

# **FINAL REPORT**

## **HEAD COMPETITION TEAM F**

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## Executive Summary

The ATS transit analysis project aimed to address the inflexibility of public transportation services for persons with disabilities in Hamilton by leveraging data analytics to generate insights for improving the service. The project recognized the significance of accessible transportation and the potential advantages of data-driven enhancements. Specifically, the project focused on enhancing the accessibility and inclusivity of public transportation services for people with disabilities in Hamilton by increasing client satisfaction by 25%. It also aimed to improve rural transportation and accommodate diverse demographics.

The project followed the CRISP-DM data analytics framework, cleaning and exploring the ATS transactional data set to generate insights on the distribution of ambulatory and non-ambulatory client trips across rural and urban zones, the effectiveness of provider types, the average time duration of trips, and detailed heat maps of the trips. However, due to insufficient data available, it was not possible to make critical

analyses of the demographics of the clients. Despite this limitation, the project's insights recommended that same-day or next-day reservations be made available for non-ambulatory clients to enhance the efficiency of the provider type, DARTS, which had the highest late arrival time.

Moreover, the project suggested that the city municipality should focus more on reducing the pick-up arrival delays noticed in the most traveled postal code by clients, L9C. To achieve this, the project recommended deploying more strategies to ensure efficient transportation around peak hours (9 a.m.-2 p.m.). Finally, the project emphasized the need for the city municipality to evaluate the impact of the new transportation infrastructure on the traveling pattern of clients, underscoring the importance of ongoing data-driven enhancements to improve the public transportation system's accessibility and inclusivity in Hamilton.

In conclusion, the ATS transit analysis project sought to enhance the accessibility and inclusivity of public transportation services for people with disabilities in Hamilton by leveraging data analytics to generate insights for improving the service. Despite the limitation of insufficient data, the project provided valuable insights on how to enhance transportation services for clients, including same-day or next-day reservations for non-ambulatory clients, reducing pick-up arrival delays, and evaluating the impact of new transportation infrastructure. These insights can guide ongoing efforts to improve public transportation in Hamilton and beyond.

Project Name: Higher Education Analytics Data Competition	Project Acronym and/or No. <b>HEAD COMPETITION</b>	
Project Sponsor: Saifur Rahman	Target Project Completion Date 2023/03/17	
Project Managers: Nathaniel Fleming, Chimobi Anaeme	Version No. 1.0	Version Date 2023/02 /15

## Project Charter

### Project Purpose and Benefits

The problem that this project will assess is the lack of flexibility in public transit services provided to persons with disabilities in the City of Hamilton. The current door-to-door service provided by a contractor is limited to subscribed trips for recurring medical appointments or other activities, and casual trips that are reserved seven days in advance. The city is interested in exploring opportunities to improve the overall customer experience for clients using the accessible transportation services (ATS).

The project aims to convert trip data from ATS into useful information that can provide insights into the service. The project will explore the potential to offer more flexibility to persons with disabilities by identifying areas for improvement. The insights generated from the data will help to address key needs such as understanding the patterns of trips made by clients, the major trip destinations, trips by ward, inter-regional trips, volume by time and day, and the impact of the future Light Rail Transit Corridor. Additionally, the project will assess the opportunities to bring rural clients to the urban transit boundary and onto conventional HSR transportation, and the possibility of creating community bussing in some areas.

The reasons why this project needs have arisen are due to the city's commitment to improving the overall customer experience for clients using public transit. The city recognizes the importance of providing accessible transportation services to persons with disabilities and the need to ensure that the service is flexible, efficient, and meets the needs of its clients. The city also recognizes the potential benefits that the conversion of trip data into useful information can have on improving the service.

