INSTITUTIONAL BARRIERS TO COORDINATION OF PARKING SUPPLY AND DEMAND MANAGEMENT WITH TRANSIT IN DOWNTOWNS: CASE STUDIES FROM SOUTH FLORIDA

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Parking management in downtown areas can be complex because of the variety of users placing demands on the parking system and a variety of decision makers (e.g., parking agencies, transit system, local, regional and state transportation departments, and transportation and land use planning agencies). However, the connections between parking in downtowns, land use management, transit provision, and agency coordination has received less attention from parking researchers. The objective of this paper is to understand the institutional barriers to coordination of parking pricing and management strategies, with the regulation of land uses, the provision of transit and other economic and environmental goals in two South Florida Central Business Districts (CBDs), the City of Miami and the City of Fort Lauderdale Best practices are reviewed for other cities in the United States to derive lesson learned for the study cases. To compile the data, a parking inventory, a review of planning and transportation documents, and interviews with key stakeholders, are conducted. The study finds that both CBDs support the coordination between transit, parking and land-use policies, especially coordination among transit institutions. Field parking inventories indicate that parking spaces are easily found within the CBDs, presenting the opportunities to implement more efficient parking supply and demand management strategies. Challenges in institutional coordination include: (1) the need for various entities to establish formal coordination both at the local and regional

levels; (2) the need for institutions who manage publicly-owned parking to coordinate with private parking providers about pricing, location and information-related; (3) the need for the underutilized parking to be minimized; and (4) the need for institutions to increase the frequency and reliability of transit service and integrate information system on transit and parking. In addition, a crucial challenge is that all institutions need to support a unified vision to integrate land use, transit and parking policies in support of a more liveable and integrated downtown.

Keywords: Parking Demand and Supply Management, Transit, Institutional Barrier, Downtown, CBD, Miami, Fort Lauderdale

INTRODUCTION

Downtown areas have been increasingly seen as good locations for sustainable land use-transportation solutions, such as higher density development, a greater mix of land uses, greater connectivity in design, and shorter distances to transit (the so-called "5 Ds" (Cervero, Ferrell & Murphy, 2002, Ewing and Cervero, 2010). One of the most significant transportation issues in downtown areas is parking. Parking supply and demand management are seen as strategies to increase the cost of driving, provide greater alternatives to driving, reduce greenhouse gas emissions, and reduce congestion associated with parking. However, parking management in downtown areas can be a complex process because of the variety of users who place demands on the parking system and decision makers involved in transportation (e.g., parking agencies, transit system, local, regional and state transportation departments, and transportation and land use planning agencies).

A large amount of research has been completed on parking pricing, parking supply, and parking demand management (Shoup 1997, 2005; Litman 2006; TRB, 2008; Weinberger et al 2010). However, the important connections between parking in downtowns, the management of land uses, the provision of transit, and, more importantly, the coordination between land use, parking and transit agencies have received less attention.

Objective

The objective of this paper is to understand the institutional barriers to coordination of parking pricing and management strategies, with the regulation of land uses, the provision of transit, and other economic and environmental goals in the two case studies of downtown Miami and downtown Fort Lauderdale.

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LITERATURE REVIEW

Coordination of transit, parking supply, and demand management is important, especially in downtowns, because transit systems closely connected to downtown areas can reinforce parking strategies, while poorly planned transit can undermine the success of efforts to manage parking supply. When parking supply management is inefficient, people continue relying upon personal vehicles, which may lead to spill over parking in adjacent neighbourhoods and "cruising" for parking in the downtown. This literature review clarifies how the interconnectivity between parking and transit takes place, restates the concepts of parking supply and demand management, and discusses the challenges in the implementation of parking supply and demand management.

Interconnectivity between Parking and Transit

Parking policies may encourage car users to change their mode of travel to transit. In reverse, the attractiveness or unattractiveness of a transit system can reinforce or undermine the effectiveness of parking policies. Indeed, the expected results from implementation of parking policies are to reduce the number of automobile users and to modify their preferences towards transit, reflecting larger mode choice issues. Many researchers have examined how parking policies influence users' mode choice, especially how far parking policy promote automobile users to change their preference for transit.

