12
4/15/19	white large dodge truck	1:59:57 p. m.	2:03:26 p. m.	2:03:38 p. m.	2:04:01 p. m.	0:03:28	0:00:35	0:00:13	0:00:22
4/15/19	dark kia van	1:59:57 p. m.	2:03:32 p. m.	2:04:05 p. m.	2:04:21 p. m.	0:03:35	0:00:49	0:00:33	0:00:16
4/15/19	silver hyundai car	1:59:57 p. m.	2:03:38 p. m.	2:03:53 p. m.	2:04:25 p. m.	0:03:41	0:00:47	0:00:15	0:00:32
4/15/19	silver mazda Crossover	1:59:57 p. m.	2:04:24 p. m.	2:04:39 p. m.	2:04:51 p. m.	0:04:27	0:00:27	0:00:15	0:00:13
4/15/19	Tan Chrysler Van	1:59:57 p. m.	2:04:30 p. m.	2:04:46 p. m.	2:05:01 p. m.	0:04:33	0:00:30	0:00:15	0:00:15
4/15/19	white dodge truck	1:59:57 p. m.	2:04:36 p. m.	2:04:49 p. m.	2:05:11 p. m.	0:04:39	0:00:35	0:00:13	0:00:22
4/15/19	White buick SUV	1:59:57 p. m.	2:04:42 p. m.	2:04:53 p. m.	2:05:15 p. m.	0:04:45	0:00:33	0:00:11	0:00:22
4/15/19	silver ford car	1:59:57 p. m.	2:04:47 p. m.	2:04:58 p. m.	2:05:20 p. m.	0:04:50	0:00:33	0:00:10	0:00:22
4/15/19	tan dodge van	1:59:57 p. m.	2:04:54 p. m.	2:05:17 p. m.	2:05:42 p. m.	0:04:57	0:00:49	0:00:23	0:00:26
4/15/19	White Jeep SUV	1:59:57 p. m.	2:05:41 p. m.	2:06:05 p. m.	2:06:11 p. m.	0:05:44	0:00:30	0:00:25	0:00:06
4/15/19	silver honda van	1:59:57 p. m.	2:05:44 p. m.	2:05:59 p. m.	2:06:19 p. m.	0:05:47	0:00:35	0:00:15	0:00:20
4/15/19	white kia van	1:59:57 p. m.	2:05:49 p. m.	2:06:04 p. m.	2:06:23 p. m.	0:05:51	0:00:34	0:00:15	0:00:19
4/15/19	white hyundai Crossover	1:59:57 p. m.	2:05:53 p. m.	2:06:09 p. m.	2:06:28 p. m.	0:05:56	0:00:35	0:00:17	0:00:19
4/15/19	silver gmc suv	1:59:57 p. m.	2:05:58 p. m.	2:06:11 p. m.	2:06:32 p. m.	0:06:00	0:00:34	0:00:13	0:00:21
4/15/19	Blue Nissan Car	1:59:57 p. m.	2:06:02 p. m.	2:06:23 p. m.	2:06:44 p. m.	0:06:05	0:00:42	0:00:21	0:00:21

4/15/19	blueish honda van	1:59:57 p. m.	2:06:48 p. m.	2:06:56 p. m.	2:07:09 p. m.	0:06:51	0:00:20	0:00:08	0:00:12
4/15/19	white nissan suv	1:59:57 p. m.	2:06:51 p. m.	2:07:00 p. m.	2:07:14 p. m.	0:06:54	0:00:23	0:00:09	0:00:15
4/15/19	white dodge crossover	1:59:57 p. m.	2:06:56 p. m.	2:07:02 p. m.	2:07:18 p. m.	0:06:59	0:00:21	0:00:06	0:00:15
4/15/19	White Acura Crossover	1:59:57 p. m.	2:07:01 p. m.	2:07:09 p. m.	2:07:25 p. m.	0:07:04	0:00:24	0:00:08	0:00:16
4/15/19	silver kia car	1:59:57 p. m.	2:07:07 p. m.	2:07:15 p. m.	2:07:35 p. m.	0:07:10	0:00:27	0:00:07	0:00:20
4/15/19	tan chevy truck	1:59:57 p. m.	2:07:36 p. m.	2:07:17 p. m.	2:07:46 p. m.	0:07:39	0:00:09		0:00:29
4/15/19	silver toyota car	1:59:57 p. m.	2:07:40 p. m.	2:07:51 p. m.	2:08:15 p. m.	0:07:43	0:00:35	0:00:11	0:00:24
4/15/19	white nissan car	1:59:57 p. m.	2:07:43 p. m.	2:08:06 p. m.	2:08:16 p. m.	0:07:45	0:00:34	0:00:23	0:00:11
4/15/19	white ford car	1:59:57 p. m.	2:07:51 p. m.	2:08:15 p. m.	2:08:28 p. m.	0:07:54	0:00:36	0:00:23	0:00:13
4/15/19	silver dodge truck	1:59:57 p. m.	2:08:04 p. m.	2:08:22 p. m.	2:08:37 p. m.	0:08:06	0:00:34	0:00:18	0:00:16
4/15/19	white toyota rav4	1:59:57 p. m.	2:08:14 p. m.	2:09:02 p. m.	2:09:05 p. m.	0:08:16	0:00:52	0:00:49	0:00:03
4/15/19	tan ford truck	1:59:57 p. m.	2:08:18 p. m.	2:08:29 p. m.	2:09:09 p. m.	0:08:21	0:00:51	0:00:11	0:00:40
4/15/19	red chevy car	1:59:57 p. m.	2:08:46 p. m.	2:09:22 p. m.	2:09:41 p. m.	0:08:49	0:00:55	0:00:36	0:00:19
4/15/19	tan chevy car	1:59:57 p. m.	2:08:54 p. m.	2:09:32 p. m.	2:09:51 p. m.	0:08:56	0:00:57	0:00:38	0:00:19
4/15/19	navy honda van	1:59:57 p. m.	2:08:59 p. m.	2:09:30 p. m.	2:10:01 p. m.	0:09:02	0:01:02	0:00:32	0:00:30
4/15/19	silver dodge van	1:59:57 p. m.	2:09:23 p. m.	2:09:41 p. m.	2:10:04 p. m.	0:09:26	0:00:41	0:00:17	0:00:23
4/15/19	red PT cruiser	1:59:57 p. m.	2:09:26 p. m.	2:09:44 p. m.	2:10:09 p. m.	0:09:29	0:00:43	0:00:18	0:00:25
4/15/19	white kia van	1:59:57 p. m.	2:09:35 p. m.	2:09:48 p. m.	2:10:14 p. m.	0:09:38	0:00:39	0:00:12	0:00:27
4/15/19	brownish honda van	2:06:00 p. m.	2:10:14 p. m.	2:10:34 p. m.	2:10:46 p. m.	0:04:14	0:00:33	0:00:21	0:00:12
4/15/19	navy chevy crossover	2:07:19 p. m.	2:10:19 p. m.	2:10:44 p. m.	2:10:54 p. m.	0:03:00	0:00:35	0:00:25	0:00:10
4/15/19	Golf Cart Lady	2:07:21 p. m.	2:10:23 p. m.	2:10:41 p. m.	2:11:12 p. m.	0:03:02	0:00:49	0:00:18	0:00:32
4/15/19	silver van	2:08:50 p. m.	2:10:32 p. m.	2:10:39 p. m.	2:11:30 p. m.	0:01:41	0:00:58	0:00:07	0:00:51
4/15/19	silver toyota suv (nice)	2:08:50 p. m.	2:10:40 p. m.	2:11:12 p. m.	2:11:38 p. m.	0:01:50	0:00:58	0:00:32	0:00:26
4/15/19	silver ford crossover	2:09:19 p. m.	2:10:49 p. m.	2:11:42 p. m.	2:12:07 p. m.	0:01:30			
4/15/19	white chevy car	2:10:55 p. m.	2:12:12 p. m.	2:12:17 p. m.	2:12:31 p. m.	0:01:17	0:00:19	0:00:05	0:00:14
4/15/19	golf cart 2	2:12:07 p. m.	2:12:13 p. m.	2:12:20 p. m.	2:12:37 p. m.	0:00:06	0:00:24	0:00:07	0:00:18
4/16/19	white honda van	2:00:52 p. m.	2:01:19 p. m.	2:01:52 p. m.	2:01:57 p. m.	0:00:27	0:00:38	0:00:33	0:00:05
4/16/19	navy truck	2:00:52 p. m.	2:01:25 p. m.	2:01:57 p. m.	2:02:07 p. m.	0:00:33	0:00:42	0:00:33	0:00:10
4/16/19	silver cadillac?	2:00:52 p. m.	2:01:29 p. m.	2:02:01 p. m.	2:02:12 p. m.	0:00:37	0:00:43	0:00:32	0:00:11

