A PROPOSED CIRCULATION SYSTEM FOR THE OLD CALLE REAL DE ILOILO CITY

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Abstract

Calle Real de Iloilo is one of the most important places in Iloilo during the Spanish era. The building and structures in this area are very old. The area is underdeveloped hence the people and economic activities are diverted to other parts of Iloilo, away from Calle Real. The city of Iloilo has focused on other projects around the vicinity before finally proposing a redevelopment plan of the Old Calle Real Heritage Zone. The study is basically about proposing the most effective circulation system for Calle Real. It would like to be able to recapture the 1950s colonial setting through this redevelopment plan. This plan focuses on altering the circulation system of pedestrian, traffic, and parking using the JICA STRADA 3 program and at the same time, taking into consideration the environmental impact of this circulation. Three new circulation system models were proposed in this study to supply the need for development. The first model focused on more parking spaces and pedestrianized zones in the areas of Calle Real by blocking off the minor roads, the second model does not block much of the roads and adds few parking spaces, and the third model has the adequate amount of pedestrianized zones but less parking spaces. Among the three models made, the first model showed the best distribution of traffic between the two directions of the road and produced less congestion in most of the areas. While in terms of the environmental impact and efficiency, second model is most recommended.

Keywords: *JICA STRADA 3, pedestrianized zones, environmental impact, proposed circulation system*

1. Introduction

1.1 Background of the study

Iloilo City is located in Western Visayas, Region VI, in the Philippines as shown in Figure 1.1. It is surrounded by neighboring provinces namely: Antique, Capiz, Guimaras, Aklan and Negros Occidental. Also, it is bordered by the Iloilo Strait on its Southern portion. Figure 1.2 shows the location of the Old Calle Real Road in Iloilo. The Old Calle Real has an area setting of Spanish Colonial Period. The buildings and structures in the area are very old and of Spanish architecture. The area is underdeveloped since new developments are ongoing outside the Old Iloilo Ciy. However,

renewed interest on the redevelopment of the Old Calle Real Heritage Zone has emerged.

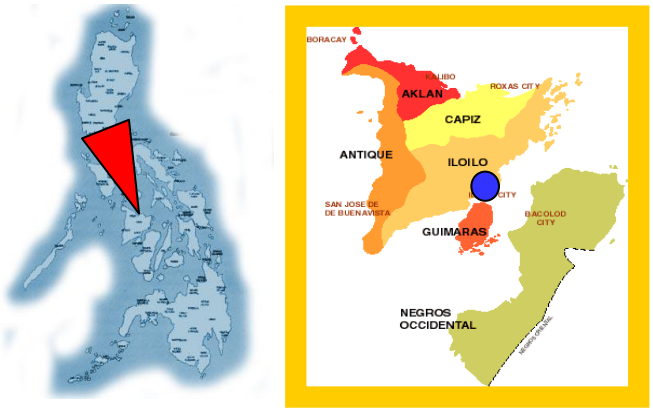

Figure 1.1 Location of Iloilo City

Source: Concep, Inc, The Iloilo CBD redevelopment project, 2008

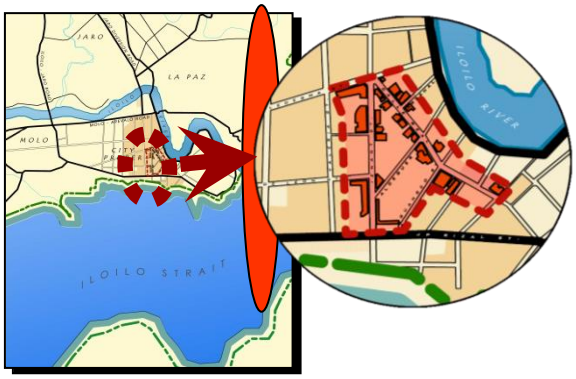

Figure 1.2 Location of Calle Real de Iloilo

Source: Concep, Inc, The Iloilo CBD redevelopment project, 2008

The Calle Real CBD Heritage Zone would like to be able to recapture the 1950s colonial setting through this redevelopment plan. This plan focuses on altering the circulation system of both pedestrian and vehicular traffic as well as the parking location in the area while at the same time, considering efficiency, cost and environmental impact. The goal is to create an appealing vibe for pedestrians to move around along proposed pedestrian zones, while still allowing a smooth flow in the movement of vehicular traffic.