Increasing the price of parking can be a significant factor in encouraging car users to change their mode to transit (Peng, Dueker, and Strathman 1996; Hess 2001; Shiftan and Burd-Eden 2001). Because cost is a significant factor for people choosing parking spaces, researchers in parking policy focus on pricing as a tool to influence parking choice behaviour. Peng, Dueker, and Strathman (1996) conclude that transit use is more encouraged when high parking prices are combined with low-frequency transit service than when low parking prices are combined with high-frequency transit service. However, other factors, such as employment location, transit frequency, urban or suburban location, and travel distance are also important determinants of mode choice. Hess (2001) uses a multinomial logit model to determine commuter's responses to the availability of employer-paid parking in the CBD Portland, Oregon. Hess (2001) finds that 62% of commuters drive alone and 22% use transit when they receive free parking, but when drivers are charged a daily parking fee of US $6, the proportion who drive alone is reduced to 46%, and the proportion who use transit increases to 50%. It is important to note that transit in the Portland is fare-free. Shiftan and Burd-Eden (2001) conclude that when workers paid for parking in the CBD Haifa, Israel, workers changed their mode to vehicles with higher occupancy rates, while non-work travellers tended to either change their mode or to travel to other locations. Additionally, Wilson (1992), and Willson and Shoup (1990) conclude that parking price plays a role in decreasing the rate of driving alone for workers.

In other respects, the number of parking spaces per employee may influence the percentage of people using transit (Morrall and Bolger, 1996). A study performed by Moral and Bolger

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(1996) using data from Canadian Cities finds an inverse relationship between these variables. In other words, when the number of parking spaces per employee increases, the percentage of people using transit decreases or in opposite way.

Consequently, abundant, free, parking supply may hinder transit usage. In the past, transportation planners have tended to oversupply parking spaces in two separate but related processes: through applying minimum parking supply requirements in zoning ordinances and calculating parking generation. In zoning ordinances, city planners in one city have adopted the parking standards on another city without considering the distinct needs of their own community (Shoup, 1999). Many urban planners take the ITE Parking Generation Handbook rates as the minimum parking requirement for specific land use (Shoup, 1999). However, these parking requirements are based upon the provision free parking and do not consider the cost of externalities and the financial cost of parking spaces (see the cost of parking spaces section on Shoup, 1999). Accordingly, as this review suggests earlier, the provision of free parking spaces reinforces the continuation of car use, hinders public transit usage, and even stimulates indirect consequences, including "traffic congestion, air pollution, energy imports, car-oriented development, or global climate change" (Shoup, 1999, p. 559). Hence, Shoup (1999) suggests various strategies to charge parking supply, through parking benefit districts and on-street pricing. These strategies are parts of parking supply and demand management.

Parking Supply and Demand Management

Researchers in parking management, such as Donald Shoup (2005) and Todd Littman (2006) propose a variety of parking management solutions. Because these solutions deal with both supply and demand, these strategies are most commonly defined as parking supply and demand management.

The goals of parking supply and demand management are to maintain and maximize current parking resources through programs and policies (VTPI, 2011). Proposed parking programs and policies promote fiscal efficiency in building parking garages, acquiring land for parking purposes, focusing on multimodal choices of transportation and better quality of transportation services, being responsive to new users and additional demand, and providing interesting, adaptable, and environmental-friendly designs (Litman, 2006). Litman's parking supply and demand strategies can organized into nine groups.

- **Using pricing strategies to manage demand for parking.** Because cost is one variable that contributes to parking demand, parking pricing is used to manage demand, which includes: variable pricing based on demand where parking occupancy is approximately 85%; pricing based on time that is proportionally based on the popularity of peak hours; and location that is based on popular places and destinations.
- **Funding through parking benefit districts and fines.** Benefit districts are applied for areas or districts that are frequently subject to spill over impacts from parking

pricing. These districts charge parkers to get revenue and can use the revenue from the charges for business districts or and residential neighbourhood development (Shoup, 2005). Other strategy, setting the fines higher than before, about twice to five times of the daily rate (Litman, 2006), may increase the level of obedience from people to follow the parking regulations..

