Singapore Management University

Analytics Practicum Proposal v2

Walkthere.tp

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Contents

Versions

No	Date	Description
1	9 January 2016	First version of proposal
2	3 February 2016	Updated proposal with the following changes: • included analysis of ez-link data as part of the project • changed sponsor from CLC to Professor Kam Tin Seong • updated review of previous studies with critics on the research • updated methodologies

About the Project

The concept of new towns dates back to the late 1800s where the cities in UK became more crowded with poor living conditions. In 1898, Ebenezer Howard provide ideas on how we can improve our quality of life by imagining "garden cities" being surrounded by a "country belt" which was known as the "new towns movement" (Little, 1990)

In Singapore, new town planning is done by the Housing and Development Board (HDB). Queenstown was the first new town to be built when the new town concept was first introduced in Singapore. Currently, there are a total of 22 new towns in Singapore. These new towns have three key features which include high accessibility to public transportation, mixed land use and lots of greenery within the town.

Out of these new towns, Tampines is known to be the most outstanding and well-planned new town in Singapore. Built in the 1970s, Tampines new town has since developed into an institutional, social, recreational and commercial hub of the eastern part of Singapore. Its new town model has even won an award for its outstanding housing design and contribution to human settlement development. Now, it is home to over 200,000 people with a population density of 47,000 people/km.

As the population size grows, transportation improves incredibly to accommodate the growing number of ridership. However, it is questionable whether the convenience of readily available transportation is being taken advantage of, thereby compromising walkability within the town. Walkability reflects on the liveability of the town where people can walk on the streets feeling safe; where the ambience is soothing to the eyes of the people; where the safety of the pedestrians are not compromised with the traffic conditions.

Some may argue that the hot and humid weather conditions in Singapore influence the decision to take the public transport than to walk. However, taking walkability from another perspective, is the great availability of transportation influencing decisions to walk where people are getting more complacent and lazier? With the amalgamation of ez-link data provided by LARC and various geographic shapefiles available online, we will analyze the commuters' behaviour and justify if the hypothesis holds true.

After which, a particular neighbourhood in Tampines will be selected based on the results of the ez-link data analysis. We would then conduct a more in-depth walkability analysis on the neighbourhood and provide recommendations on how we can transform the neighbourhood into a more walkable area. Thus, the main aim of this project is to assess the walkability in Tampines.

Review of Previous Work

We reviewed papers that had relations to walkability in Singapore and in overseas countries to gain a better understanding of how to carry out our project.

Singapore Context

In the paper Enhancing the Pedestrian Experience in Singapore: A Closer Look at MRT Transfers and CBD Walkability, a research was conducted to find out the extent whereby the pedestrian system of Singapore could be improved, given the state of infrastructure assets and the hot and humid tropical climate present. The research was focused on walking as a form of transport in Singapore. A "Walking Experience in Singapore" survey was conducted, and it was discovered that Singaporeans' two biggest complaints of walking were the bad weather conditions and humid climate, and the paths that they chose to walk by depended on weather considerations.

Also, in the paper, a research was conducted with regards to walkability within Residential Estates. The main neighbourhood that was studied was Pasir Ris, and it was concluded that urban planners had to find a balance between traffic priority and residential walkability. The best solution would be to reroute areas with major traffic away from areas with high pedestrian movements, so as to appease both the working population who commute during peak hours as well as the residents who travel intra-neighbourhood for non-work trips during off-peak hours. The main issue that was pointed out was that Singapore's current main transportation planning has revolved around getting the working population to work efficiently, but the permanent road infrastructure poses more as a disincentive to walkability because it encourages road traffic more than residential walkability. The paper has not yet researched on ways in which walkability can be encouraged in the residential areas.

Hence, in our project, we will seek to find alternatives that will incentivize walkability in residential areas, especially during the non-peak hours. Also, we will look for reasons, apart from the weather conditions, that may impair the walking experience for residents. However, another research gap was that a survey of a wider-scale had to be conducted to understand residents' sentiment with regards to walkability. In this project, however, we are unable to conduct a wide-scale survey due to the lack of resources available.