4/16/19	white passenger van	2:00:52 p. m.	2:01:33 p. m.	2:01:53 p. m.	2:02:00 p. m.	0:00:41	0:00:27	0:00:20	0:00:07
4/16/19	white car	2:00:52 p. m.	2:01:56 p. m.	2:01:59 p. m.	2:02:34 p. m.	0:01:04	0:00:38	0:00:03	0:00:35
4/16/19	silver prius	2:00:52 p. m.	2:02:13 p. m.	2:02:14 p. m.	2:02:45 p. m.	0:01:21	0:00:32	0:00:01	0:00:32
4/16/19	gray dodge charger	2:00:52 p. m.	2:02:35 p. m.	2:03:13 p. m.	2:03:32 p. m.	0:01:43	0:00:57	0:00:38	0:00:19
4/16/19	white honda van	2:00:52 p. m.	2:02:37 p. m.	2:03:10 p. m.	2:03:35 p. m.	0:01:45	0:00:58	0:00:33	0:00:25
4/16/19	gray toyota corrola/camry	2:00:52 p. m.	2:02:41 p. m.	2:03:17 p. m.	2:03:41 p. m.	0:01:49	0:01:00	0:00:36	0:00:24
4/16/19	white honda van	2:00:52 p. m.	2:02:45 p. m.	2:03:07 p. m.	2:03:45 p. m.	0:01:53	0:01:00	0:00:22	0:00:38
4/16/19	black toyota car	2:00:52 p. m.	2:02:52 p. m.	2:03:26 p. m.	2:03:56 p. m.	0:02:00	0:01:05	0:00:35	0:00:30
4/16/19	siler gmc crossover	2:00:52 p. m.	2:02:55 p. m.	2:03:15 p. m.	2:03:59 p. m.	0:02:04	0:01:03	0:00:20	0:00:43
4/16/19	blue nissan Car	2:00:52 p. m.	2:03:45 p. m.	2:04:18 p. m.	2:04:19 p. m.	0:02:53	0:00:35	0:00:33	0:00:01
4/16/19	red fiat	2:00:52 p. m.	2:03:51 p. m.	2:04:57 p. m.	2:04:56 p. m.	0:02:59	0:01:05		
4/16/19	White Acura Crossover	2:00:52 p. m.	2:03:55 p. m.	2:04:27 p. m.	2:05:00 p. m.	0:03:03	0:01:05	0:00:32	0:00:33
4/16/19	brown van	2:00:52 p. m.	2:04:01 p. m.	2:04:17 p. m.	2:05:05 p. m.	0:03:09	0:01:04	0:00:16	0:00:47
4/16/19	black mazda crossover	2:00:52 p. m.	2:04:09 p. m.	2:04:21 p. m.	2:05:10 p. m.	0:03:17	0:01:00	0:00:12	0:00:49
4/16/19	tan van	2:00:52 p. m.	2:04:17 p. m.	2:05:54 p. m.	2:05:56 p. m.	0:03:25			
4/16/19	gray jeep	2:00:52 p. m.	2:05:15 p. m.	2:05:57 p. m.	2:05:58 p. m.	0:04:24	0:00:42	0:00:42	
4/16/19	silver toyota crossover	2:00:52 p. m.	2:05:29 p. m.	2:05:51 p. m.	2:06:10 p. m.	0:04:38	0:00:41	0:00:21	0:00:19
4/16/19	white gmc suv	2:00:52 p. m.	2:05:39 p. m.	2:06:31 p. m.	2:06:40 p. m.	0:04:47	0:01:01	0:00:52	0:00:09
4/16/19	white toyota csuv	2:00:52 p. m.	2:05:52 p. m.	2:06:41 p. m.	2:07:00 p. m.	0:05:00	0:01:08	0:00:49	0:00:19
4/16/19	white kia van	2:00:52 p. m.	2:06:19 p. m.	2:06:26 p. m.	2:07:05 p. m.	0:05:27	0:00:46	0:00:07	0:00:39
4/16/19	white fancy crossover	2:00:52 p. m.	2:06:22 p. m.	2:06:34 p. m.	2:07:10 p. m.	0:05:30	0:00:48	0:00:12	0:00:36
4/16/19	tan honda accord	2:00:52 p. m.	2:06:24 p. m.	2:07:33 p. m.	2:07:34 p. m.	0:05:32	0:01:10	**0:01:09**	0:00:01
4/16/19	tan chevy suv	2:00:52 p. m.	2:07:05 p. m.	2:07:37 p. m.	2:07:40 p. m.	0:06:13	0:00:36	0:00:32	0:00:04
4/16/19	white van	2:00:52 p. m.	2:07:08 p. m.	2:07:39 p. m.	2:07:45 p. m.	0:06:16	0:00:37	0:00:30	0:00:07
4/16/19	white toyota crossover	2:00:52 p. m.	2:07:13 p. m.	2:07:27 p. m.	2:07:52 p. m.	0:06:21	0:00:39	0:00:13	0:00:25
4/16/19	navy van	2:00:52 p. m.	2:07:18 p. m.	2:07:31 p. m.	2:07:56 p. m.	0:06:26	0:00:38	0:00:13	0:00:25
4/16/19	silver toyota car???	2:00:52 p. m.	2:07:22 p. m.	2:07:36 p. m.	2:08:02 p. m.	0:06:31	0:00:40	0:00:13	0:00:26
4/16/19	silver chevy car	2:00:52 p. m.	2:07:55 p. m.	2:08:35 p. m.	2:08:38 p. m.	0:07:03	0:00:43	0:00:40	0:00:03
4/16/19	blue car	2:00:52 p. m.	2:08:01 p. m.	2:08:37 p. m.	2:08:42 p. m.	0:07:09	0:00:42	0:00:36	0:00:06