1.2 Statement of the Problem

Calle Real de Iloilo is one of the most important places in Iloilo during the Spanish era. The structures and buildings in this area are very Spanish colonial in setting. Due to the focus of developments in Iloilo City along the diversion road which is also near the Old Iloilo Airport, business and shopping activities are being diverted to this new development away from Calle Real. In order to bring back Calle Real's historic and scenic substance, redevelopment of the said area is being proposed. The problems in the existing circulation system should be identified and addressed. The current transportation system such as existing roads, routes, amount of vehicles, local policies and regulations, and modes of transportation are considered as well as the land use and activities that affect the transportation quality.

1.3 Statement of Objectives

The primary objective of the study is to analyze the current circulation system of Calle Real in Iloilo and to propose the most effective circulation system for the area.

- To determine the travel behavior and characteristics of people and vehicle going to the area.
- To estimate the impact on vehicle and pedestrian traffic of the proposed circulation system.
- To estimate the environmental impact of the proposed circulation system.
- To compare the impact of the planned circulation system with the proposed circulation system on people and vehicular traffic of Iloilo City

1.4 Significance of the Study

Having a well-planned and well-designed circulation system would really make a difference in safety and organization of the Old Calle Real de Iloilo. Planning this proposed circulation system would improve the flow of transportation in the area. Traffic congestion in some areas would greatly be reduced. The study would also permit better accessibility in the area which would attract the target population, because of this, Old Calle Real would flourish in tourism as desired by the redevelopment project. Revitalization of business activities as well as conservation of cultural

heritage and historic structures would take place. It would be able to bring back the old essence of the area. The level of service provided for the pedestrians would be better if the walkways for them are modeled properly which would result in giving more safety to them. Calle Real would develop and flourish desirably with this organized circulation system.

2 Review of Literature

Studies related to the proposed study could be basically divided under three categories of pedestrianisation, traffic calming and traffic management.

2.1 Pedestrianisation

Pedestrianisation restricts vehicle access to areas for the safety of pedestrian travel. Several studies were conducted regarding pedestrianisation since safety and the lives of many are of prime importance. Iramnesh (2008) made a study regarding pedestrianisation; a great necessity in urban designing to create a sustainable city in developing countries. He stated the significance of pedestrianisation today since several countries develop continuously hence, vehicular access in cities increase as well making the pedestrian, in a way, preoccupied. He also included social impacts when pedestrianisation is implemented, plus, the corresponding case studies of various countries.

In the study of multi-modal network design by Wu (2005), et al, pedestrian scheme design is shown considering flow equilibrium and modal equity constraints. A discrete multi-modal network design problem was used which is the bi-level model. The advantages and disadvantages to users of the new pedestrian scheme were defined taking into account the modal equity constraints. As said by Wu, the results of this case study show that the proposed model can be effectively applied to realistic multi-modal transport networks for strategic planning. This concept could be linked in our study in addressing new discrete equilibrium network design problem.

Pedestrianisation is important for the commuters therefore it should be incorporated in planning the circulation system of the Old Calle Real. It should be definitely considered to cater safety and good flow for pedestrians for an effective circulation system.

2.2 Traffic Calming

Traffic calming is a method used by transportation engineers that is used to slow motor-vehicle traffic improve the safety and pedestrians and to improve the environment. It is one of the most used techniques in modeling circulation systems. Many tools are used are used in traffic calming. These tools have proved themselves to be useful in ensuring traffic flow in an area. Many areas have undergone traffic calming and have changed or are still changing for the better.

The article entitled Traffic Calming as an Integral Element of a Suburban Revitalization Program by Robert Eschbacher (2006) presented the traffic calming project proposed for the New Cassel community of sub-urban Long Island in New York City, USA. The area is an economically distressed area that is known for their proverty, a shortage of necessary local shopping opportunities and many vacant lots, empty storefronts and boarded-up buildings. After many tries in improving the condition of the area, only minimal progress has been made. The government then tried to use traffic calming plan that aims in addressing the housing, business and transportation problems of the area. Eschbacher stated that “the desired redevelopment of the said place contains design guidelines aimed at improving the character of the street by redefining public space, an atmosphere that attracts people to the street and creates a safe and pedestrian-friendly environment”.