The second paper we reviewed, Influence of Space and Time Concepts on Physical Activity Intensity in Singapore, a research was conducted to understand how the different characteristics of the built environment in communities influence people's physical activity level. Results showed that walkability index of the neighbourhood have a positive correlation to the residents' physical activity levels. This is also more prominent for men than women. It was also concluded that Bukit Timah, Tanglin and Tengah areas are least conducive for residents to walk for utilitarian or leisure purposes whereas Queenstown, Bukit Merah and Toa Payoh are the most conducive areas.

The author also mentioned about a previous study that was conducted to analyse the relationship between the proximity and mix of neighbourhood destinations and physical activity. He discovered that proximity and mix of destinations appears to have a stronger correlation with walking for utilitarian purposes as compared to walking for leisure purposes. Therefore, increasing the diversity of destinations may encourage adults doing more transport-related walking and achieving recommended levels of physical activity (McCormack, 2008). The author concluded by mentioning that there needs to be greater amounts of research conducted on how "residential neighbourhoods' built and social environment characteristics can promote active, healthy lifestyles."

Therefore, for our project, apart from adopting the walkability index model will provide a more in-depth analysis on walkability in the Tampines area, we will also look analyse the built environment in Tampines itself, especially of the common transportation routes taken, and eventually suggest ways in which improvements in the built environment can be made in order to promote walkability in the residential area.

Overseas Countries Context

In the research paper The Walkable City: Neighbourhood Design and Preferences, Travel Choices and Health, a study was conducted in Toronto's neighbourhoods to research on the public's preferences for walkable neighbourhoods. Residents in such neighbourhoods are known to enjoy advantages such as health benefits and a better quality of life. Through a survey conducted, it was found that there was an overwhelming preference for more walkable neighbourhoods. Results also found that neighbourhoods with positive significant air quality, climate, less traffic congestion and higher connectivity to nearby shops and services were associated with high walkability.

This research paper adopts walkability index as a tool to measure and evaluate neighbourhood's physical infrastructures that are closely related with utilitarian working. However, it is crucial to note that this walkability index was not designed to address other factors such as safety or streetscape features such as shade. We can adopt this walkability index model and further enhance it by taking into account some of these neighbourhood features mentioned in this research paper that are not considered in the walkability index model.

In the second research paper A Walkability Study of North Adams, Massachusetts, a study was conducted to assess the walkability of North Adams and provide recommendations to further improve North Adams walkability. The walkability audit is broken down into quantitative and qualitative assessment. In quantitative assessment, the author assess mainly the physical infrastructures in North Adams such as sidewalks and signage and rank them on a scale from 1(worst) to 5(best). In qualitative assessment, the author mainly conduct interviews and surveys with various stakeholders such as the pedestrians and mayor of North Adams to help them to identify other influential aspects of a particular area that are not captured in the quantitative data. Thus, we could refer to this research paper in order to provide guidance to our walkability audit. This is crucial as it will allow us to be equipped with the correct techniques to make a thorough analysis.

The author suggests in the research paper that one should exercise prudence when providing recommendations to improve the current pathways. Recommendations that require huge developments to the pre-existing urban sprawl will be costly and difficult to implement. On the other hand, smaller changes such as improving the quality of the signage can also make the neighborhoods more pedestrian friendly without incurring such huge costs. Furthermore, it is also important to take into account the demographics of the neighborhood, such as age group, when proposing future improvements to the physical infrastructure or when conducting walkability audits.

The author also states that physical activity was once part of our daily routines. Cars have since replaced walking or biking, and stairs climbing is now being replaced by elevators and escalators. These have resulted in physical inactivity where people are not moving enough.

However, both studies focused mainly on the physical infrastructures in North Adams and Toronto, and failed to consider other factors, such as the availability of cars, that was mentioned in one of the research papers that could lead to physical inactivity. This could pave the way for more research to be done on whether other factors such as availability of cars would affect the walkability of the neighbourhood.

Bringing this study back to the context of Singapore, it will be more relevant to look at the availability of public transport instead of cars where public transport ridership has been increasing and hit a record of 6.65 million trips per day in 2014.

Thus, this leads to our study where we seek to justify if an efficient transport system encourage people to take buses instead of walking even if the time taken to walk is shorter than taking a bus.

Objectives

The main aim of this project is to assess the walkability of a neighbourhood in Tampines. There are two parts to this project. The first part of the project involves analyzing the commuting patterns in Tampines using ez-link data. From there, we will identify a particular neighbourhood in Tampines to do a more in-depth walkability analysis on it which will form the second part of this project.

