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ID 1529 | THE SCHOOL TRAVEL BEHAVIOR CHARACTERISTICS AND ITS CONSTRAINT OF THE PRIMARY SCHOOLS IN XI'AN CITY

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1 INTRODUCTION

The urban primary school travel in China is the necessary life behavior in the family daily life. For the adjustment of the urban population structure and the diversification of the transport means, as well as the unbalance public education resources and the school choice behavior, there are large spatial-temporal differences among the families school travel modes, all of the factora above cause the unsuitable of the urban primary school layout method which is only dependent on the service radius and the thousand people index. Combining the travel behavior with the layout of the urban primary school is one of the leading directions to improvement the urban primary school planning(Zhang,2014). Xi'an is the dominant city in the northwest area in China. The types of the urban primary school in Xi'an is multiple, and the city also concentrates more excellent educational resources and students enrollment. The paradox between the pupil number and the land area, and the spatial-temporal accessibility of the school travel issues become more fierce. This paper takes Xi'an as the example and analyzes the school travel constraint mechanism based on the summarization of the urban primary school travel characteristics, as well as doing the basic job for the future study which is to optimize the urban primary school layout from the perspective of the urban land and transportation integration.

2 RESEARCH METHOD AND DATA SOURCE

2.1 RESEARCH BOUNDARY AND THE SUBJECT SELECTION

School travel means school commuting of the the pupil. The primary school travel includes 2 layers: the first layer is the school travel mode (which include the go to school alone and and picked up by others); the second layer is the school travel characteristics (which includes the travel subject, mode, time and distance). By comprehensively considering the conditions of the urban primary schools (establishment time, school scale, education quality etc.) in Xi'an and the city build environment, and this paper choose 2 primary schools respectively from the 6 main administration districts between different areas within the Third Ring road in Xi'an. 6 in total, as the sample, which are Houzaimen primary school（A）, Primary school attached to Xi'an Normal university（B）, Primary school attached to the Xi'an Architectural & Science university（C）, Cuihua Road primary school（D）, Qujiang No.1 primary school（E）, and South lake primary school（F）(table 1).

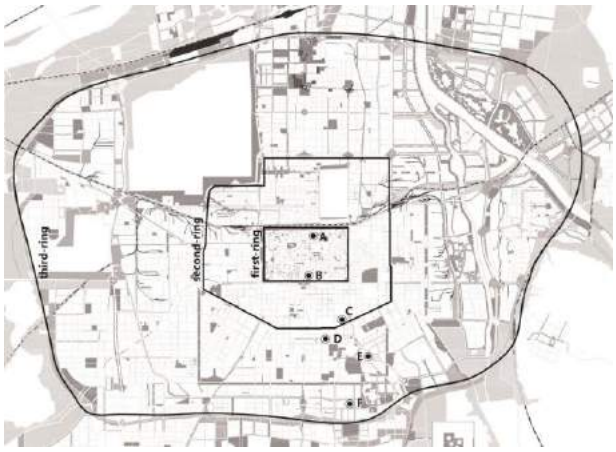

Figure 1- Location map of the sample primary schools

Category \ Primary school		A	B	C	D	E	F
Establishment time		1956	1908	1986	1960	2011	2014
School construction	Total area of used land（㎡）	10496	10160	4860	12074	17020	10779
	Total gross building area（㎡）	6000	3650	2687	9615	11700	17000
	The number of the primary school in the big scool district	5	4	5	5	——	——
Number of students	Number of students	2600	1410	1360	2500	1370	676
	Actual class/（Planned class）	46	42	21	58	54/(56)	14/(56)
	class mixximun student number	60	45	64	55	56	45
build environment overview	site location	Within first-ring road	Within first-ring road	Within Second-ring road	along the second ring	Within third-ring road	Within third-ring road
	Community characteistic and relation with the urban road	beside the danwei community of the old city, beside a T-cross side of urban branch	In the community of the old city, beside a Pedestrian street	In the unit community, beside community road	Beside urban sub-artery and a T-cross side of urban branch	Beside urban artery and cross side of express way	Beside urban artery and cross side of urban main road
	School district scale（h ㎡）	25.4	26.4	92.2	162.4	522.2	1321.1
	distance to the nearest bus stop（m）	500	100/135	520	60/150	60/600	460
	distance to the most usually used bus stop（m）	760	100/135	460/750	710	60/600	600
Time management	time in the school	8：00-16：50	8：00-16：50	8：00-16：50	8：00-16：50	8：00-16：50	8：00-16：50
	Extracurricular and long-hourclass	have	have	have	have	have	no