**Project Purpose and Benefits**

Goal	Strategy / Deliverables	Objective / Performance Measures
<p>1. To improve the accessibility and inclusivity of public transportation services for persons with disabilities in the City of Hamilton by analyzing trip data from ATS, and increase the number of ATS clients who report feeling satisfied with the accessibility and flexibility of the service by 25% within the next month (by 13th March 2023).</p> <p>2. To explore other rewarding and effective opportunities that provide public transportation services for people with disabilities in the rural zones.</p> <p>3. To create adequate comfort that satisfies the demographic patterns of all persons with disabilities of all ages by improving public transportation services for persons with disabilities in the City of Hamilton.</p>	<p><b>Strategy</b></p> <p>a). Conduct a comprehensive analysis of ATS trip data to identify patterns and major trip destinations for persons with disabilities.</p> <p>b). Engage with persons with disabilities, disability advocates, and community organizations to understand their needs and preferences regarding public transportation services.</p> <p>c). Collaborate with transportation experts and planners to assess the impact of the future Light Rail Transit Corridor on ATS services and identify opportunities to enhance accessibility and flexibility.</p> <p>d). Develop new transportation services and routes based on the analysis of trip data and consultation with stakeholders to address identified areas for improvement.</p> <p><b>Deliverables</b></p> <p>A report detailing the results of the trip data analysis and recommendations for improving accessibility and flexibility of ATS services.</p> <p>A comprehensive outreach plan that includes engagement with persons with disabilities, disability advocates, and community organizations.</p> <p>A transportation plan that considers the impact of the Light Rail Transit Corridor on ATS services and identifies strategies for enhancing accessibility and flexibility.</p> <p>A proposal for new transportation services and routes based on the analysis of trip data and consultation with stakeholders.</p> <p>A marketing and communication plan that increases awareness of ATS services and accessibility features, encourages non-recurring, casual trips, and provides information on</p>	<p><b>Objectives</b></p> <p>To analyze trip data from ATS to identify areas for improvement in the accessibility and flexibility of public transportation services for persons with disabilities in the City of Hamilton.</p> <p>To improve the customer experience for clients using ATS by addressing key needs such as understanding trip patterns, identifying major trip destinations, and assessing the impact of the future Light Rail Transit Corridor.</p> <p>To increase the number of non-recurring, casual trips made by clients using ATS to improve the overall flexibility of the service.</p> <p><b>Performance measures:</b></p> <p>i). Number of areas for improvement identified through analysis of trip data.</p> <p>ii). The percentage of clients who report feeling satisfied with the accessibility and flexibility of the service.</p> <p>iii). Number of new transportation services and routes developed based on the analysis of trip data.</p> <p>iv). Number of non-recurring, casual trips made by clients using ATS.</p> <p>v). Percentage increase in the number of non-recurring, casual trips made by clients using ATS.</p>

Goal	Strategy / Deliverables	Objective / Performance Measures
	new transportation services and routes.	
4.		
5.		<ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>

"IN" Scope	"OUT" of Scope
<ul style="list-style-type: none"> <li>• Exploratory Analysis on the demographic patterns of persons with disabilities in Hamilton.</li> <li>• Exploratory Analysis on trips that fit into the conventional Hamilton Street service.</li> <li>• Descriptive analysis of all trips from the rural areas.</li> <li>• Descriptive analysis of the conventional service already available for riders for many routes.</li> <li>• Descriptive analysis of the zones people are travelling to and from and for what type of riders.</li> <li>• Descriptive analysis of the number of trips that cross the urban transit boundary.</li> <li>• Descriptive analysis of the options to bring rural persons with disabilities to urban transit boundary and into conventional HSR transportation.</li> <li>• Descriptive analysis of the trips crossing regional boundaries.</li> <li>• Predictive analysis on opportunities to create community bussin in some areas.</li> <li>• Descriptive analysis on the standard catchment for ATS clients.</li> <li>• Prescriptive analysis on the support for on- demand service of ATS.</li> <li>• Predictive analysis on the number of trips in the future LRT corridor.</li> <li>• Predictive analysis of the potential impact for LRT across the corridor.</li> <li>• Descriptive analysis of the good transfer points within the LRT corridor.</li> <li>• Descriptive analysis of the distance people with disabilities travel.</li> <li>• Descriptive analysis of the average passenger trip duration.</li> <li>• Exploratory analysis on the comparison of trip duration in conventional travel via HSR or car.</li> <li>• Descriptive analysis on the rate of travel/ per hour.</li> <li>• Data preparation</li> <li>• Data Visualization</li> <li>• Interpretation of results</li> <li>• Communication with stakeholders</li> <li>• Project management tasks</li> </ul>	<ul style="list-style-type: none"> <li>• Collection of new data</li> <li>• Long term strategy development</li> <li>• Business decisions</li> <li>• Other municipalities</li> </ul>