Another study is conducted at Amherst, Massachusetts by Dulaski (2006). It was done in order to balance vehicular mobility and pedestrian safety by looking for traffic calming methods to be able to address the pedestrians’ safety issue. These methods will be selected using a criteria selection for choosing the correct method. They collected existing conditions of the area by getting pedestrian and vehicle data. They used these data to select appropriate traffic calming methods. The main traffic calming methods used were yield. These signs are placed in the more public areas. More symbols that were painted on the streets that inform whether the lane is for bicycles or whether drivers should stop at certain areas or even for crossing of the streets.

Traffic calming is needed in our study since we have to analyze the traffic behavior of a city and propose a design for its flow. The articles included herein are related to the current study in a sense that it includes traffic calming and its approaches as well as technicalities. We have to

consider factors that were counted in these studies. The concept of traffic calming is necessary in our study since it is interconnected in circulation flow.

2.3 Traffic Management

Traffic management is one good approach in managing road transport policies and flow. It is very important in order to avoid traffic congestion for a good flow on circulation system. Gorill Palmer Consulting Engineers have conducted a traffic circulation study in the town of York as a response to the request for proposals of the city for traffic circulation changes. Their goal is to Improve traffic flow in the York Beach Village Center (specifically Railroad Avenue, Ocean Avenue, Bay Street, Church Street, and County Road), improve access to, through and from the beach area for nearby residents and visitors (i.e., Nubble, Freeman, etc.), create a safer environment for pedestrians and vehicular traffic and to comply with state and federal traffic and roadway guidelines (i.e. MUTCD requirements for roadway striping). The method they would be using is to collect the data of the existing conditions of the town of York. To do this they will work with the Town and MaineDOT to acquire necessary information related to traffic, geometrics, sight distances, speed limits and turning movement counts. Afterwards they would be creating a traffic system management plan by using Google Maps as their main modeling software and plug in the necessary data to simulate traffic patterns in the area.

Zhang (2010) states the different impacts of transportation system on urban land use. Both variables are dependent and affect each other. Zhang affirmed that it has become increasingly important to determine and understand the impact of transportation control measures such as highway capacity expansion and traffic management strategies. He explored the influence of traffic management technique on land use patterns using the example of ramp metering. Also, he emphasized various models that could be used in traffic management like regression-based transportation model and land use change indicator model. Another study conducted by Bin Jiang (2010) was about street hierarchy which is an urban design technique for laying out road networks that exclude automobile through-traffic from developed areas.

Traffic management is necessary with the present study since it deals with the analysis and design of transportation. It shows a transportation planning process as well as factors need to be considered in this study for an effective circulation and traffic management of a city.

3 Methodology

The four-step modeling process of transportation was the main tool for conducting this study.

3.1 Trip Generation

The Trip Generation was taken from an Origin-Destination Survey distributed to people in the area of Calle Real. These origins and destinations were divided properly into 58 inside zones and 8 outside zones as shown in figure 3.1.

Figure 3.1 Iloilo City Internal Zones

Since the survey on the site was small scale, the researchers used a larger scale survey conducted on 2009 and projected the 2011 small scale survey to be able to combined them.

3.2 Trip Distribution

The Trip Distribution step creates a matrix of origins and destinations. The combined matrix was just used for the proportions of origins and destinations per zone, to make a more realistic projection of trips on a daily basis, the researchers acquired the 2007 NSO household data for Iloilo City and projected it using their given yearly growth factor of 1.86% to be able to get the 2011 household data. This household data was used for the desired total of each origin and destination and to project the combined 2009 and 2011 survey, the researchers used the Fratar Method to correct each of the elements of the matrix.

3.3 Modal Split

This matrix was now the daily trips made by Iloilo City and was for both public and private vehicles. The third step was Modal Split analysis three main factors were the basis for choosing a mode of transportation: 1. Characteristics of the trip maker, 2. Characteristics of the journey, and 3. Characteristics of the transport facility.

3.4 Traffic Assignment

The final step was the traffic assignment where the researchers used JICA STRADA 3 to model the transportation network of Iloilo City as shown in figure 3.2.

Figure 3.4 Iloilo Road Network modeled by JICA STRADA 3

This is where the researchers were able to alter the routes that public vehicles would take and create variations in the road network.