Date	Description								
4/16/19	white nissan suv	2:00:52 p. m.	2:08:07 p. m.	2:08:40 p. m.	2:08:49 p. m.	0:07:15	0:00:42	0:00:34	0:00:08
4/16/19	gray van	2:00:52 p. m.	2:08:12 p. m.	2:08:31 p. m.	2:08:56 p. m.	0:07:20	0:00:44	0:00:19	0:00:24
4/16/19	white suv	2:00:52 p. m.	2:08:19 p. m.	2:08:40 p. m.	2:09:02 p. m.	0:07:28	0:00:43	0:00:20	0:00:23
4/16/19	silver crossover	2:00:52 p. m.	2:08:26 p. m.	2:08:42 p. m.	2:09:07 p. m.	0:07:34	0:00:41	0:00:16	0:00:24
4/16/19	gray toyota truck	2:00:52 p. m.	2:08:54 p. m.	2:09:31 p. m.	2:09:31 p. m.	0:08:02	0:00:36	0:00:37	
4/16/19	silver hyundai car	2:00:52 p. m.	2:09:00 p. m.	2:09:37 p. m.	2:09:37 p. m.	0:08:09	0:00:36	0:00:36	
4/16/19	tan crossover	2:00:52 p. m.	2:09:05 p. m.	2:09:39 p. m.	2:09:54 p. m.	0:08:13	0:00:49	0:00:33	0:00:16
4/16/19	brownish chevy crossover	2:00:52 p. m.	2:09:12 p. m.	2:09:34 p. m.	2:10:01 p. m.	0:08:20	0:00:49	0:00:22	0:00:27
4/16/19	tan van	2:00:52 p. m.	2:09:17 p. m.	2:09:39 p. m.	2:10:05 p. m.	0:08:25	0:00:48	0:00:23	0:00:26
4/16/19	white car	2:00:52 p. m.	2:09:28 p. m.	2:09:41 p. m.	2:10:09 p. m.	0:08:36	0:00:41	0:00:13	0:00:28
4/16/19	tan honda car	2:00:52 p. m.	?						
4/16/19	silver pickup truck	2:00:52 p. m.	2:09:57 p. m.	2:10:32 p. m.	2:10:33 p. m.	0:09:05	0:00:36	0:00:35	0:00:01
4/16/19	silver honda van	2:00:52 p. m.	2:10:03 p. m.	2:10:36 p. m.	2:10:40 p. m.	0:09:11	0:00:37	0:00:34	0:00:03
4/16/19	white jeep	2:00:52 p. m.	2:10:10 p. m.	2:10:40 p. m.	2:10:46 p. m.	0:09:18	0:00:37	0:00:30	0:00:07
4/16/19	silver crossover	2:08:37 p. m.	2:10:19 p. m.	2:10:43 p. m.	2:11:24 p. m.	0:01:43		0:00:23	
4/16/19	white chevy suv	2:09:07 p. m.		2:10:37 p. m.	2:11:24 p. m.				
4/16/19	tan honda van	2:09:14 p. m.	2:10:25 p. m.	2:10:55 p. m.	2:11:30 p. m.	0:01:11	0:01:05	0:00:30	0:00:35
4/16/19	white van	2:09:22 p. m.	2:10:33 p. m.	2:10:55 p. m.	2:11:48 p. m.	0:01:11	0:01:15	0:00:22	0:00:53
4/16/19	golf cart	2:09:29 p. m.	2:11:22 p. m.	2:11:58 p. m.	2:12:23 p. m.	0:01:53	0:01:01	0:00:36	0:00:25
4/16/19	white jeep	2:09:31 p. m.	2:11:27 p. m.	2:12:01 p. m.	2:12:30 p. m.	0:01:56	0:01:03	0:00:34	0:00:29
4/16/19	tan truck	2:09:40 p. m.	2:11:33 p. m.	2:12:04 p. m.	2:12:34 p. m.	0:01:53	0:01:01	0:00:32	0:00:29
4/16/19	red crossover thing	2:10:18 p. m.	2:11:39 p. m.	2:11:53 p. m.	2:12:39 p. m.	0:01:21	0:01:00	0:00:13	0:00:46
4/16/19	tan camo car	2:11:35 p. m.	2:11:52 p. m.	2:12:02 p. m.	2:12:43 p. m.	0:00:16	0:00:51	0:00:10	0:00:40
4/17/19	white van	12:45:37 p. m.	12:46:10 p. m.	12:46:32 p. m.	12:46:48 p. m.	0:00:33	0:00:38	0:00:21	0:00:17
4/17/19	red truck	12:45:37 p. m.	12:46:19 p. m.	12:46:42 p. m.	12:47:09 p. m.	0:00:42	0:00:50	0:00:23	0:00:27
4/17/19	silve van	12:45:37 p. m.	12:46:26 p. m.	12:46:46 p. m.	12:47:14 p. m.	0:00:49	0:00:49	0:00:20	0:00:28
4/17/19	pickup truck	12:45:37 p. m.	12:46:32 p. m.	12:46:49 p. m.	12:47:18 p. m.	0:00:55	0:00:46	0:00:17	0:00:29
4/17/19	white van	12:45:37 p. m.	12:46:37 p. m.	12:46:50 p. m.	12:47:21 p. m.	0:01:00	0:00:44	0:00:14	0:00:30
4/17/19	silver cadillac	12:45:37 p. m.	12:46:45 p. m.	12:46:55 p. m.	12:47:26 p. m.	0:01:08	0:00:41	0:00:10	0:00:32