High-Level Milestones	Target Completion Dates (Month/Day)
Research complete	Feb 24, 2023
Data Cleaned and complete	TBA- Waiting on data to be released
All models complete and easy to understand	March 10, 2023
Board Complete, presentable and clean	March 17, 2023

Project Costs	Associated dates
None	
<b>TOTALS</b>	<b>0</b>

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#### Project Team and Stakeholders

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Team Member Name and Title	Role on the Project	Required Involvement	
		Estimated Duration	Level of Effort
Nathaniel Fleming: Project Manager	<ul style="list-style-type: none"> <li>Communicate project roadmaps</li> <li>Coordinate and monitor day-to-day tasks and workflows</li> <li>Scope and design</li> <li>Planning and scheduling</li> </ul>	<ul style="list-style-type: none"> <li>4 Weeks</li> <li>March 23rd</li> </ul>	<ul style="list-style-type: none"> <li>Moderate- High</li> </ul>
Chimobi Anaeme – Project Manager	<ul style="list-style-type: none"> <li>Communicate with stakeholders</li> <li>Monitoring and controlling</li> <li>Identify risk</li> </ul>	<ul style="list-style-type: none"> <li>4 weeks</li> <li>March 23rd</li> </ul>	<ul style="list-style-type: none"> <li>Moderate- High</li> </ul>
Kazim Bektas – Data Analyst	<ul style="list-style-type: none"> <li>Data Cleaning and preprocessing</li> <li>Exploratory Data analysis</li> <li>Statistical modeling</li> </ul>	<ul style="list-style-type: none"> <li>4 Weeks</li> <li>March 23rd</li> </ul>	<ul style="list-style-type: none"> <li>Moderate- High</li> </ul>
Segun Akinnawonu - Data Analyst	<ul style="list-style-type: none"> <li>Data Visualization</li> <li>Interpolation and reporting</li> <li>Data Cleaning and preprocessing</li> </ul>	<ul style="list-style-type: none"> <li>4 Weeks</li> <li>March 23rd</li> </ul>	<ul style="list-style-type: none"> <li>Moderate- High</li> </ul>

Stakeholder Names	Interests & Needs	Strategies to Manage Expectations
<ul style="list-style-type: none"> <li>ATS</li> </ul>	<ul style="list-style-type: none"> <li>Insight into trips and needs to understand how to provide better service to persons with disabilities</li> <li></li> </ul>	<ul style="list-style-type: none"> <li>Research into links provided on website</li> <li>Contact with the sponsor to ensure that we are meeting expectation</li> </ul>

Stakeholder Names	Interests & Needs	Strategies to Manage Expectations
• Saifur Rahmen-Project sponsor	<ul style="list-style-type: none"> <li>Have groups provide the best project they can</li> <li>Project Charter</li> <li>Project plan and dates</li> </ul>	<ul style="list-style-type: none"> <li>Stay in contact with him</li> <li>Set reasonable goals and accomplish them</li> </ul>
• Group F	<ul style="list-style-type: none"> <li>Analyze Data and provide insights into data</li> <li>Time to complete project</li> </ul>	<ul style="list-style-type: none"> <li>Create Project plan and have dates set ahead of time to manage expectations</li> <li>Check in weekly for progress on project</li> </ul>

Other Related Projects & Initiatives	Interdependency & Impact
• Capstone Project	<ul style="list-style-type: none"> <li>Data analysis for a company or organization/ Low to moderate impact depending on the Capstone</li> </ul>

Project Risks	Likelihood (Low/Moderate/High)	Impact (Low/Moderate/High)	Risk Response
<ul style="list-style-type: none"> <li>Data is not complete/ contains errors/ missing data</li> <li>Biases interpretation</li> <li>Not enough Team input</li> </ul>	<ul style="list-style-type: none"> <li>Moderate to high</li> <li>Moderate</li> <li>Moderate- high</li> </ul>	<ul style="list-style-type: none"> <li>Low</li> <li>Moderate</li> <li>High</li> </ul>	<ul style="list-style-type: none"> <li>Clean data in desired program before analysis</li> <li>Research topic and keep an open mind</li> <li>Check in with group daily and provide an accommodating schedule</li> </ul>