The traffic flow equation was modeled using the Bureau of Public Roads method.

$$T_Q = T_O\left[1+\propto\left(\frac{Q}{Qmax}\right)^{\beta}\right] \quad (1)$$

This equation was plugged into the parameters of the road network of JICA STRADA 3 to be used for projecting a correct value of speed and travel time for each link in the network.

3.5 JICA STRADA 3 Evaluator

JICA STRADA 3 would include also an evaluator that calculates the time savings, vehicle operating costs savings and the environmental costs of the vehicles that pass through the network.

3.6 Parking Survey

For a more micro level approach, the researchers also conducted a parking survey for the area of Calle Real. The relevant information required such as the number and duration for vehicles legally and illegally parked, space-hours demand for parking, and supply of parking facilities are the tools to be used in the analysis of parking data. The parameters needed are to be summarized, coded, and interpreted.

The space-hours of demand for parking uses the equation:

$$D = \sum_{t=1}^{N}(n_i t_i) \quad (2)$$

Whereas the space-hours of supply for parking uses the equation:

$$S = f\sum_{t=1}^{N}(t_i) \quad (3)$$

where:

S = practical number of space-hours of supply for a specific period of time,

N = number of parking spaces available,

t_i = total length of time in hours when the ith space can be legally parked on during the specific period,

f = efficiency factor,

To determine the activity of on-street parking, the average parking duration and turnover rates are used which are then further used in determining the parking revenues.

For the average parking duration:

$$D = (30)\sum N_x(X)/N_T \quad (4)$$

where:

N_x = number of vehicles parked for X intervals,

X = number of time intervals the vehicles parked, time interval use is 30 minutes, and

N_T= total number of vehicles observed

For the parking turnover rate:

$$TR = N_T/(S)T_s \quad (5)$$

where:

N_T = total number of vehicles observed,

S = number of parking slots, and

T_S = time of study in hours.

For the estimation of the revenue of the additional pay parking:

$$R = (N)\left(PF_j\right) + \sum(i)(n_i)(PF_i) \quad (6)$$

where:

PFj = preset parking fee for the *j* time,

i= hourly increment, or fraction thereof, of vehicles parked more than *j* time,

n_i= number of vehicles for every hourly increment *i*, or fraction thereof, that parked more than *j* time,

PFi = increment in parking fee for the hourly increment *i* greater than *j* time, and

R = total parking revenue (in pesos)

4. Results

4.1 Cross-Tab Analysis

Table 4.1.1. Cross-tab analysis of gender and age from the survey results.

Age	Gender		
	Male	Female	Total
14 & below	1	0	1
15-20	9	57	66
21-25	16	19	35
26-30	6	14	20
31-35	7	7	14
36-40	7	10	17
41-45	3	5	8
46-50	2	9	11
51-55	2	5	7
56-60	1	4	5
61-65	2	0	2
66 & up	3	4	7
Total	59	134	193

Table 4.1.2 Cross-tab analysis of gender and trip purpose from the survey results.

Gender	Purpose					
	Market	Work	School	Shopping	Others	Total
Male	7	19	3	9	28	66
Female	21	35	14	26	43	139
Total	28	54	17	35	71	205

Table 4.1.3 Cross-tab analysis of age and trip purpose from the survey results.

Age	Purpose					
	Market	Work	School	Shopping	Others	Total
14 & below	0	0	1	0	0	1
15-20	7	17	12	9	24	69
21-25	5	13	2	7	8	35
26-30	1	7	1	1	10	20
31-35	5	3	0	2	5	15
36-40	3	4	0	6	4	17
41-45	1	2	0	2	4	9
46-50	2	2	0	3	4	11
51-55	2	2	0	0	3	7
56-60	1	1	0	1	2	5
61-65	2	0	0	0	1	3
66 & up	1	1	0	3	2	7
Total	30	52	16	34	67	199

Table 4.1.4 Cross-tab analysis of time stayed and trip purpose from the survey results.