The objectives of our project are:

Part 1: Identify Commuter Patterns

- To understand the demographics of the residents in Tampines
- To analyze the commuting patterns in Tampines
- To highlight areas where the time taken to travel by bus is longer than walking
- To identify a particular area in Tampines for further analysis in the second part of the project

Part 2: Identify Gaps in Infrastructure

- To understand if the current physical infrastructures cater to the needs of the residents (based on demographics)
- To analyze the connectivity of the selected residential area to the points of interests
- To highlight areas in the selected residential area that are less accessible and propose recommendations to improve walkability

Part 1: Identify Commuter Patterns

This analysis aims to identify commuter patterns of each demographic groups - students, adults and elderly - as each group has differing interests and preferences in the places to frequent at. These patterns are recognized by areas with high volumes of people commuting by bus using the ez-link data. We aim to identify any commonalities where people travel for short distances, with only a few bus stops, within journeys, as well as recognize what are the common places of interests that the various demographic groups frequent at and at what periods of the week.

Our data for this analysis consists of the following:

1. **Ez-link transactions**

With the support from LARC, we were able to obtain ez-link transactions data from 20 to 26 January 2014. We have selected just a week of data in January 2014 because the travelling patterns for each week in a month are similar and there are neither no public holidays nor school holidays in the selected week for analysis. However, regardless of scaling down the data into just a week's period, there are still millions of transactions presented. As such, analysis of the data will be further scaled down to grouping the transactions based on demographic profiles, followed by aggregating the timings of transactions to every 15 minutes given that the timings presented come in seconds.

2. **Bus routes**

Busrouters.sg is an online portal where bus routes in Singapore are displayed in a map version. Data for bus routes is public available by the developer. The bus routes are updated to the latest bus profiles provided by the Land Transport Authority (LTA). However, the bus routes are published in json format. In order for us to conduct geospatial analysis using QGIS, a conversion of json to csv format is required. Besides having the bus routes plotted out in lines using QGIS, we realized that it is also important to have the bus stops included in the bus routes, where points of the bus stops and lines of the bus routes are snapped as a whole. Busrouters.sg has provided data of bus stops for each bus services. With that information, our team will be working on incorporating bus stops with the routes using PostGIS and QGIS.

3. **Points of interests**

Given that the places that each demographic groups frequent at varies due to differing interests and preferences, to include points of interests (POI) in this analysis will be helpful to understand which places attract various groups of people at various periods of the week. With that, our team conclude that POI should be places that serve the primary needs of the people. As such, POI include:

- MRT stations
- Schools (primary, secondary, pre-tertiary and tertiary education)
- Shopping malls
- Sports complex
- Parks
- Childcare
- Community centers
- Shapefiles for the identified POI can be retrieved from data.gov.sg, Openstreetmap, Onemap and LTA Data Mall.

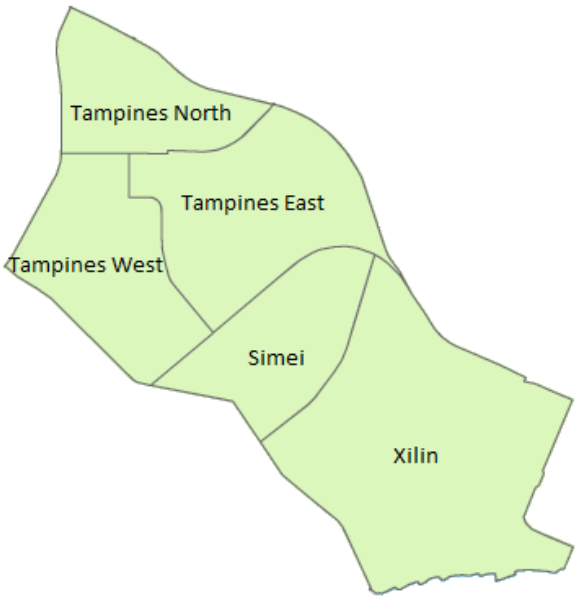
Part 2: Site Visit - Identify gaps in infrastructure

After conducting the first analysis where we identify areas with high volume of commuters, and commuters who travel short distances. The ez-link data will show us places that attract more elderly than students, for example, asking questions such as: “do those places serve the elderly well enough?”