- **Coordinate parking and land use through parking reduction and exemptions.** Parking reduction, exemptions, parking maximum strategy, and unbundling parking allow developers and businesses to have fewer parking spaces than required by parking generation manuals. Developers or businesses should meet criteria, such as proximity to transit, mix uses or downtown locations, or the availability of other parking facilities. Parking maximums set the ceiling limit of the required parking spaces. Unbundling parking is a strategy for stratifying parking fees from the rental or the development costs of apartments and businesses. As a result, developers treat parking fees as additional services to purchase separately, opening up opportunities to reduce development costs and let the market dictate the supply of parking.

- **Incentives for Transit-Oriented Development (TOD) and smart growth.** TOD and smart growth share similar concepts in terms of a focus on high density, mixed use and multimodal transit service. Both concepts also value the importance of accessibility for people to complete their daily activities near where they live (Cervero, 2002; VTPI, 2010).

- **Multimodal transportation.** To harmonize parking policies, strategies exist that include mass transit services, park-and-ride, car-sharing, bicycle facilities planning, and commuter incentives for modes other than the automobile. By putting parking policies and all of these services together, drivers are given better access to circulate within downtown areas without using their private vehicles. Commuter incentives, such as parking cash-out, transit subsidies and tax benefit, may also encourage commuters to use alternative modes.

- **Regulate parking providers.** This objective includes the strategies of taxes on commercial parking, rate regulation, and the collection of taxes and fees. All of these strategies may reduce the total parking supply. Taxes on parking providers are applied when the percentages of parking fees are given to public sector. The examples of rate regulation and collection of taxes and fees are: per space levies, taxes on underutilized land or parking spaces that are based on the number of spaces or square footage, and in-lieu fees, such as optional fees for developers to pay besides of providing parking.

- **Improve parking design and technology**. There are several strategies focusing upon signage and way-finding, electronic systems, and sensor, real-time data, and parking pricing applications. Incorporating these forms of design and technology can ease users in finding parking spaces and other means of transportation, paying for parking, and accessing information from electronic devices.

- **Enhance public education** through social marketing. This strategy is intended to increase the awareness, to improve the education, and to shift public opinion in favour to use alternative modes of transportation than the private automobiles.

- **Coordinate institutions** on parking, transportation and land use policies and

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programs. This strategy supports parking policies implementation through coordination of internal and different level institutions to ensure coherency among land use, transit system, and parking policies. This strategy forms the basis for the remainder of this paper.

Challenges for Parking and Transit Institutions

The main challenge for local and regional institutions is implementing parking pricing policy as the effective means to reduce parking demand. As a market-oriented paradigm, parking pricing that Barter (2010) needs specific efforts to be implemented. Specifically, the market-oriented parking paradigm refers to what Shoup (2005) suggests - "the prices do the planning." In other words, the market determines the supply of parking spaces and the right price of parking. The strategies associated with parking charges are, curb pricing, parking benefit districts, and unbundled parking (Shoup, 2005).

Although impacts of this market-oriented policy have promising measures to manage parking demand, it poses long-term concerns of *spill-over* impacts, leading to political barrier to implementation of pricing strategies (Barter, 2010). Besides the spill over impact, Barter (2010) also notes the other challenges on parking pricing implementation. Those are:

- *Conflict of interest* among customers and employees;
- *Spatial competition* among retail centre or enterprises to attract customers by providing parking spaces;
- *Full market pricing and basic parking reform does not take place* because government controls the parking price and does not coordinate with the private-market pric*e*
- *The existence of informal market* can prevent the market-based pricing policy to perform.

Additionally, technology and design should be appropriate enough to accommodate the function of market parking pricing implementation. Such "high standards" of parking infrastructures are:

> "*open entry and exit, good information, a tolerable lack of market power
> and of other market failures, such as externalities, and supply that is
> responsive to price signals without too much delay or rigidity*" (Barter,
> 2010, p. 578)

Downtown users are thought to primarily come from surrounding municipalities in the county or nearby counties. Therefore, *local institutions need to integrate parking policies into an area-wide transportation program* (Bradley, 1996). Bradley (1996) examines off-street parking requirements among local municipal zoning ordinances in Dade County (where one of the two case studies in this research are located - Miami). He found that multiple jurisdictions have different standards, such as the dimensions of parking spaces, compact car spaces, sharing mixed-use supply, flexibility in supply, and the number of spaces based upon land use categories. By comparing these standards, Bradley tried to integrate local parking policy with county parking policies. The main purpose for integrating the policies is to

have less dependency on single-occupant vehicles (SOV) for commuters, and to shift commuters' mode choice to transit system with the resultant reduction in area-wide congestion and to mitigate air quality problems (Bradley, 1996).