Time (stay)	Purpose					
	Market	Work	School	Shopping	Others	Total
0<x<1	11	19	9	18	43	100
1≤x<2	10	3	1	12	8	34
2≤x<3	2	3	2	4	7	18
3≤x<4	3	1	1	1	4	10
4≤x<5	1	2	2	0	0	5
5≤x<6	0	2	1	0	1	4
6≤x<7	0	2	0	1	1	4
7≤x<8	0	0	0	0	2	2
8≤x<9	1	11	1	0	2	15
9≤x<10	0	0	0	0	0	0
10≤x<11	0	4	0	0	2	6
11≤x<12	0	6	1	0	0	7
12≤x	2	1	1	0	1	5
Total	30	54	19	36	71	210

Table 4.1.5 Cross-tab analysis of gender and mode of transportation from the survey results.

Gender	Mode of Transportation						
	Jeepney	Taxi	Car	Walk	Tricycle	Motorcycle	Total
Male	31	0	5	22	1	5	64
Female	93	1	3	39	0	0	136
Total	124	1	8	61	1	5	200

Table 4.1.6 Cross-tab analysis of age and mode of transportation from the survey results

Age	Mode of Transportation						
	Jeepney	Taxi	Car	Walk	Tricycle	Motorcycle	Total
14 & below	1	0	0	0	0	0	1
15-20	51	1	1	14	0	0	67
21-25	18	0	1	14	0	1	34
26-30	10	0	1	8	0	1	20
31-35	7	0	0	5	1	2	15
36-40	7	0	4	5	0	0	16
41-45	7	0	0	2	0	0	9
46-50	7	0	1	3	0	0	11
51-55	4	0	0	3	0	0	7
56-60	3	0	0	2	0	0	5
61-65	2	0	0	0	0	0	2
66 & up	6	0	0	1	0	0	7

Table 4.1.7. Cross-tab analysis of travel time and mode of transportation from the survey results.

Travel time(min)	Mode of Transportation						
	Jeepney	Taxi	Car	Walk	Tricycle	Motorcycle	Total
0-10	21	1	3	33	1	3	62
11-20	37	0	2	18	0	0	57
21-30	33	0	2	9	0	1	45
31-40	1	0	0	1	0	0	2
41-50	6	0	1	0	0	0	7
51-60	18	0	0	2	0	0	20
61-70	0	0	0	0	0	0	0
71-80	0	0	0	0	0	0	0
81-90	6	0	0	1	0	1	8
91-100	0	0	0	0	0	0	0
101-110	0	0	0	0	0	0	0
111-120	5	0	0	0	0	0	5
2hrs&up	2	0	0	0	0	0	2

4.2 Parking Survey

#	Street	Block	Hours	Stalls	Vehicles	Duration (hr/veh)	Turnover Rate(veh /sp-hr)
1	Iznart	1	11	27	94	2.62	0.32
2	Iznart	1	11	20	71	2.24	0.32
3	Aldeguer	1	11	62	282	1.49	0.41
4	Aldeguer	2	11	-	-	-	-
5	Guanco	2	11	9	6	5.42	0.06
6	Iznart	2	11	18	114	1.10	0.58
7	Rizal	2	11	11	123	1.21	0.58
8	Guanco	3	11	88	378	1.91	0.39
9	Mapa	3	11	44	136	2.12	0.28
10	Mapa	4	11	8	8	1.94	0.09
11	Ortiz	4	11	7	12	4.63	0.16
12	Rizal	4	11	4	5	5.10	0.11
13	shorter side	5	11	8	18	3.31	0.21
14	shorter side	5	11	12	52	1.70	0.39
15	Ortiz	5	11	25	108	1.08	0.39
16	Rizal	5	11	20	77	1.32	0.35
17	Rizal	5	11	13	74	1.00	0.52
18	Arroyo	6	11	26	86	1.73	0.28
19	Arsenal	6	11	37	121	1.69	0.30
20	Arsenal	7	11	23	34	2.50	0.13
21	Aldeguer	7	11	18	43	3.17	0.22
22	Aldeguer	8	11	5	26	1.39	0.47
23	Guanco	8	11	9	7	1.15	0.07
24	Guanco	9	11	17	33	2.93	0.18

4.3 Design of Circulation System

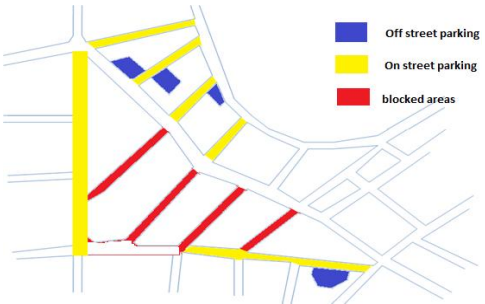

Figure 4.3.1 Calle Real Option 1

Blue is Off Street parking, yellow is On Street parking and red are the blocked areas. There would be a total of 373 parking stalls and projected capacity of 1393 vehicles.