Table 1 - Basic characteristics of the sample primary schools

2.2 RESEARCH METHOD AND DATA

This paper takes the time geography as the theoretical base, the activity dairy surveys of the school travel behavior and the families in-depth interview as the data base, and summarizes the family daily activity path; this research explains the constraint factors that affect the school travel behavior and proposes initial thought of the planning layout. The research group did surveys about the 6 sample primary schools within Oct. to Dec. 2013 and Mar. to Apr. 2016. The researchers observed and recorded the data of the 6 primary school commuting travel modes at the reasonable layout points of the school gates, as well as distributing the survey questionnaire about the family activity journal at each school based on the ratio of the 5-10% of the students numbers, the questionnaire content involves the family attribute, the travel mode of the pick-up subject, the travel satisfaction and the daily life record. 504 copies of questionnaires were recovered. Based on the questionnaire, this research did in-depth interview with 5-10 families for each school, and asked about the various activities within the daily life, behavioral habit and the family satisfaction in details.

3 SPATIAL-TEMPORAL CHARACTERISTICS OF THE URBAN PRIMARY SCHOOL TRAVEL IN XI'AN

The spatial-temporal characteristics of the urban primary school commuting travel include the travel subject, distance, time, mode and frequency.

3.1 TRAVEL SUBJECT: THE PARENTS AND GRANDPARENT'S PICK-UP SCHOOL COMMUTING, THE RADIO OF WORKING PARENTS OCCUPY LESS THAN 50%.

The urban primary school commuting travel subject is composed of the primary students and the pick-up parents. The proportion of the primary students travel alone is low, mostly are based on the parents pick-up. In term of the nature property of the pick-up parents, the mother occupy the leading position, meanwhile, nearly half of them are full time mother (or freelancer); secondary is the grandparents, then the father, others are the baby sitter or relatives. From the perspective of working nature, the pick- up subject is based on the non-working parents; the working parents only occupy a proportion of less than 40%. Among the working parents, the proportion of the female working parent is higher than the working male parent. The spatial-temporal characteristics of the primary school pick-up travel mode has large constraints to the working parents, especially to the working female parent (table 2).

Category \ Primary school		A	B	C	D	E	F	Total and totall proportion
Pick-up parents	Full time mother(freelancer)	7/15%	2/2%	17/17.9%	12/11.4%	37/20.5%	5/9%	80/15.6%
	Working mother	10/18%	21/25%	50/51.6%	27/25.7%	51/17.0%	7/12%	126/21.4%
	Working father	12/21%	6/6%	19/20%	17/16.2%	27/14.8%	12/21%	93/15.8%
	Full time father(freelancer)	0/0%	5/5%	2/2.1%	4/3.8%	6/3.3%	0/0%	16/2.6%
	Grandfather	9/16%	37/40%	19/20%	20/19.1%	36/19.8%	16/28%	137/23.2%
	Grandmother	18/32%	25/26%	8/10%	26/25.8%	38/20.9%	16/26%	127/21.6%
	Baby sitter, friend or relatives	0/0%	1/1%	0/0%	0/0%	7/3.8%	3/6%	11/2%
	Sum	56	95	95	105	182	59	609/100%
Travel distance	Less than 0.8 km	9/16%	15/14%	14/14.8%	18/25.1%	67/36.8%	19/40%	159/27.6%
	0.81km-1.5km	10/20%	28/30%	32/33.6%	25/29.6%	37/20.5%	12/25%	152/26.2%
	1.51km-2.5km	6/12%	15/16%	29/30.6%	17/21.8%	25/12.7%	11/25%	96/18.8%
	2.51 km -3.5km	6/12%	13/14%	7/7.4%	9/11.4%	19/10.4%	6/11%	63/10.6%
	More than 3.5km	20/40%	24/26%	13/13.7%	11/14.0%	56/19.8%	1/5%	86/16.9%
Travel mode	Private car	512/15.0%	102/11.2%	270/24.8%	290/10.9%	292/16.6%	171/29.7%	1437/16.1%
	Taxi	5/0.2%	25/2.7%	7/0.6%	——	9/0.8%	——	46/0.6%
	Bus	175/7.5%	57/6.2%	44/4.0%	150/4.9%	17/0.9%	12/2.1%	456/4.6%