Assumptions	Constraints
<ul style="list-style-type: none"> <li>The data provided by ATS is complete and accurate</li> <li>Data is representative</li> </ul>	<ul style="list-style-type: none"> <li>Project must be completed before March 23, 2023</li> <li>Access to data</li> </ul>

**Sign-Off****Project Sponsor Name:** Saifur Rahmen

Signature

Date

**Project Members' Names**

Signature

Date

**Nathaniel Fleming**

Nathaniel Fleming

February 13 2023

**Chimobi Anaeme****Kazim Bektas**

Kazim Bektas

February 17, 2023

**Segun Akinnawonu**

Segun Akinnawonu

February 17 2023

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## Data Reports

### CRISP-DM Documentation Requirements

<b>Business Understanding</b>
<ul style="list-style-type: none"> <li>• Project Plan</li> </ul>
<b>Data Understanding</b>
<ul style="list-style-type: none"> <li>• Data Collection Report</li> <li>• Data Description Report</li> <li>• Data Exploration Report</li> <li>• Data Quality Report</li> </ul>
<b>Data Preparation</b>
<ul style="list-style-type: none"> <li>• Data Cleaning Report</li> </ul>
<b>Modeling</b>
<ul style="list-style-type: none"> <li>• Test Design</li> </ul>
<b>Evaluation</b>
<ul style="list-style-type: none"> <li>• Review Report</li> </ul>
<b>Deployment</b>
<ul style="list-style-type: none"> <li>• Deployment Plan</li> <li>• Maintenance Plan</li> <li>• Final Report</li> </ul>

## Data Collection Report

This report contains references to all the data currently available for the project, data that may be purchased, or data the needs to be acquired for analysis.

Dataset ID : Unique identifier created to refer to a dataset.

Dataset : Name of the dataset. Can refer to individual tables or entire DB as required.

Source Location: Where the dataset resides such as URL address, IP address, fileserver, computer, database, etc.

Owner : Who owns or is responsible for the dataset such as a company or database administrator.

Description : A summary description of what the dataset contains.

Intended Use : What the analyst hopes to learn from the dataset or the information it will provide for analysis.

### 1. Existing Data

Dataset ID	Dataset	Source Location	Owner	Description	Intended Use
01	ATS (Application Tracking Software)	ATS, 2023 Head Competition Datasets	Accessible transport services	Dataset of trips made in the Hamilton region using the accessible	Analysis of the problem, building models to answer

	Transactional Dataset			transport, during 2019	questions about the data.
02	ATS Transactional Dataset Dictionary	2023 Head competition datasets	Accessible transport services	Defines all the columns of data used in the ATS transactional dataset	Refer to when cleaning and understanding the data values

## 2. Purchased Data

Dataset ID	Dataset	Source Location	Owner	Description	Intended Use
Not Available	N/A	N/A	N/A	N/A	N/A

## 3. Additional Data

Dataset ID	Dataset	Acquisition Method	Owner	Description	Intended Use
03	ATS Transactional Data Cleaned	Cleaned dataset	Accessible Transport Services	Cleaned dataset of the original data	Use for modelling the data

## Data Description Report

This report contains descriptions of all the datasets to be used for analysis in this project.

Source Format: Refers to whether the dataset comes from database (if so, which one), CSV file, text file, XML file, log files, etc.

Acquisition Method: Refers to how the data is acquired, such as database connection, FTP download, HTML download, etc.

Dataset Type: Refers to why the data is collected such as transactional data, aggregate data, archival data, etc.

Granularity: The temporal level of detail available in the data such as daily, monthly, annual, etc.

Size: Amount of disk space required to store the dataset.

Number of Records: How many rows are in the dataset.

Number of Columns: How many fields are in the dataset.

Period Covered: The period of data collection, or the data range of transactions stored in the dataset.

Field Name: The name of the column in the dataset.

PK: Flag to denote if the field is a primary key.

FK: Flag to denote if the field is a foreign key.