Date	Description								
4/17/19	toyota van	12:45:37 p. m.	12:47:14 p. m.	12:47:37 p. m.	12:47:51 p. m.	0:01:37	0:00:37	0:00:23	0:00:15
4/17/19	honda van	12:45:37 p. m.	12:47:18 p. m.	12:47:39 p. m.	12:47:55 p. m.	0:01:41	0:00:37	0:00:21	0:00:16
4/17/19	brown ford	12:45:37 p. m.	12:47:23 p. m.	12:47:44 p. m.	12:48:01 p. m.	0:01:46	0:00:38	0:00:21	0:00:17
4/17/19	gray toyota sedan	12:45:37 p. m.	12:47:29 p. m.	12:47:45 p. m.	12:48:11 p. m.	0:01:52	0:00:43	0:00:17	0:00:26
4/17/19	white honda van	12:45:37 p. m.	12:47:34 p. m.	12:47:47 p. m.	12:48:20 p. m.	0:01:57	0:00:46	0:00:13	0:00:33
4/17/19	red fiat	12:45:37 p. m.	12:47:41 p. m.	12:47:53 p. m.	12:48:25 p. m.	0:02:04	0:00:45	0:00:12	0:00:32
4/17/19	silver hyundai car	12:45:37 p. m.	12:48:13 p. m.	12:48:41 p. m.	12:48:54 p. m.	0:02:36	0:00:42	0:00:28	0:00:13
4/17/19	black toyota car	12:45:37 p. m.	12:48:18 p. m.	12:48:39 p. m.	12:48:56 p. m.	0:02:41	0:00:38	0:00:21	0:00:17
4/17/19	jeep	12:45:37 p. m.	12:48:24 p. m.	12:49:52 p. m.	12:50:00 p. m.	0:02:47			
4/17/19	mazda crossover	12:45:37 p. m.	12:48:28 p. m.	12:48:51 p. m.	12:50:05 p. m.	0:02:51	0:01:37	0:00:23	0:01:14
4/17/19	chevy truck	12:45:37 p. m.	12:48:34 p. m.	12:48:46 p. m.	12:50:08 p. m.	0:02:57	0:01:34	0:00:12	0:01:22
4/17/19	blue honda	12:45:37 p. m.	12:48:39 p. m.	12:48:55 p. m.	12:50:13 p. m.	0:03:02	0:01:34	0:00:16	0:01:18
4/17/19	blue nissan Car	12:45:37 p. m.	12:49:57 p. m.	12:50:23 p. m.	12:50:45 p. m.	0:04:20	0:00:48	0:00:26	0:00:22
4/17/19	kia grey	12:45:37 p. m.	12:50:02 p. m.	12:50:59 p. m.	12:51:05 p. m.	0:04:25			
4/17/19	white nissan big	12:45:37 p. m.	12:50:06 p. m.	12:50:29 p. m.	12:51:09 p. m.	0:04:29	0:01:03	0:00:23	0:00:40
4/17/19	kia van white	12:45:37 p. m.	12:50:09 p. m.	12:50:32 p. m.	12:51:13 p. m.	0:04:32	0:01:03	0:00:23	0:00:41
4/17/19	hyundai white	12:45:37 p. m.	12:50:15 p. m.	12:50:35 p. m.	12:51:17 p. m.	0:04:38	0:01:02	0:00:20	0:00:42
4/17/19	brown kia van	12:45:37 p. m.	12:50:28 p. m.		12:51:34 p. m.	0:04:51			
4/17/19	black nissan mid size	12:45:37 p. m.	12:51:25 p. m.	12:51:51 p. m.	12:52:04 p. m.	0:05:48	0:00:39	0:00:25	0:00:13
4/17/19	silver ford	12:45:37 p. m.	12:51:31 p. m.	12:51:55 p. m.	12:52:10 p. m.	0:05:54	0:00:39	0:00:24	0:00:15
4/17/19	honda big car	12:45:37 p. m.	12:51:34 p. m.	12:51:56 p. m.	12:52:16 p. m.	0:05:57	0:00:42	0:00:22	0:00:19
4/17/19	silver dodge van	12:45:37 p. m.	12:51:38 p. m.	12:51:53 p. m.	12:52:22 p. m.	0:06:01	0:00:44	0:00:16	0:00:29
4/17/19	white toyota	12:45:37 p. m.	12:51:43 p. m.	12:52:00 p. m.	12:52:36 p. m.	0:06:06	0:00:53	0:00:17	0:00:35
4/17/19	gold honda	12:45:37 p. m.	12:51:50 p. m.	12:51:58 p. m.	12:52:41 p. m.	0:06:13	0:00:51	0:00:09	0:00:42
4/17/19	crusty gmc	12:45:37 p. m.	12:52:31 p. m.	12:52:51 p. m.	12:52:59 p. m.	0:06:54	0:00:29	0:00:21	0:00:08
4/17/19	red chevy car	12:45:37 p. m.	12:52:35 p. m.	12:52:56 p. m.	12:53:19 p. m.	0:06:58	0:00:45	0:00:22	0:00:23
4/17/19	red pt cruiser	12:45:37 p. m.	12:52:38 p. m.	12:53:10 p. m.	12:53:23 p. m.	0:07:01	0:00:45	0:00:32	0:00:13
4/17/19	white dodge can	12:45:37 p. m.	12:52:45 p. m.	12:53:00 p. m.	12:53:29 p. m.	0:07:08	0:00:45	0:00:15	0:00:29
4/17/19	white toyota	12:45:37 p. m.	12:52:49 p. m.	12:53:01 p. m.	12:53:33 p. m.	0:07:12	0:00:44	0:00:12	0:00:32
4/17/19	silver blue thing	12:45:37 p. m.	12:52:56 p. m.	12:53:17 p. m.	12:53:39 p. m.	0:07:19	0:00:42	0:00:21	0:00:22