	Metro	143/6.2%	56/3.8%	——	——	——	——	199/1.9%
	School bus	312/13.0%	——	26/2.4%	57/1.4%	314/16.8%	——	689/7.2%
	Electro-mobile (motor-tricycle-taxis included)	297/12.4%	120/13.2%	173/16.9%	191/7.2%	60/3.2%	25/4.5%	866/9.1%
	Bicycle	51/1.5%	14/1.6%	61/4.7%	72/2.7%	50/1.6%	3/0.5%	201/2.1%
	Walk	1117/46.6%	666/61.4%	618/47.6%	1958/72.9%	1148/61.4%	565/65.4%	6662/69.4%
Bus travel willingness	A Yes	50/ 75%	28/84.8%	75 / 75%	9/25.1%	45/ 60.5%	29/82.9%	——
	B No	11/ 27%	5/16.2%	24 / 25%	50/76.9%	20 / 31.7%	6/17.1%	——
Noon pick-up	Pick-up	5/6%	6/8%	24/25%	23/29.6%	89/70%	58/79.2%	——
	Not pick-up	47/94%	67/92%	71/75%	49/62.8%	38/30%	10/20.8%	——

Table 2: The travel characteristics of the primary school families in Xi'an city

3.2 TRAVEL DISTANCE: THE DISTANCE IS ENLARGING, BUT STILL HAS THE CHARACTERISTIC OF THE SPACE AGGREGATION

1）the travel distance for 27.6% families is within 0.8 kilometer, which reflects the special service enlargement trends of the primary school in Xi'an city. 2）about 73% families are distributed within 2.5 kilometers travel distance from the school, which suggests the families' strong demand to near the primary school space proximity. 3）while the family numbers within 2.5-3.5 kilometers start to decrease obviously, the constraint of the special and time distance is increased for the family travel. 4）16.9% family travel distance is beyond 2.5 kilometers, which reflects the primary schools with fine teaching quality still have attraction for some families.

3.3 TRAVEL TIME: THE IDEAL UNIT TRAVEL TIME IS 15 TO 20 MINUTES, THERE IS CERTAIN SPACE AND TIME STABILITY

In terms of the family satisfaction survey results, no matter which travel mode is chosen, the ideal unit travel time for the family is 15 to 20 minutes, and the maximum tolerable travel time is 30 minutes.

There is a very large travel time difference among different means of transportation (table 3), the travel time for walk, electro-mobile(or bicycle) and private car is about 30 minutes; while, the average travel time for the bus is about 31 minutes, which is longest among all the travel modes. The travel mode of the electro-mobile (bicycle) is the point to point mode and the travel efficiency is relative high.

Primary school / Means of transport		A	B	C	D	E	F	The average cost
Travel time	Private car (Sample size/minute)	14/26	9/19	19/18	14/21	54/17	16/15	106/18
	Bus (Sample size/minute)	12/58	19/56	16/26	15/24	9/55	5/27	72/51.4
	Non-motor vehicle (Sample size/minute)	10/15	15/15	24/16	11/10	10/10	4/12	74/16
	Walk (Sample size/minute)	14/11	50/21	56/11	40/11	74/15	25/15	259/14

Table 3: Average Time for Different Ways of Travel

3.4 TRAVEL MODE: BASED ON WALK AND PRIVATE CAR, THE BUS TRAVEL RATIO IS LOW

Among all the travel mode (in table 2), 1) Walk is still the main ways of travel, following is the private car and the non-motor vehicle; 2) the proportion of the motor vehicle is one third, but the travel is based on the private car, the proportion of the bus is very low; 3)the coverage of the school bus is very low, and the cost is high and paid by the families, therefore, only a few families choose the school bus. 4) Among the non-motor vehicles, the proportion of the electro-mobile is high because of its speed, flexibility and less time cost, while the travel proportion of the bicycle is low, etc.

3.5 TRAVEL FREQUENCY: TENDS TO 2 TIMES PER DAY, THE NOON PICK-UP CONSTRICTS TO A LARGE EXTENT FOR THE WORKING PARENTS

Among the 6 surveyed schools, 4 of them have lunch and noon break at school. The parents who choose not to pick-up the child occupy a large proportion (table 2). Most of the travel frequency for the primary school students is 2 times per day, which is going out at early morning and coming back at dusk. Interview shows that there is strong noon boarding appeal from the parents.