In conclusion, the literature review points to challenges for parking and transit institutions in the implementation of parking policy, including: spill-over impacts, conflicts of interest among stakeholders, spatial competition of retails and business entities, coordination between government or public parking providers with private market, the existence of informal markets, the high standards of technology and design, and the integration of local and regional transportation policies and institutions.

DATA/METHODOLOGY

To understand the connections between parking and other downtown planning goals, we researched best practices in parking supply and demand management, and collected and mapped data on the location of the parking and transit supply in downtown Fort Lauderdale and Miami. We analysed comprehensive plans, transit development plans, transportation investments plans for the Miami-Dade region, and interviewed approximately 60 (sixty) policy makers, planners, and private and public sector organizations in these downtowns, and developed an implementation strategy for each downtown.

First, we found best practices in parking supply and demand management from the literature and both Miami-Dade Transit and/or Broward County Transit Development plans. The study cases are selected based on the relative similar characteristics of population, housing, and employment. Furthermore, cities with parking and transit related practices get more consideration as the study cases for taking the lesson learned. In this paper, we examine eight (8) study cases. Specifically, San Francisco (CA) is selected because the San Francisco Municipal Transportation Agency (SFMTA) uses an approach that closely integrates both parking and transit. Boston (MA) and Washington, D.C are selected because they are Miami-Dade County's peer cities for fixed-route bus and heavy rail, while Seattle (WA) is listed as a fixed-route bus peer in the Miami-Dade County Transit Development Plan 2010 – 2019. The Broward County Transit Development Plan 2009 – 2018 stated Austin (TX) and Charlotte (NC) are fixed-bus peers for the Broward County Transit. Denver (CO) has incorporated parking in the city's Transit Oriented Development goals and has employed parking management in city plan documents. New Jersey region focuses on multimodal transit system and smart growth initiatives, as well as recognizing multilevel and private partnerships to achieve those initiatives' goals.

Second, we collected data for parking inventory during field visits to Miami and Fort Lauderdale in May 2010 and August 2010. Using the data, we mapped the parking inventory onto parcels data that is available through the Florida Geographic Data Library (FGDL). In addition, we also checked the parcels of parking spaces using Google maps. This paper shows the map and locations of parking inventories for both downtowns.

The third part of the methodology is the stakeholder interviews. Sixty stakeholders were identified using a snowball technique. The interviews were performed face-to-face or by phone, to understand several themes in the context of the study, such as: issues about coordination between various agencies and to coordinating land use, parking and transit, and the role of government

This study focuses upon two (2) cases - downtown Fort Lauderdale and downtown Miami. The boundaries of downtown Fort Lauderdale are delineated by the jurisdiction of the Downtown Development Authority (DDA). DDA is an economic development agency, and has a stated role of renewal of slum and blighted areas in the downtown (DDAFTL, 2009). The downtown is about 0.57 square miles, with the boundaries: NE 6th Street on the north, the New River on the southwest, SE 7th Street on the southeast, NE/SE 5th Terrace on the east, NW 2nd Avenue on the west, and the boundary of SW 7th Avenue and SW 2nd Avenue from north to south

Moreover, the city of Miami also has a Downtown Development Authority, known as the Miami DDA. The primary goal of the Miami DDA is to develop Downtown Miami

> "*to be the most liveable urban centre in the nation and strengthening its position as the international centre for commerce, culture and tourism*"
> *(Miami DDA, 2009)*