Date	Description								
4/17/19	silver honda van	12:45:37 p. m.	12:53:32 p. m.	12:53:59 p. m.	12:54:08 p. m.	0:07:55	0:00:36	0:00:27	0:00:09
4/17/19	dodge silver truck	12:45:37 p. m.	12:53:37 p. m.	12:54:03 p. m.	12:54:19 p. m.	0:08:00	0:00:42	0:00:26	0:00:16
4/17/19	black chevy	12:45:37 p. m.	12:53:41 p. m.	12:54:04 p. m.	12:54:25 p. m.	0:08:04	0:00:44	0:00:23	0:00:21
4/17/19	silver gmc suv	12:45:37 p. m.	12:53:46 p. m.	12:54:04 p. m.	12:54:58 p. m.	0:08:09		0:00:18	
4/17/19	white dodge dirty	12:45:37 p. m.	12:53:56 p. m.	12:54:10 p. m.	12:55:01 p. m.	0:08:19	0:01:05	0:00:14	0:00:51
4/17/19	brown ford truck	12:45:37 p. m.	12:54:08 p. m.	12:54:09 p. m.	12:55:07 p. m.	0:08:31	0:00:58	0:00:01	0:00:57
4/17/19	honda van	12:45:37 p. m.	12:54:24 p. m.	12:55:19 p. m.	12:55:30 p. m.	0:08:47	0:01:07	0:00:55	0:00:12
4/17/19	silver truck	12:45:37 p. m.	12:54:28 p. m.	12:55:23 p. m.	12:55:31 p. m.	0:08:51	0:01:03	0:00:55	0:00:09
4/17/19	honda van blueish	12:45:37 p. m.	12:55:06 p. m.	12:55:42 p. m.	12:55:50 p. m.	0:09:29	0:00:44	0:00:36	0:00:08
4/17/19	cool car	12:53:26 p. m.	12:55:12 p. m.		12:55:50 p. m.	0:01:46	0:00:38		
4/17/19	silver sedan idk	12:53:39 p. m.	12:55:27 p. m.		12:56:36 p. m.	0:01:48			
4/17/19	silver ford	12:54:00 p. m.	12:55:26 p. m.	12:55:39 p. m.	12:56:36 p. m.	0:01:27	0:01:10	0:00:12	0:00:57
4/17/19	blue honda van	12:54:09 p. m.	12:55:23 p. m.	12:55:33 p. m.	12:56:41 p. m.	0:01:15	0:01:18	0:00:09	0:01:08
4/18/19	silver chrysler van	2:00:36 p. m.	2:01:06 p. m.	2:01:25 p. m.	2:01:42 p. m.	0:00:30	0:00:35	0:00:18	0:00:17
4/18/19	white honda van	2:00:36 p. m.	2:01:12 p. m.	2:01:29 p. m.	2:01:51 p. m.	0:00:36	0:00:39	0:00:17	0:00:22
4/18/19	black ford truck	2:00:36 p. m.	2:01:17 p. m.	2:01:36 p. m.	2:01:57 p. m.	0:00:41	0:00:40	0:00:19	0:00:21
4/18/19	grey dodge car	2:00:36 p. m.	2:01:27 p. m.	2:01:39 p. m.	2:02:12 p. m.	0:00:51	0:00:45	0:00:12	0:00:33
4/18/19	grey nissan	2:00:36 p. m.	2:01:38 p. m.	2:02:28 p. m.	2:02:51 p. m.	0:01:02			
4/18/19	white ford crossover	2:00:36 p. m.	2:01:43 p. m.	2:06:45 p. m.	2:02:40 p. m.	0:01:07	0:00:58		
4/18/19	white honda minivan	2:00:36 p. m.	2:02:12 p. m.		2:03:03 p. m.	0:01:36	0:00:51		
4/18/19	white honda van	2:00:36 p. m.	2:02:19 p. m.	2:03:06 p. m.	2:03:27 p. m.	0:01:43			
4/18/19	silver toyota	2:00:36 p. m.	2:02:29 p. m.	2:03:48 p. m.	2:04:06 p. m.	0:01:53			
4/18/19	red fiat	2:00:36 p. m.	2:02:36 p. m.			0:02:00			
4/18/19	white honda	2:00:36 p. m.	2:03:07 p. m.			0:02:31			
4/18/19	silver car	2:00:36 p. m.	2:03:46 p. m.	2:03:50 p. m.	2:04:11 p. m.	0:03:10	0:00:25	0:00:04	0:00:20
4/18/19	black jeep	2:00:36 p. m.	2:03:48 p. m.	2:04:11 p. m.	2:04:37 p. m.	0:03:12	0:00:48	0:00:22	0:00:26
4/18/19	brown minivan	2:00:36 p. m.	2:03:58 p. m.	2:03:57 p. m.	2:04:42 p. m.	0:03:22	0:00:43		0:00:45
4/18/19	tan minivan	2:00:36 p. m.	2:04:00 p. m.	2:04:14 p. m.	2:04:47 p. m.	0:03:24	0:00:47	0:00:14	0:00:33
4/18/19	silver car	2:00:36 p. m.	2:04:02 p. m.		2:04:51 p. m.	0:03:26	0:00:49		
4/18/19	tan 4runnner (toyota)	2:00:36 p. m.	2:04:42 p. m.	2:05:08 p. m.	2:05:43 p. m.	0:04:06	0:01:01	0:00:26	0:00:35
4/18/19	white giant ahh van	2:00:36 p. m.	2:04:47 p. m.		2:05:50 p. m.	0:04:11	0:01:03		