Data Type: The type of data contained in the field such as integer, real, Boolean, date, etc.

Data Value:	The values of data contained such as continuous, categorical including nominal, ordinal, a flag (Boolean), or text.
Length:	How many characters are the length of the field.
Description:	A summary of the data stored in the field.
Format or Coding:	Special formatting applied to the field such as a date (MM-DD-YYYY), or special symbols or characters used to represent categories (e.g. U: undergraduate student, G: graduate student).
Data Range:	The range of values contained in the column.
Analytically Relevant:	Flag to indicate whether the field will be considered for analysis or not.
NULL Ok:	Flag to indicate whether Null values are acceptable or not.

## 1. Descriptive Characteristics

Dataset ID	Source Format	Acquisition Method	Dataset Type	Granularity
01	CSV	Download from Head Competition website	Transactional Data	Daily data
02	XLSX	Download from Head Competition website	Data Dictionary	N/A
03	CSV	Cleaned the initial dataset	Transactional Data	Daily

## 2. Quantitative Characteristics

Dataset ID	Size	Number of Records	Number of Columns	Period Covered
01	86994 KB	806713	16	Jan 1, 2019 – Dec 31, 2019
03	90845 KB	6288078	25	Jan 1, 2019 – Dec 31, 2019

## 3. Data Dictionary

Dataset ID: 01										
Table Name (if available):										
Field Name	PK	FK	Data Type	Value Type	Length	Description	Format or Coding	Data Range	Analytically Relevant	NULL Ok
Date	Booking									

## Data Exploration Report

This report describes preliminary analysis performed and potential insights to achieve the project's goals.

Datasets Used: The Dataset IDs of the datasets used in the analysis.

Exploration Technique: The type of table or visualization used (e.g., histogram) to examine the data.

Analysis Results: Identification of any data patterns and a description of the exploration outcomes.

Promising Attributes: Fields that may contribute to hypothesis evolution or decision making.

Hypothesis : Potential explanation of the relationship, or modification of existing hypothesis.

Further Investigation: Fields and data subsets to consider for further analysis.

Datasets Used	Exploration Technique	Exploration Results	Promising Attributes	Hypothesis	Further Investigation	Data Quality Report  This report contains descriptions of the quality of data available for analysis in this project.  Problem ID: The
Booking ID, Ambulatory	Histogram	Each bar represents how data is distributed in an Ambulatory Category	Ambulatory Category("Yes")	Comparing categories		
Space Type, Early or Late	Distribution Graph	Which Space Type has more records.	Early or Late Space Type	Since the largest number of records fall under the AM and WK type.		
Origin Postal Start, Destination Postal Start	Web Graph	Which origin postal associations between different destination	Fields contribute to hypothesis evolution.	L9C origin is associated with destination L9C.		

problem identifier created to track the issue.

Dataset ID: The dataset affected.

Problem Type: Identification of the problem type including missing data, data errors, measurement errors, coding inconsistencies, and bad metadata.

Field Affected: Which field is affected if the problem is column specific.

Description: A specific description of the problem encountered.

Problem ID	Dataset ID	Problem Type	Field Affected	Description
01	03	Data Type error	Requested Pickup Time	Field data type was text.
02	03	Texting Error	Vehicle Type	Leading and trailing spaces and mismatched writing
03	03	Missing Data	Pickup Arrival Time Pickup Departure Time Dropoff Arrival Time	Fields have a blank value.

			Dropoff Departure Time	
04	03	Data Type Error	Booking ID, Trip Count	Data type is non-numeric

## Data Cleaning Report

This report contains descriptions of the quality of data available for analysis in this project.

Problem ID: The identified data quality problem.

Resolution: The approach adopted to resolve the data quality problem and/or clean the data.

Outcome: What was the result of the attempted resolution.

Completed: A flag to denote the problem has been successfully addressed.

Problem ID	Resolution	Outcome	Completed
01	Change the data type.	Data type update time.	Succeed
02	Change texting style and trim.	"taxi" was changed to TAXI.	Succeed
03	Remove to null value.	Null value replaces to blank value. Booking ID and Trip Count data type were changed numeric	Succeed
04	Change the data type		Succeed

## Test Design

This report details the steps performed to model and analyze the data.