The Miami DDA's jurisdiction encompasses 1.7 square miles. In this study, downtown Miami's boundaries also follow the jurisdiction of the Miami DDA. Consequently, the boundaries are: NE 9th Street on the North, the Miami River on the South, Biscayne Boulevard and Bay-front Park on the east, and SE 1st Avenue on the West. The following figure XX displays the area for study cases
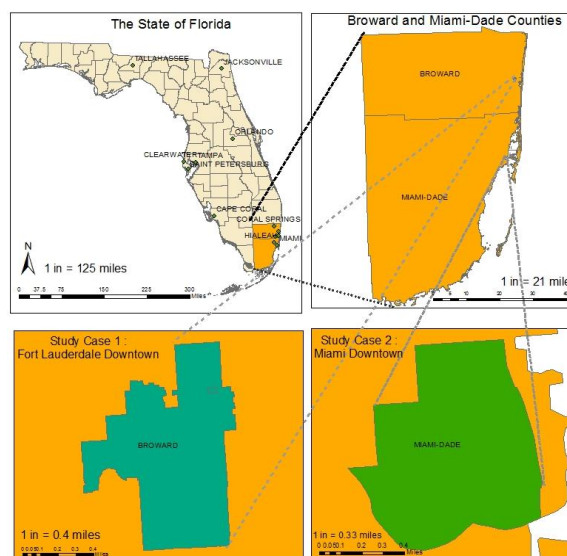

Figure 1. The Study Cases Boundaries

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CASE STUDIES OVERVIEW

The Condition of Parking and Parking Supply and Demand Management Strategies

Parallel to the challenges on abovementioned reviews, current parking condition and strategies in both downtowns are explored. First, the quantity of parking supply in both Miami and Fort Lauderdale's CBDs are quite large and may be a barrier for users to prefer the use of transit as an alternative mode over car. Parking inventory in both CBDs illustrates the generosity of parking supply. Figure 2 displays the parking inventories for both of these CBDs. The figures below show that off street spaces (combined between commercial and public) are available. This data on parking spaces does not include the business entities that provide parking for their employers and could not be used by the public. If this data was included, the number of parking spaces available for downtown travellers in general is more than what we get here.
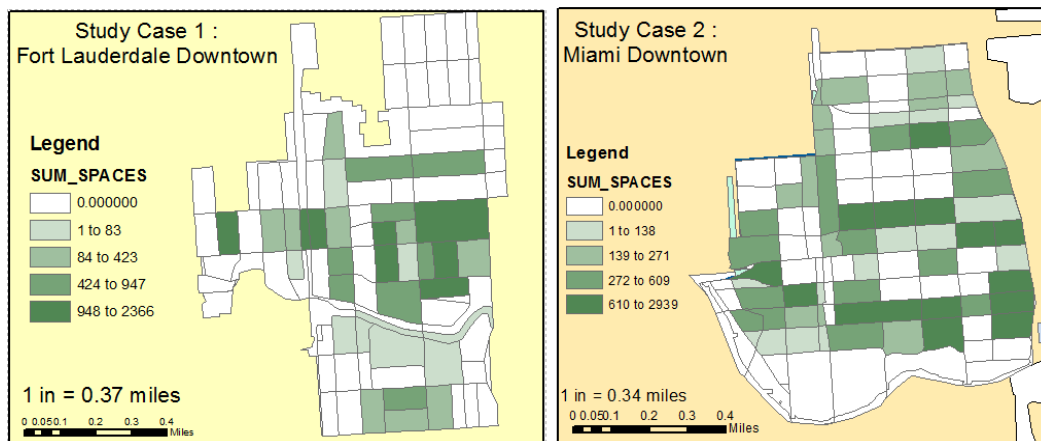

Figure 2. Parking Inventories

Second, these downtowns experience the existence of lesser intensity parking spaces. This term is given to parking facilities that seem informal based on observation and examination through Google maps, but are permitted by zoning regulation to adjusting the incidental demands, such as for an event. From our observation, lesser intensity lots hold around 544 parking spaces in the Miami downtown and 281 parking spaces in the Fort Lauderdale downtown.

Third, the parking sector in both downtowns involves many parking providers. Not only are many of them lesser intensity parking providers, but also commercial parking providers. Private sectors provide two thirds of the quantity of parking spaces in Miami - 11 providers and 2 unknown private providers - while Fort Lauderdale CBD has around 13 parking providers.