| Date	Vehicle								
4/18/19	black toyota car	2:00:36 p. m.	2:06:01 p. m.	2:05:53 p. m.	2:06:23 p. m.	0:05:25	0:00:22		0:00:30
4/18/19	white acura Crossover	2:00:36 p. m.	2:06:02 p. m.	2:06:06 p. m.	2:06:28 p. m.	0:05:26	0:00:27	0:00:05	0:00:22
4/18/19	white lincoln suv	2:00:36 p. m.	2:06:03 p. m.	2:06:20 p. m.	2:06:37 p. m.	0:05:26	0:00:34	0:00:17	0:00:17
4/18/19	whitw buick suv	2:00:36 p. m.	2:06:04 p. m.	2:06:22 p. m.	2:06:40 p. m.	0:05:28	0:00:37	0:00:18	0:00:18
4/18/19	bluish chevy suv	2:00:36 p. m.	2:06:11 p. m.	2:06:23 p. m.	2:06:45 p. m.	0:05:35	0:00:34	0:00:12	0:00:22
4/18/19	black chevy suv	2:00:36 p. m.	2:06:10 p. m.	2:06:25 p. m.	2:06:50 p. m.	0:05:33	0:00:40	0:00:16	0:00:24
4/18/19	white minivan	2:00:36 p. m.	2:06:35 p. m.	2:06:54 p. m.	2:07:30 p. m.	0:05:59	0:00:55	0:00:18	0:00:36
4/18/19	white toyota suv	2:00:36 p. m.	2:06:41 p. m.	2:07:02 p. m.	2:07:36 p. m.	0:06:05	0:00:55	0:00:21	0:00:34
4/18/19	silver honda minivan	2:00:36 p. m.	2:06:47 p. m.	2:07:00 p. m.	2:07:37 p. m.	0:06:11	0:00:50	0:00:14	0:00:37
4/18/19	white hyunda Crossover	2:00:36 p. m.	2:06:53 p. m.	2:07:01 p. m.	2:07:39 p. m.	0:06:17	0:00:46	0:00:07	0:00:38
4/18/19	white jeep	2:00:36 p. m.	2:06:57 p. m.	2:07:13 p. m.	2:07:41 p. m.	0:06:21	0:00:44	0:00:16	0:00:29
4/18/19	white dodge suv	2:00:36 p. m.	2:07:03 p. m.	2:07:08 p. m.	2:07:48 p. m.	0:06:27	0:00:44	0:00:05	0:00:39
4/18/19	tan chevy truck	2:00:36 p. m.	2:07:32 p. m.	2:07:48 p. m.	2:08:07 p. m.	0:06:56	0:00:36	0:00:17	0:00:19
4/18/19	red chevy car	2:00:36 p. m.	2:07:37 p. m.	2:07:55 p. m.	2:08:33 p. m.	0:07:01	0:00:56	0:00:19	0:00:38
4/18/19	white nissan suv	2:00:36 p. m.	2:07:43 p. m.	2:08:00 p. m.	2:08:37 p. m.	0:07:07	0:00:54	0:00:17	0:00:37
4/18/19	black honda minivan	2:00:36 p. m.	2:07:47 p. m.	2:07:57 p. m.	2:08:41 p. m.	0:07:11	0:00:54	0:00:10	0:00:44
4/18/19	white toyota crossover	2:00:36 p. m.	2:07:53 p. m.	2:08:02 p. m.	2:08:46 p. m.	0:07:16	0:00:53	0:00:09	0:00:44
4/18/19	blue nissan car	2:00:36 p. m.	2:07:58 p. m.	2:08:08 p. m.	2:08:49 p. m.	0:07:22	0:00:51	0:00:10	0:00:42
4/18/19	tiny mazda car	2:00:36 p. m.	2:08:38 p. m.	2:08:57 p. m.	2:09:13 p. m.	0:08:02	0:00:35	0:00:19	0:00:16
4/18/19	wilver honda minivan	2:00:36 p. m.	2:08:42 p. m.	2:08:59 p. m.	2:09:22 p. m.	0:08:06	0:00:40	0:00:17	0:00:23
4/18/19	red dodge crossover	2:00:36 p. m.	2:08:47 p. m.	2:09:03 p. m.	2:09:25 p. m.	0:08:11	0:00:38	0:00:16	0:00:22
4/18/19	black toyota car	2:00:36 p. m.	2:08:53 p. m.	2:09:01 p. m.	2:09:29 p. m.	0:08:17	0:00:36	0:00:08	0:00:28
4/18/19	black nissan mid size	2:00:36 p. m.	2:09:00 p. m.	2:09:10 p. m.	2:09:39 p. m.	0:08:24	0:00:39	0:00:10	0:00:29
4/18/19	red PT CRUISER	2:00:36 p. m.	2:09:06 p. m.	2:09:12 p. m.	2:09:44 p. m.	0:08:30	0:00:38	0:00:05	0:00:32
4/18/19	brownish honda minivan	2:00:36 p. m.	2:09:31 p. m.	2:09:53 p. m.	2:10:37 p. m.	0:08:55	0:01:06	0:00:21	0:00:44
4/18/19	silver chevy truck	2:00:36 p. m.	2:09:37 p. m.	2:09:55 p. m.	2:10:39 p. m.	0:09:01	0:01:03	0:00:18	0:00:45
4/18/19	silver dodge truck	2:00:36 p. m.	2:09:45 p. m.	2:10:00 p. m.	2:10:45 p. m.	0:09:09	0:01:00	0:00:15	0:00:44
4/18/19	silver toyota truck	2:00:36 p. m.	2:09:52 p. m.	2:10:09 p. m.	2:10:50 p. m.	0:09:15	0:00:58	0:00:17	0:00:41
4/18/19	white kia minivan	2:00:36 p. m.	2:09:59 p. m.	2:10:07 p. m.	2:10:54 p. m.	0:09:23	0:00:55	0:00:07	0:00:47

4/18/19	tan chevy suv	2:00:36 p. m.	2:10:08 p. m.	2:10:12 p. m.	2:10:58 p. m.	0:09:32	0:00:50	0:00:04	0:00:47
4/18/19	navy honda van	2:00:36 p. m.	2:10:45 p. m.	2:11:03 p. m.	2:11:28 p. m.	0:10:09	0:00:43	0:00:18	0:00:25
4/18/19	silver toyota 4runner	2:08:07 p. m.	2:10:50 p. m.	2:11:09 p. m.	2:11:35 p. m.	0:02:42	0:00:45	0:00:20	0:00:26
4/18/19	White Jeep SUV	2:09:01 p. m.	2:10:55 p. m.	2:11:11 p. m.	2:11:40 p. m.	0:01:54	0:00:46	0:00:16	0:00:30
4/18/19	tan chevy tahoe w/ canoes	2:09:37 p. m.	2:11:01 p. m.	2:11:14 p. m.	2:11:44 p. m.	0:01:24	0:00:43	0:00:13	0:00:30

B. Standard Parking Spots Dimensions Table [TEME]

Regular Size Parking Spaces (in feet)						
Dimension Indicator	**Description**	**Angle**				
		0°	**30°**	**45°**	**60°**	**90°**
	Overall module width					
A1	One-way	35.0	49.0	56.0	59.0	60.0
A2	Two-way	40.0	55.0	60.0	63.0	60.0
B	Stall width	10.0	9.0	9.0	9.0	9.0
C	Stall width parallel to aisle or curb	22.0	18.0	12.5	10.4	9.0
D	Length of parking stall	22.0	18.0	18.0	18.0	18.0
E	Stall depth to wall or curb	10.0	17.5	20.0	20.5	18.0
	Aisle width					
F1	One-way	15.0	14.0	16.0	18.0	24.0
F2	Two-way	20.0	20.0	20.0	22.0	24.0
Existing Compact Size Parking Spaces (new compact parking spaces are not allowed)						
	Overall module width					
A1	One-way	32.0	44.0	50.0	54.0	56.0
A2	Two-way	38.0	50.0	54.0	58.0	56.0
B	Stall width	9.0	8.0	8.0	8.0	8.0
C	Stall width parallel to aisle or curb	20.0	16.0	11.5	9.0	8.0
D	Length of parking stall	20.0	16.0	16.0	16.0	16.0
E	Stall depth to wall or curb	9.0	15.0	17.0	18.0	16.0
	Aisle width					
F1	One-way	14.0	14.0	16.0	18.0	24.0
F2	Two-way	20.0	20.0	20.0	22.0	24.0
Parking Spaces for the Disabled						
	Overall module width					
A1	One-way	43.0	57.0	62.0	64.0	60.0
A2	Two-way	48.0	63.0	67.0	68.0	60.0
B	Stall width	14.0	14.0	14.0	14.0	14.0
C	Stall width parallel to aisle or curb	23.0	28.0	19.8	16.2	14.0
D	Length of parking stall	23.0	19.0	19.0	19.0	18.0
E	Stall depth to wall or curb	14.0	21.5	23.0	23.0	18.0
	Aisle width					
F1	One-way	15.0	14.0	16.0	18.0	24.0
F2	Two-way	20.0	20.0	21.0	22.0	24.0