4 THE ACTIVITY PATH ANALYSIS AND BEHAVIORAL MODE OF THE SCHOOL COMMUTING TRAVEL

This research summarizes the activity path of the family school travel and finds there is certain regularity.

This paper classifies the family samples from the aspects of the pick-up parents(people), house-school-job spatical-temporal diatance (space) and pick-up frequency(time), and gets 30 types of family school travel paths and 4 space-behavior patterns(figure 2).

The pick-up parents can be classified into 5 types, which are :full time parents （N-no job）, 2 working parents（F-full time job）, one of the 2 working parents has free working time（P-part time job）, 2 working parents +grandparents（G-grandparents）and 2 working parents +afterclass or education institutions（E-education）.

The space distance can be classfied into 5 types, which are: job-school-house proximity, school-house proximity, school-job proximity, job-house proximity and the job-school-house is separation. The time can be mainly classified into 2 types, which are the not pick-up at noon and pick-up at noon according to the travel frequency.

It is needed explaining that the space and time path reflection is the school commuting situation of the one child family. In addition, according to the survey results, most of the pupils attend the after school interest class within the weekdays and on the wekends. The travel situation of the primary school students' interest class within the weekdays is included in Figure 2.

According to the time and spatial-temporal constraint , the school travel path can be classified as the following 4 types.(fugure 2)

Mode 1—the time and space constraint extent are small, the ideal status

Mode2—there is time or space constraint, the most of the situation

Mode 3—there are both time and space constraint, extreme status

Mode 4—there are both large time and space constraint , no stable status

5 THE SPAITIAL AND TEMPORAL CONSTRAINTS ANALYSIS OF THE SCHOOL COMMUTING TRAVEL

The core method of the time geography is to explain the human activities by 3 constraints, which are capability constraints, coupling constraints and authority constraints(Hagerstrand,1970).

5.1 CAPABILITY CONSTRAINTS

As the primary school students of the travel subjects, the capability constraints mainly derive from the physiology constraints and safety constraints.

5.1.1 PHYSIOLOGY CONSTRAINTS—THE TRAVEL DISTANCE IS SHORT AND THE SPEED IS SLOW

The walk speed differs with age. For the young, the walk speed can reach to 60-70 meters per minute, and the fatigue interval is 30 minutes; the walk speed of the aged and the child is 40-50 meters per minutes, and the fatigue interval is 20 minutes. In terms of physiology characteristics, the walk speed of the primary school student is slow, the fatigue interval is short and the travel distance is also relatively short [4].

5.1.2 SAFETY CONSTRAINTS—HIGH SAFETY REQUIREMENT, ACCOMPANY IS NEEDED

The school travel behavior has high safety requirement. The self-safety behavior awareness of the primary students is weak, the walk process of the primary students is often accompanied by running, jumping and playing, and they lack the pre-determination ability about the potential dangerous accident within the space, and there is certain safety problem.in addition, there are also some hurt accidents with extreme bad nature in the society. Therefore, the primary students commute to and from the school is certain accompanied by the parents, this has become the popular social phenomenon(Wang,2015).