The second part of analysis involves identifying gaps in the infrastructure within Tampines planning area. Why are people commuting by bus instead of walking? Will safety be compromised if people choose to walk? Or are there roads hindering the connectivity between the point of start with the destination? Singstat had the statistics of population for June 2015 published publicly. This information will aid in the understanding of how well-served are the living areas to the community. With that, we will conduct site visits to understand the situation better on ground level.

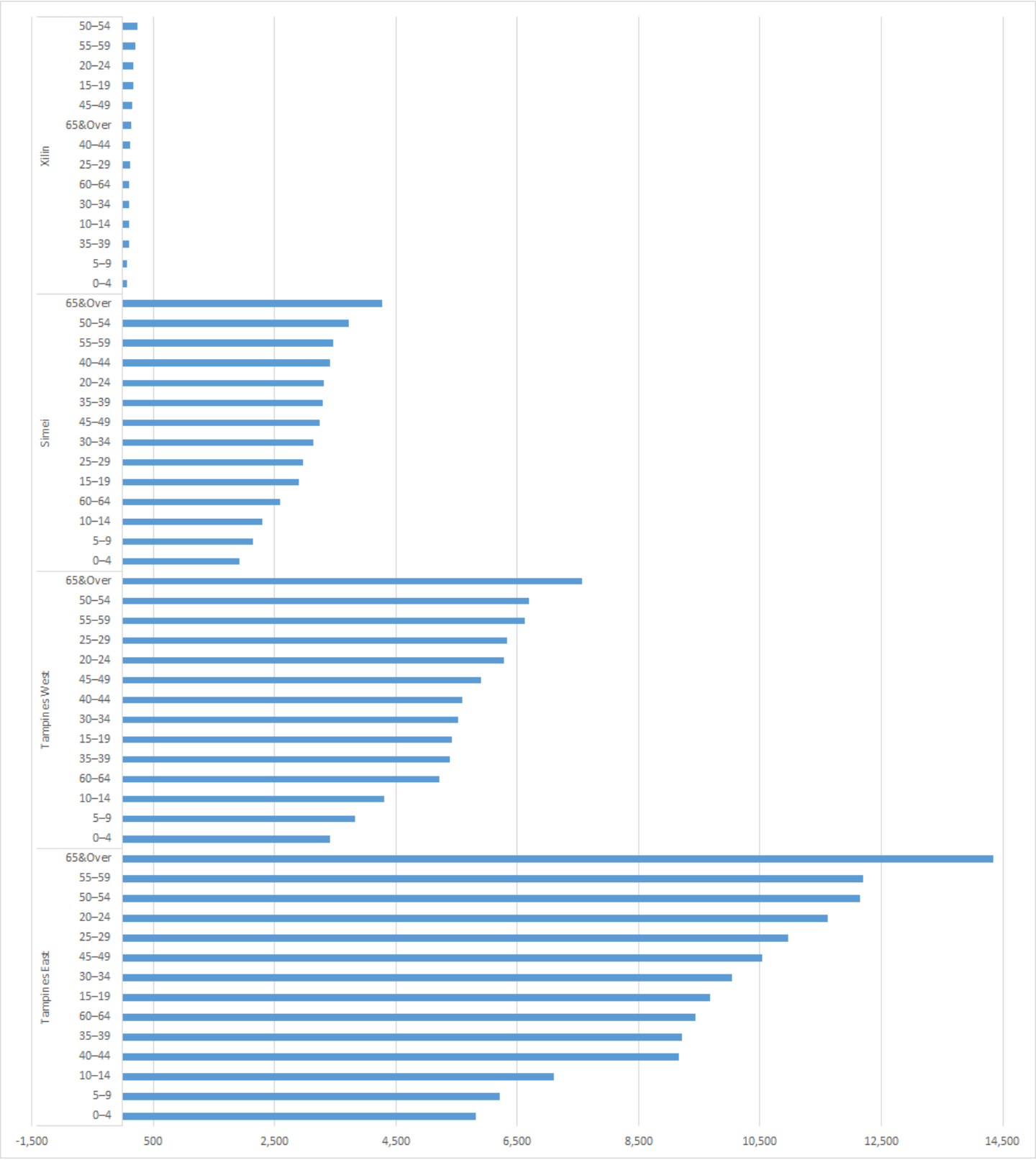
Data for this analysis includes:

1. **Statistics on demographic profile**



Number

Planning Area	Subzone	Total	0 – 4	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54	55 – 59	60 – 64	65 & Over
		Total														
Tampines	Total	261,230	11,210	12,260	13,820	18,180	21,380	20,420	18,820	18,000	18,310	19,840	22,810	22,490	17,360	26,340
	Simei	42,710	1,920	2,140	2,300	2,900	3,310	2,970	3,140	3,290	3,410	3,250	3,730	3,460	2,600	4,280
	Tampines East	138,500	5,820	6,220	7,100	9,680	11,610	10,970	10,030	9,220	9,170	10,530	12,140	12,200	9,440	14,350
	Tampines North	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tampines West	78,110	3,410	3,830	4,310	5,430	6,280	6,340	5,530	5,390	5,600	5,900	6,700	6,630	5,210	7,570
	Xilin	1,920	70	70	110	170	180	130	110	100	130	160	240	200	110	140



Based on the charts above, the top 3 age ranges in all subzones lie in the older range, which is above 50 years old. This shows that Tampines is more of a mature estate and as such, it is important to have facilities and footpaths catered to the elderly.

2. **Linking of pedestrian walkways**

As a tropical country located near the equator, Singapore receives her fair share of sunlight and often discourages people from staying outdoors for long due to the high level of humidity. With that, people may choose to commute by bus even for a short distance just to avoid the sun. Having covered linked ways and planting more trees, may help alleviate the situation through introducing more shades to pedestrians during daytime; and lamp posts to provide sufficient lighting at night for safer walking experience. Areas are obstructed with varied reasons, such as not enough lightings or shades and more, will be identified when we conduct site visit. LTA data mall has provided the following data:

- footpath
- covered linkway
- lamp post
- road crossing
- pedestrian overhead bridge and underpass

3. **Pedestrian network**

This data allows us to understand whether pedestrians can arrive at their destinations via walking. However, as the data is not available to us publicly, we have to formulate this network at our own means. By connecting the road network and plotting the pedestrian connectivity, even walking through void decks, will be done after conducting site visits.

Scope of Work

Literature Study

To understand previous studies on walkability in Singapore and in other countries, and the types of infrastructures that can be introduced so as to be able to make recommendations to improve the connectivity between residential estates and points of interest.

Software Learning

Learn how to use the QGis software, both on the laptop as well as on the mobile phone (to aid data collection).

Data Collection

Ez-link data will be provided by LARC while points of interests data sets are publicly available on Openstreetmap, Data.gov.sg, LTA data mall and Onemap. Pedestrian network will be manually mapped out through conducting site visits and with the integration of road network.

Data Exploration

Ez-link data of one week will be segmented into 3 sections for analysis: student, adult and elderly. Each team members has to identify trends and patterns for each profile groups with the use of analytics tools such as JMP and QGIS.

Geospatial Analysis

Using QGIS, for the following:

- Commuters behaviours throughout the entire one week.
- Map out paths that residents may take from their houses to identified points of interest
- Understand the coverage of street lamps to analyse the safety of walking paths at night. Through measuring the radius of coverage and the height of the lamp post, we can understand how the distribution of the lamp post should be placed.

Proposed Timeline

Task/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Research														
Proposal development	**All**													
Research on project	**All**													
Proposal Submission														
Proposal document	**All**													
Wiki page	**All**													
Milestone: Proposal Submission (10 January 2016)														
Data Collection														
Update and finalise proposal		**All**	**All**											
Generate spatial data				**All**										
Analyse ez-link data and gather insights					**All**	**All**								
Documentation for research paper							**All**							
Finalise initial findings							**All**							
Project Revision Iteration														
Review findings with sponsor							**All**							
Revise project							**All**							
Mid-term Presentation Preparation														
Prepare mid-term presentation slides							**All**							
Update research paper							**All**							
Update wiki							**All**							
Milestone: Mid-term Presentation														
Mid-term Presentation Follow-up														
Revise project								**All**						
Development														
Site visit									**All**	**All**				
Project Revision Iteration														
Review findings with sponsor											**All**			
Revise project												**All**		
Buffer Week (Wk 13)														
Final Presentation Preparation														
Prepare final presentation slides														**All**
Finalise research paper														**All**
Update wiki														**All**
Milestone: Final Presentation														
Poster														
Create poster														**Jea**
Milestone: Project Day and Submission														

Stakeholders

Sponsor and Supervisor: Prof Kam Tin Seong

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