After we study the study cases, parking pricing and management strategies that have been implemented are still underutilized and open the possibility for additional improvements. Currently, both CBDs have potential to adjust their parking charges based on variable pricing since currently the prices are around $1.25 to $1.5 per hour for on-street parking. According

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to A. Noriega (personal communication, May 3, 2010), location is one of the considerations in defining the rates of parking on the Miami Parking Authority (MPA)'s parking lots. Fort Lauderdale has different prices for parking based on high-demand areas to accommodate short-term parking (D. Alarcon, personal communication, June 3, 2010).

Additionally, Fort Lauderdale has been implemented other parking management strategies, such as parking enforcement that fines violators between $25 and $50. Strategies have been implemented in Miami: the shared parking, parking Maximum, Employer Discount Program (EDP) gives a 25% off to posted passes' prices, nested parking is used as a strategy that lie in between unbundled and shared parking for resident and commercial uses, flexibility on the negotiation of parking requirements, car-sharing at the University of Miami and Florida International University, and the Car2Go program was introduced in June 2012. Moreover, both CBDs have acknowledged parking exemption strategies, addressed Transit Oriented Development in the policy documents, used technology for revenue collection (pay-and-display meters and pay-by-phone systems), and connected the transportation system into the Park and Ride facilities. Significant efforts towards bicycle facility development and bicycle sharing programs have also been introduced in both CBDs.

The Condition of Transit

Various types of public transportation connect and operate in the Fort Lauderdale CBD and Miami CBD. Tri-rail and its shuttles, bus routes (BCT), and Sun-Trolley—as downtown circulators—serve Fort Lauderdale CBD. In addition, Broward County has 18 park-and-ride facilities. Moreover, three vanpools serve Downtown Fort Lauderdale (S. Glenn, personal communication, August 6, 2010). Downtown Miami offers Tri Rail, shuttles, metro bus, Metrorail, Metro mover as the downtown circulator, and Para-transit services. Although park-and-ride lots are not present in the CBD, the facilities do support commuters from Miami-Dade County and South Florida whose final destination is the CBD. Furthermore, vanpool service is also available - 197 vanpools operate in South Florida overall, 24 vanpools in Downtown Miami, and 3 vanpools in Downtown Fort Lauderdale (S. Glenn, personal communication, August 6, 2010).

However, these services have not warranted enough for Miami and Fort Lauderdale commuters to switch from their cars to using existing transit systems. According to the National Household Travel Survey (NHTS) 2009 Florida Department of Transportation (FDOT) file, the proportion of transit users is 1.19 % for all of Southeast Florida, including Broward, Miami-Dade, and Palm-Beach Counties. From the total of 28,951 trip samples, around 80.70% of those were personal automobile users.

The Condition of Institutions

Different parking providers and various public transportation services have involved with both CBDs and the overall Southeast Florida regional planning system. Specifically for parking, transportation, and land use planning in both Miami and Fort Lauderdale, the complete list of

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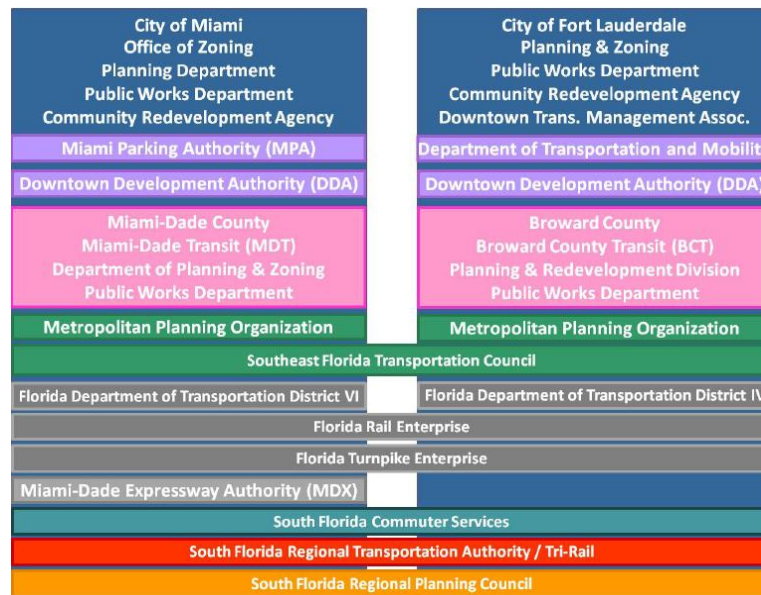
institutions is listed in figure 3.