Figure 4.3.2 Calle Real Option 2

Total of 252 stalls and 941 projected capacity of vehicles.

Figure 4.3.3 Calle Real Option 3

Similar amount of stalls and projected vehicle capacity as option 2.

4.4 JICA STRADA 3

Table 4.4 Summary and Findings for each option

Options	Description
Option 1	1. More parking spaces and pedestrianized zones in the area of Calle Real by blocking off the minor roads 2. Has the best distribution of traffic ; less volume of traffic in most of the congested areas 3. Increase in cost for the running time and time cost 4. Parking accomodation: 1390 vehicles, 373 stalls
Option 2	1. Few blocked roads and few parking spaces 2. Less balanced distribution between the trips in both directions 3. Decrease in both time cost and environmental cost 4. Increase in running time cost 5. Parking accomodation: 940 vehicles, 250 stalls
Option 3	1. With more pedestrianized zones but less parking spaces 2. Unbalanced trip distribution 3. More cost than the original circulation system 4. Parking accomodation: 940 vehicles, 250 stalls
CBD 1	1. Unbalanced concentration of volume 2. Negative benefit for running cost and time cost 3. Fewer volume for JM Basa Street
CBD 2	1. Significantly equal to CBD 1

5. Conclusion/Dicussion

The positive economic development of Iloilo City has brought the need for improving the attractiveness of the highly commercialized areas of the City. Calle Real de Iloilo is a heritage site turned commercial area which has attracted a lot of attention with these redevelopment projects. Three

new circulation system models have been proposed to supply the need for redevelopment.

From the OD survey and OD matrix made in this study, the majority which is 62% of the people around Calle Real use the jeepneys as their primary mode of transportation since there were several jeepney routes that pass the area that are also from other parts of Iloilo City. Similarly, it is known that 30% of the respondents are originally from the adjacent internal zones as well as from Guimaras (zone 65), having 5% respondents, which is an external zone. For the destination of the people, it appeared to be in Calle Real itself. The main trip purpose of the people in the area are work being around 26% of the respondents and 17% being shopping/market since 67% of the respondents were female. It basically aligns with the land use map provided by the CBD development plan of Iloilo city wherein Calle Real was seen to be for commercial and retail uses.

Between the three variations of the proposed circulation system based based on the analysis, Option 1 would have the best distribution of traffic between the two directions of roads and these roads are not so congested in most of the areas. This may indicate that there are more cars going out of Calle Real compared to cars going in. Option 1 incremental assignment for the same link shows an unbalanced ratio in JM Basa Street but balanced out the rest of Rizal Street. In terms of cost analysis in Option 1, it shows that it would decrease the cost for running time and would result to time lost while increasing the environmental cost. Option 2 may show a less balanced distribution between the trips in the stated directions but distributes the trips more on the links inside the triangle of Calle Real but completely reduced the use of Iznart Street. Option 2 would decrease the cost for all factors: time, running and environmental cost. For Option 3, it shows that it would have an unbalanced trip distribution in terms of traffic flow but also decreases the cost of all factors. The CBD 1 and CBD 2 proposals were both similar in traffic flows and cost efficiency. They both showed a poor distribution in terms of traffic flow. Volume of JM Basa Street was transferred into Iznart Street and Rizal Streets. In terms of operating cost, it showed that all 3 factors gained an increase in operating cost.

Considering all the factors, Option 1 is the most suitable circulation system for Calle Real if the impact of traffic flow would be considered. If the group would prioritize the traffic flow over the operating cost then Option 1 would be chosen. It would also be the best variation for the pedestrianization in the area. Conversely if the operating cost would be considered over the traffic flow, then Option 2 and Option 3 would be proposed as the new circulation system for the area. It has the greatest benefits in terms of efficiency and environmental impact. CBD 1 and CBD 2 appeared to have the worst results considering all the factors mainly because the JICA STRADA 3 program did not favor the redirecting of trips of one of the links of JM Basa Street.

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