| Regular Size Parking Spaces (in meters)						
Dimension Indicator	Description	Angle				
		0°	30°	45°	60°	90°
	Overall module width					
A1	One-way	10,67	14,94	17,07	17,98	18,29
A2	Two-way	12,19	16,76	18,29	19,2	18,29
B	Stall width	3,05	2,74	2,74	2,74	2,74
C	Stall width parallel to aisle or curb	6,71	5,49	3,81	3,17	2,74
D	Length of parking stall	6,71	5,49	5,49	5,49	5,49
E	Stall depth to wall or curb	3,05	5,33	6,1	6,25	5,49
	Aisle width					
F1	One-way	4,57	4,27	4,88	5,49	7,32
F2	Two-way	6,1	6,1	6,1	6,71	7,32
Existing Compact Size Parking Spaces (new compact parking spaces are not allowed)						
	Overall module width					
A1	One-way	9,75	13,41	15,24	16,46	17,07
A2	Two-way	11,58	15,24	16,46	17,68	17,07
B	Stall width	2,74	2,44	2,44	2,44	2,44
C	Stall width parallel to aisle or curb	6,1	4,88	3,51	2,74	2,44
D	Length of parking stall	6,1	4,88	4,88	4,88	4,88
E	Stall depth to wall or curb	2,74	4,57	5,18	5,49	4,88
	Aisle width					
F1	One-way	4,27	4,27	4,88	5,49	7,32
F2	Two-way	6,1	6,1	6,1	6,71	7,32
Parking Spaces for the Disabled						
	Overall module width					
A1	One-way	13,11	17,37	18,9	19,51	18,29
A2	Two-way	14,63	19,2	20,42	20,73	18,29
B	Stall width	4,27	4,27	4,27	4,27	4,27
C	Stall width parallel to aisle or curb	7,01	8,53	6,04	4,94	4,27
D	Length of parking stall	7,01	5,79	5,79	5,79	5,49
E	Stall depth to wall or curb	4,27	6,55	7,01	7,01	5,49
	Aisle width					
F1	One-way	4,57	4,27	4,88	5,49	7,32
F2	Two-way	6,1	6,1	6,1	6,71	7,32
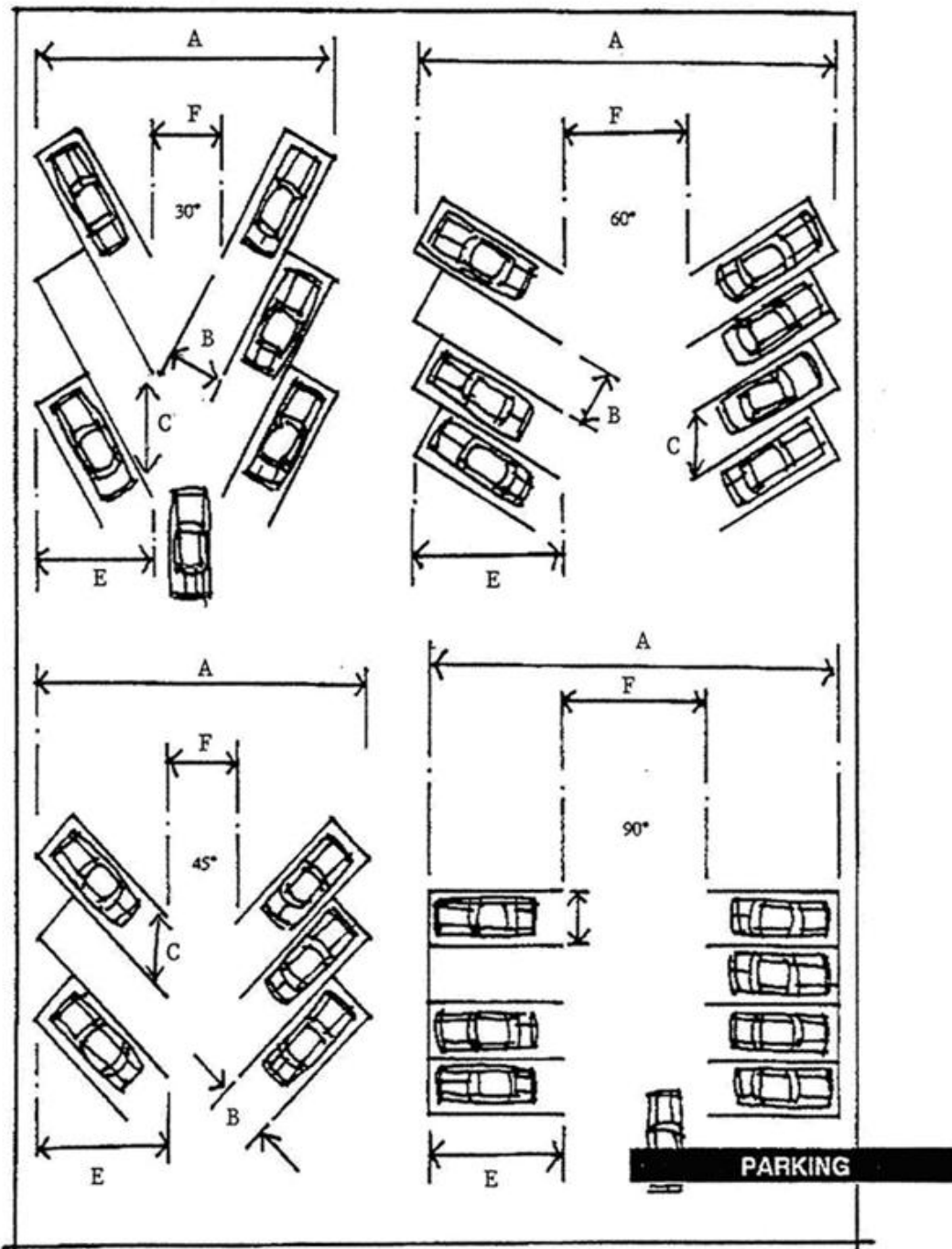
Newberry Elementary School Pick- Up Process