Step: The sequence tasks were performed in.

Dataset ID: The dataset affected.

Activity: What action was taken to prepare the data for analysis or what test was performed on the data.

Description: A specific description of the action taken, along with any parameters that needed to be set.

Result: The outcome of that step.

Test Number: 01
Test Goal: Which providers are suitable for trip the different space type.

Step	Dataset ID	Activity	Description	Result
1	Early or Late (Target)  Origin Postal Start, Destination Postal Start, Space Type, Provider Ambulatory (Input)	A partition fields are defined	<b>A decision tree</b> is a straightforward description of the splits found by the algorithm. <b>Rule Set</b> is a set of rules that tries to make predictions for individual records.	C5.0 Model to identify features, based on previous trips and early or late, it can present us the list of providers with high probability of introducing the best current space type according to results
Test Result Summary: Get an excel file.				

## Project Close Report

Project Name HEAD COMPETITION TEAM F	Project Manager: Nathaniel Fleming
Executive Sponsor Saifur Rahmen	Project Close Date (from charter) March 17 2023
Business Owner ATS Hamilton	Project Close Date (actual) *note +/-variance March 15

Project Summary
The problem that this project will assess is the lack of flexibility in public transit services provided to persons with disabilities in the City of Hamilton. The current door-to-door service provided by a contractor is limited to subscribed trips for recurring medical appointments or other activities, and casual trips that are reserved seven days in advance. The city is interested in exploring opportunities to improve the overall customer experience for clients using the accessible transportation services (ATS).  The project aims to convert trip data from ATS into useful information that can provide insights into the service. The project will explore the potential to offer more flexibility to persons with disabilities by identifying areas for improvement. The insights generated from the data will help to address key needs such as understanding the patterns of trips made by clients, the major trip destinations, trips by ward, inter-regional trips, volume by time and day, and the impact of the future Light Rail Transit Corridor. Additionally, the project will assess the opportunities to bring rural clients to the urban transit boundary and onto conventional HSR transportation, and the possibility of creating community bussing in some areas.  The reasons why this project needs have arisen are due to the city's commitment to improving the overall customer experience for clients using public transit. The city recognizes the importance of providing accessible transportation services to persons with disabilities and the need to ensure that the service is flexible, efficient, and meets the needs of its clients. The city also recognizes the potential benefits that the conversion of trip data into useful information can have on improving the service.  <i>The scope of this project was to analyze the trip data and provide insights on how the transportation could be improved. During the project there was some challenges finding appropriate measures so the scope had to be broadened to accommodate for those problems.</i>

<b>Project Success Criteria</b>		
Objective/Deliverables <i>From Goal section of charter</i>	Was it met?	Comments
To improve the accessibility and inclusivity of public transportation services for persons with disabilities in the City of Hamilton by analyzing trip data from ATS and increase the number of ATS clients who report feeling satisfied with the accessibility and flexibility of the service by 25% within the next month (by 13th March 2023).	No	This goal was far beyond anything that we could accomplish in a short amount of time
To explore other rewarding and effective opportunities that provide public transportation services for people with disabilities in the rural zones.	Partially	Rural zones were explored in the data but not to the degree where we could make any assumptions about it.
To create adequate comfort that satisfies the demographic patterns of all persons with disabilities of all ages by improving public transportation services for persons with disabilities in the City of Hamilton.	No	Creating comfort for people in the accessible services was much out of this projects scope. Also the demographic data was not provided in this so it would be very difficult to determine demographic relationships without that data.

<b>Statement of Sponsor and Stakeholder Feedback</b>
<i>Request a statement reflecting their overall level of satisfaction with the project, deliverables and success toward meeting the business objectives and functional needs.</i>

<b>Project Challenges</b>
<i>Data cleaning and scrubbing took a very long time to do, ideally we should have broken the data down into a smaller chunk to analyze/clean</i>
<i>Data Modelling, the size of the file was much too large to produce any models in under 5 minutes</i>
<i>Data Quality, there were improper values in many cells and the data was riddled with null values.</i>
<i>The project scope was blurry and lead to many challenges with modelling and finishing the project near the end.</i>