Figure 1 – Miami-Fort Lauderdale Agencies and Government Bodies (Adapted from M. Cahill, personal communication, May 3, 2011)

First part (Blue highlights) indicates the departments or divisions within the City of Miami and City of Fort Lauderdale. These cities have agencies for planning, zoning, and transportation. They are referenced with different names, for example: Miami has the office of zoning and planning department, while Fort Lauderdale has planning and zoning, however both departments work for the local government comprehensive plan and evaluate the proposals of the development. They also have Public Works Department to do the maintenance of streets and other transportation sector works and Community Redevelopment Agency to plan and to improve dedicated areas.

Second part (purple highlights) shows Downtown Development Authorities that assure the economic state and strength of both downtowns. In addition, Fort Lauderdale has non-profit organization, the Downtown Transportation Management Association, who cooperates with the Fort Lauderdale DDA and Department of Transportation and Mobility (DTM) "*to provide convenient, accessible, and reliable transportation in the advancement of economic vitality, a clean environment, and support of our community*" (DFLTMA, 2011). DTM operates on-street parking and public-owned off-street parking garages in Fort Lauderdale CBD, while the Miami Parking Authority (MPA) has similar functions of DTM in Miami CBD.

In the county level as indicated by the pink highlights, Miami-Dade Transit (MDT) and Broward County Transit (BCT) are the entities responsible for transit provision in the CBDs of Miami and Fort Lauderdale and the rest of their counties.

Furthermore, each county has Metropolitan Planning Organization, who has the responsibility of implementing the Long Range Transportation Plan, Transportation Improvement Projects (TIP) and other functional plans (Broward MPO, 2011). The South

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East Florida Transportation Council (SEFTC) is a formal forum to coordinate all planning efforts from those MPOs, including the MPO of Palm-Beach County (SEFTC, 2011). Both MPA and SEFTC are indicated by green highlights.

Grey highlights indicate the FDOT, the Florida Rail Enterprise, the Florida Turnpike Enterprise, and the Miami-Dade Expressway Authority (MDX). Specific FDOT districts are the main contacts to ensure the coordination of multimodal transportation planning in the respective districts, which are district VI and IV for Miami-Dade and Broward respectively. SFRTA (red highlights) coordinates the Tri-Rail commuter services and other transit agencies in Broward, Miami-Dade and Palm-Beach counties. The coordination of these three counties include commuter service (South Florida Commuter Service on blue highlight) and all regional level planning-related initiatives (South Florida Regional Planning Council on orange highlight).

RESULTS

The results of this research are presented in two parts: (1) the coordination challenges of parking management in the study cases, and (2) the application of best practices to the case studies in South Florida. In the first part, we identify the challenges and barriers to coordination between and among agencies of the cases, with aspects of challenges that are explained on literature reviews. In the second part, we explore the condition of best practices are provided for eight comparable cities and regions.

The Coordination Challenges of Parking Management in the Study Cases

As what we find from parking, transit and institution condition, these two study cases have the potential to improve and utilize parking management strategies. Existing conditions of each CBD indicate relatively abundant parking supply in the two downtowns; and the integration of parking policy with transit development. Therefore, coordination among entities becomes the primary challenge.

First, these two study cases have several entities in transportation planning that may indicate challenges to internal, vertical, and horizontal coordination. Vertical coordination means the coordination between different levels of agencies, for example state/provincial, regional, municipal and special districts (VTPI, 2010), while horizontal is the coordination of different agency on the similar level. Respondents from the interviews also acknowledged a challenge in the coordination of transit and parking aspects. In these study cases, no formal coordination or consultation between transit agencies and local government has been formed in establishing parking policies.

The second challenge is coordination between private-owned and public-owned parking. Private entities own most parking lots and garages in both the Miami and Fort Lauderdale CBDs. There is no formal coordination among private entities and public institutions for

providing integrated parking service in the downtowns. Actually, this challenge confirms the challenge of *spatial competition* or *corporation traps* from the literature, where prices and parking supplies are used as a tool to attract customers for corporations and off-street or garage providers.