Layout
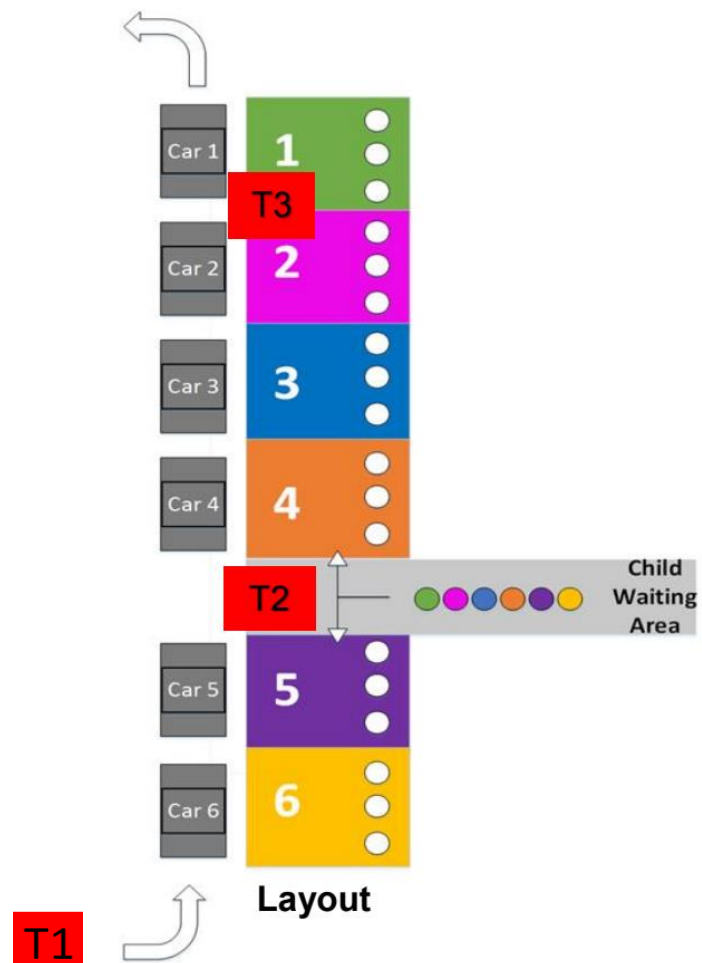
Layout

Goal

Provide an efficient and safe process for parents to pick up their child

Required Personnel and Equipment

- 6 Safety Patrols
- 3 Teachers

- Speaker/headset

Roles (refer to layout)

Teacher 1 (Name Caller)

- T1 will stand at the beginning of the loop with enough distance to read the names off the cars
- T1 will section off the cars 1-6 and reading the names into the headset
- T1 will name off the child's name followed by the number
- Ex: *"John Smith 1, Jane Green 2..., Bill Hubbard 6"*

Teacher 2 (Director)

- T2 will stand at the forefront of the child waiting area listening to the speaker
- T2 will pay attention to the announcement and direct the child to the correct spot

Teacher 3 (Floater)

- T3 will assist and ensure the children stand the correct spot

Safety Patrol

- One SP will stand by each numbered pillar
- Wave each car to pull forward entirely
- Confirm with the child that their car is in the station
- Assist the child in the car
- Wave the parent to pull forward, once the child is in

Final Notes (vital to ensure smooth flow)

- Check that the speaker/headset properly works prior to dismissal
- For *initial stacking*, have the first 6 children in position before the cars start pulling into the loop
- Make sure the cars pull up completely to the numbered pillar

Missing child/ late child

- If a car stops the flow of the line to wait for a missing child/ late child, have the car pull forward completely past the number 1 spot and assist the child to that spot
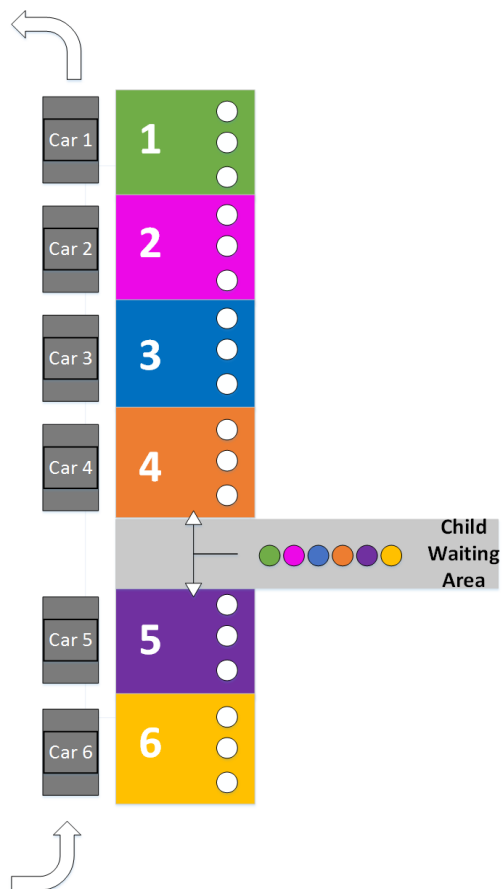- Having this car pull forward allows for the flow of the process to continue.

Newberry Elementary School Pick- Up Process

Goal:

Provide an efficient and safe process for parents to pick up their child

Layout:

Rules for pickup:

- Have the name of the child in the window visible so that the teacher can see it
- Pull up to numbered spot.
- If child is not at spot, pull forward past spot 1. Child will be taken to that waiting area.
- Please *do not* exit the vehicle.
- Pull forward with the car in front of you - do not pull around them to get past.

- Once the child is in the vehicle, please pull forward to avoid delays in the process.
- Please pay attention to the safety patrols' instructions.

Final notes:

• After testing, the conclusion reached was that the total process time takes about 15 minutes. There is no need for parents to wait outside the school before dismissal time.

D. Surveys
D.1. First survey

NES Pick-Up Process Thoughts and Opinions

Students from the University of Florida are trying to improve NES's pick-up process. Please fill out the following form to help us better understand the pros, cons, and thoughts in order to formulate a solution to help improve safety and efficiency of the process. Thank you!
COMPLETELY ANONYMOUS

*Obligatorio

Do you pick up your child through the pick-up loop? *

○ Yes

○ No, I park on the grass and have my child walk to me

○ Otro:

If answered "No" above, please explain why. If answered "Yes", reply "N/A". *

Tu respuesta

What are your thoughts & opinions on the student pick-up process? *

Tu respuesta

What improvements would you like to see? *

Tu respuesta

How safe do you feel your children are during the pick-up process? *

	1	2	3	4	5	
Extremely Safe	○	○	○	○	○	Extremely Unsafe

How efficient do you feel the pick-up process is? *

	1	2	3	4	5	
Extremely efficient	○	○	○	○	○	Extremely inefficient

Any other comments you'd like to add to help us better understand your needs as a parent during the pick-up process?

Tu respuesta

D.2. Second survey

NES Pick-Up Follow Up Survey

Students from the University of Florida want to know your opinions on the new Pick-Up process implemented the last two weeks. Please fill out the survey to give us feedback based on your experience. The survey is completely anonymous.

*Obligatorio

How safe do you feel your children are during the new pick-up process? *

	1	2	3	4	5	
Extremely Safe	○	○	○	○	○	Extremely Unsafe

How efficient do you feel the new pick-up process is? *

	1	2	3	4	5	
Extremely efficient	○	○	○	○	○	Extremely inefficient

Do you feel the new process runs smoother? *

○ Yes

○ No

What are your thoughts and opinions in the new pick-up process? *

Tu respuesta

Do you have any suggestions to help us improve the process? *

Tu respuesta

Would you like to see at any point the two loops joined in one? *

○ Yes

○ No