<b>Lessons Learned</b>
<i>Communication between group members is very important and the lack of communication between group members made it hard to focus on the scope of the project</i>
<i>Set clear due dates and make sure to follow them, put them in a calendar so that you can be reminded about when meetings or due dates are happening</i>
<i>Do more research on the topic and form clear objectives and goals, the predictive aspect of the project was very blurry and hindered our final product.</i>
<i>Use more python tools for a dataset of this size and split the data into sizable enough chunks to clean then conduct analysis on. SPSS Modeler was the wrong tool to use for this modelling unless it was a smaller dataset.</i>

<b>Project Wins</b>
<ol style="list-style-type: none"> <li>1. <i>Data was cleaned very well and calculated columns were all appropriate to the subject.</i></li> <li>2. <i>All due dates were met and there were no late submissions</i></li> <li>3. <i>Learned from mistakes of this project and will not be making the same mistakes when completing a project of this size again</i></li> </ol>

<b>Outstanding Items</b> <i>Document assigned items that are identified to be completed post project close.</i>		
<b>Outstanding Tasks/Issues</b>	<b>Assigned To</b>	<b>Target Completion Date</b>
Final Report	Nathaniel, Kazim, Segun, Chimobi	April 5

<b>Out of scope – Future items</b>
<i>Further collection of data, for example covid transit data would be very helpful to notice the patterns associated with the shutdowns and accessibility services.</i>
<i>Further research into the accessible transport, this could help at understanding the difficulties that they may be dealing with at the moment but are not explicitly seen in the data</i>
<i>Further modelling to find relationships that we may have not seen yet.</i>

<b>Action Items and Considerations</b> <i>Key Actions to be taken to improve the success of future projects.</i>		
<b>Priority</b>	<b>Action Item</b>	<b>Department/Service Area</b>
High	Scope of project	Project Planning
High	Data Cleaning	Data Exploration
Med	Poster/Presentation	Presentation

## Recommendations

One way to improve the experience of persons with disabilities using ATS is to increase flexibility in travel reservations. Currently, reservations must be made seven days in advance for casual trips, which may not be convenient for persons with disabilities who have unexpected appointments or events. The city may consider offering same-day or next-day reservation options to increase flexibility.

Optimizing travel planning based on real-time demand allows for more efficient use of resources and better service for persons with disabilities. Priority should be given to persons with disabilities with recurring medical appointments and other activities to prevent delays.

The primary objective of the project is to convert trip data into useful information that can provide insights into ATS service. The city should use data analytics tools to identify areas for improvement, such as understanding travel patterns made by clients, major travel destinations, travel by ward, inter-regional travel, and so on. Within this framework, predictive analysis has been performed, identifying the tours that experience the most delays, determining the days and hours of travel cycles, observing that the most frequently traveled postal code is L9C, and making recommendations based on this information for service expansion, resource allocation, and operational improvements. DARTS has more late arrivals for every vehicle compared to VETS and other providers. Since the largest number of records fall under the AM and WK space type.

Additionally, the city municipality should evaluate how the new transportation infrastructure will affect customers' travel patterns and adjust ATS service accordingly to ensure that it remains an important transportation option for persons with disabilities.

## Conclusions

The project did not fully meet all of its objectives and deliverables. The project aimed to convert trip data from ATS into useful information that could provide insights into the service, and explore the potential to offer more flexibility to persons with disabilities by identifying areas for improvement. However, the project faced several challenges, such as data cleaning and scrubbing taking a long time, improper values in many cells, the project scope being blurry, and the size of the file being too large to produce any models in under 5 minutes.

Although the project did not fully meet its objectives, there were some wins, such as the data being cleaned very well, all due dates being met, and the team learning from their mistakes.

Based on the challenges faced, some recommendations for future projects would be to set clear objectives and goals, communicate effectively between team members, do more research on the topic, split the data into manageable chunks, and use appropriate tools for data modelling.

In terms of recommendations for the City of Hamilton, one suggestion would be to increase flexibility in travel reservations to improve the experience of persons with disabilities using ATS. Additionally, further research and modelling could be conducted to identify any relationships that were not seen in this project, and the city may consider offering same-day or next-day reservation options to accommodate unexpected appointments or events.

## References

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