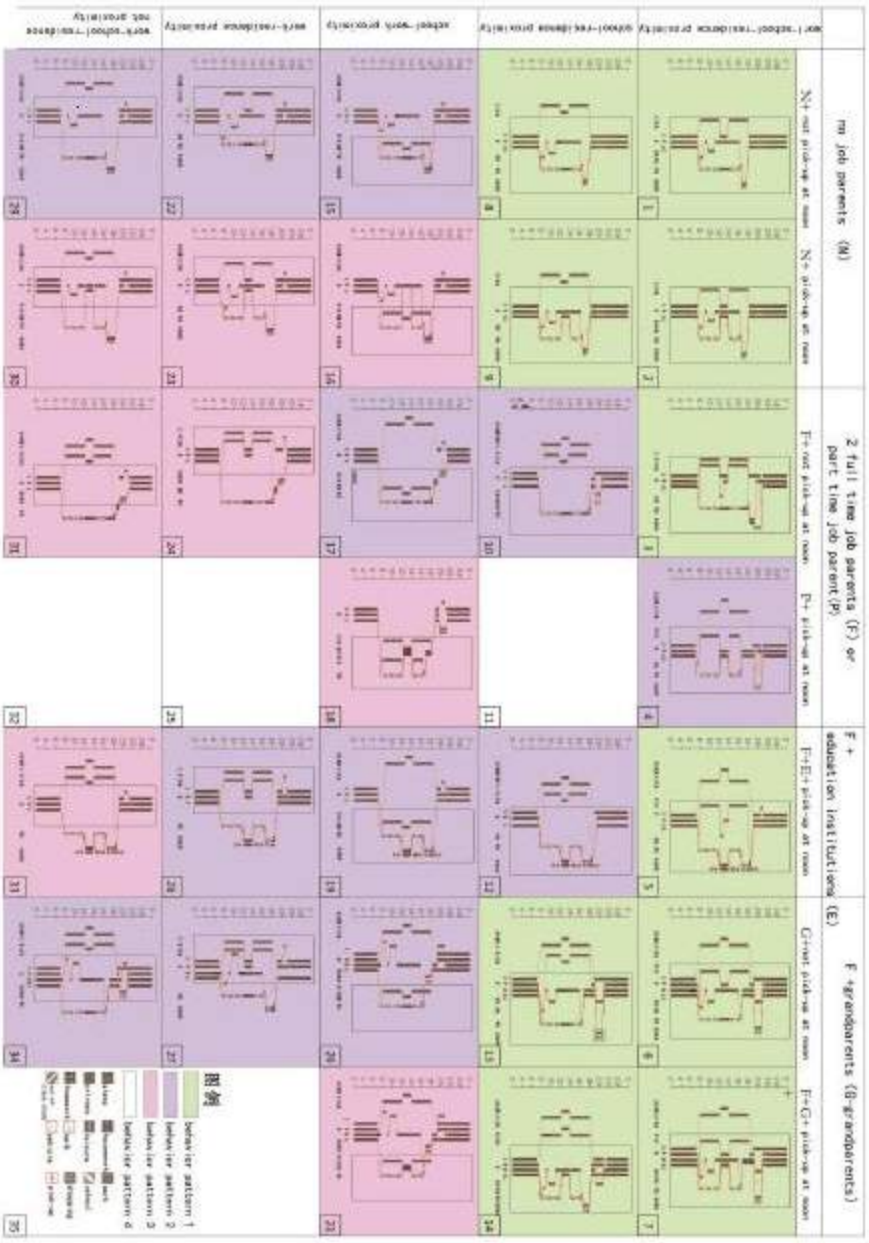

Figure 2 - 30 types of family school commuting travel paths and 4 space-behavior patterns

5.2 COUPLING CONSTRAINTS

Since the primary students commute to and from the school is accompanied by the parents, the parents naturally become the main decision makers about the school commuting travel. The pick-up time of the primary school and the distance between the school and home are the 2 most important influence factor of the school commuting travel.

5.2.1 THE PICK-UP TIME AND FREQUENCY HAVE OBVIOUS INFLUENCE ON THE CAREGIVER, ESPECIALLY FOR THE WORKING PARENTS

There are two factors that constraint the primary school family pick-up subject---time and space. The pick-up time of the urban primary school has the strongest time and space constraint for the working parents, and is the main factor for family to determine the pick-up subject.

If there is conflict between the primary school pick-up time and the working time of parents, it will constraint the pick-up behavior of the working parents; in this case, the pick-up subject is usually substituted, and the grandparents or the relatives will take the pick-up task. Besides, if the school provide the after school class or long-hour class, the pick-up demand of the working parents after work will be satisfied. The urban primary school teaching time management and space capacity support can ease the pick-up time constraint on the parents. For example long-hour class and the interest class after school in the primary school attached to the Xi'an Architectural & Science University make the working parent to pick-up possible, and the pick-up proportion of the working parents is high.

5.2.2 THE TRAVEL DISTANCE, CONSTRAINT WITH THE PICKER AND THE TRAVEL MODE , AND PRESENT CERTAIN TIME AND SPACE STABILITY

The family role, social and economic property of different pick-up parent will influence their pick-up travel modes. With the increasing of the travel distance, the constraint extent on the pick-up parents is also strengthened. The travel distance, pick-up subject and the travel mode also present certain regularity. The increased number of the aged have obvious negative influence on their travel time and space distance. The older the grandparents, the shorter the time and space distance. According to the survey date (table 6), the pick-up subject and the school commuting travel time and space distance present certain regularity: when the pick-up distance is within 800 meters, the proportion of the grandparents is highest; when the pick-up distance is 800--1500 meters, the grandfather and the mother are the pick-up subject; the pick-up distance exceeds 2500 meters, the pick-up proportions of the full time mother and working father increase obviously. The farer the travel time and space distance, the stronger constraint on the aged, and the pick-up proportion of the working father and full time mother increase greatly.

Space distance(m)	Pick-up subject proportion(the first 2)	Travel mode
≤800	grandfather<grandmother	Electro mobile(bicycle) <walk
80-150	Working mother<grandfather	Private car< Electro mobile(bicycle) <walk
1500-2500	grandfather<working mother	bus<private car<walk< Electro mobile
2500-3000	Working mother <working father	bus< Electro mobile <private
≥3500	Working father<full time mother	Electro mobile <bus<private car

Table 4: The Relation between Travel Distance, Caregivers and Travel Mode

5.2.3 THE HOUSE, SCHOOL AND WORK SPACE RELATIONS AFFECT THE SCHOOL TRAVEL MODES

The space constraint is embodied when the "house, school and job" distance is within the walk reachable range (as in figure 2 ○1~○7), the constraint on the parents is least; when the "residence, school and work" distance is separated, the constraint on the parents is strongest (as in figure 2 ○29~○35）. When the "residence, school and work" distance is in proximity, the pick-up behavior can be completed during the "family--work" travel process. As there is time constraint, the space link mode has great influence on the working parents, and the family travel cost will increased. According to the survey data, 39.2% of the families rent or borrow houses nearby the primary school, the "proximity enrollment" appeal is high.

5.3 AUTHORITY CONSTRAINTS

According to the regulation of the new Compulsory Education Law, the immediate school enrollment policy is implemented during the compulsory education period, the school is not allowed to choose the students beyond the school district, and the student is also forbidden to choose the school freely. In the actual practice the immediate school enrollment policy is implemented by the people (registered permanent residence)and the location(residence) related enrollment regime, the policy shall cover the immediate school enrollment according to the registered permanent residence as well as to the actual residence. The school district regime has been gradually implemented since 1996, which linked the education supplies with the "Hukou". The unbalance in excellent education resource and the school district regime increase the threshold of the families' school choice. There are differences in the space scales among districts in

Xi'an and the numbers of the primary school, the division of the school district range also has great differences and randomness(table 2), the family school travel which is within the school district range only occupies a small proportion.

6 CONCLUSION AND DISCUSSION

The family school travel mode is not only the subjective choice of the family, but also the result of the spatial constraint. It is found that the school travel still owns the characteristics of parents accompany, increased distance, space and time stability, motorization and multi-frequency by surveying the build-up area urban primary school space and time travel in Xi'an. The space and time can better reflect the reasonable space distribution of the urban primary school families. This paper summarizes more than 30 kinds of school travel paths by the constraint description method, 4 kinds of space behavioral modes can be classified based on the time and space constraint. Family school travel is the choice result under the individual, family, society and urban construction environment constraints. From the perspective of school travel, These aspects are necesary for the primary school layout to follow, and there are : the urban primary school extend needs the life care place; the formed community life unit taking the urban primary school as the core will facilitate the struction of the community; organize the urban primary school and the surrounding space layout from the perspective of satisfying the family travel demands. Based on the analysis of the school travel behavior, urban primary school layout from the perspective of integration of land use and transportation, can reduce the constraintans for family travel, improve the quality of life.

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ID 1538 | WHEN TRADITIONAL AND CREATIVE INDUSTRIES BLEND: A CASE-BASED DISCUSSION OF THE IMPLICATIONS FOR URBAN DESIGN

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1 INTRODUCTION

As economic interests in an urban society develop, functionally determined zones of production become zones of transition and pose challenges to urban design as an instrument for organizing competing or contradictive spatial interests. This contribution centres on such a zone of transition, an industrial site in the Belgian city of Hasselt which is progressively enveloped by urban development. Interestingly, this area is part of a larger industrial area along the quays of the Albert Canal. This canal was developed in the 1930s to connect the Campine coal basins , the maritime port of Antwerp and the steel basin in Liège to one another (Van Acker, 2014). The Hasselt Canal Zone thus exists on the interstice between two very distinct systems: the radial-concentric pattern of the (medieval) city, characterized by two concentric ring roads; and the linear development of the Albert Canal, a national backbone for industrial and commercial development. Due to their subsequent development and saturation, these distinct systems increasingly influence each other here. Hence, the Hasselt Canal Zone demonstrates a gradual transition which includes the introduction of new programmes, creating a public and urban élan on the south bank of the Canal. This process has started in 1997, when the Muziekodroom, a local non-profit organization for