The third challenge is the lesser intensity market. Parking inventory in both the Miami and Fort Lauderdale CBD shows that there are significant numbers of parking sites with the lesser intensity market. Although slightly different effect to the challenge of *informal parking providers* from the abovementioned literature, the parking institutions should be able to coordinate with private providers as well as should minimalize the existence of the lesser intensity market.

The final challenge is the standards of parking infrastructure and transit provision. Currently, both the Fort Lauderdale and Miami CBD have been using proper technology to show information for parking locations and payment systems. Our interview respondents see the enhancement of community and city's visions, and understanding varied users' needs in parking and personal preference, related to the events and attractions as the important issues. Transit and parking should be integrated to serve special events and major attractions, special attention should be given to signage, spill over effects and special transit system. For example, tourists or visitors demand good directions and information because they do not know the area and do cruising to find parking, which then causing congestion.

Best Practices in Parking Supply and Demand Management

Based on the issues and challenges inherent in the study cases, we explore lessons learned from the best cases. The focuses are on parking strategies that have been utilized in response to the study cases' specific issues, policy documents or initiatives that support the integration of parking and transit, and how the related institutions collaborate.

Parking supply and demand management and transit strategies

All best practices city show various parking management strategies and transit development. San Francisco (CA); Washington (DC), Denver (CO), and New Jersey (NJ) implement parking strategies that are supported by the intensity of transit services. Variable pricing is operated in San Francisco based on demand (reserving 85% occupancy level) and in Washington, D.C. based on location, such as: location with premium demand zone has the price of $2.00 per hour and a normal zone has the price of $0.75 per hour (DDOT, 2010).

Second, they apply parking restrictions within the CBD. San Francisco has city code for parking restriction, and Washington, D.C. has limited parking spaces due to the hour's enforcement and high prices for parking in the CBD. Enforcement durations are 2 hours or less and some garages are $15 a day (N. Abass, personal communication, September 27, 2010). In addition, San Francisco has utilized technology to understand the parking condition. Information about parking availability, and pricing for users can be obtained

through multiple applications, such as phone, text message, and electronic display. The pricing signs are updated based on the pricing formula, if needed (SFMTA, 2011). As part of SFpark program, San Francisco has advanced way finding and signage of parking. San Francisco also has the Commuter Benefit Programs to encourage commuter using transit and the 25% parking tax on all parking garages.

Other best practices cities, such as Boston (MA), Austin (TX), Charlotte (NC), and Seattle (WA), utilize parking restrictions and other means of transit encouragement strategies. Boston (MA) freezes off-street parking to improve air quality (City of Boston, 2010), and Charlotte (NC) implements CBD infill development. This leads to a net decrease of approximately 19,000 parking (D. Macdonald & J. Kimbler, personal communication, August 5, 2010). Washington (D.C.) has a Reduced-fare program, Austin (TX) gives free fares to students and faculty, Charlotte (NC) uses an employee transit coordinator program, and Seattle (WA) has free ride zones.

Parking and Transit Policies and initiatives

Policies and initiatives that relate to parking, transit and land-use support the implementation of parking supply and demand management and transit strategies. San Francisco, Washington D.C., Denver, New Jersey, Austin, and Charlotte have programs and policy documents that integrate those abovementioned aspects.

As a part from the Urban Partnership Program federal grant that it contributes to 80% fund of it (J. Primus, personal communication, September 29, 2010), San Francisco applies the SF*park* program that advances the efficient parking activities through information, way finding, and signage. This program utilizes the various Intelligent Transportation Systems (ITS) to improve users' information about the number of vacant parking spaces, pricing, and locations. This city has applied the Livable Street Plan and a bicycle program and plan. Also, Washington, D.C. is implementing livability studies, performance-based parking pilot projects, and neighbourhood parking plans.

Denver has the "Living Streets" program. Together with its policy documents that integrate parking, land-use and transportation, such as Blueprint Denver, Greenprint Denver, Strategic Parking Plan (SPP), and the comprehensive plan, Denver has been a pioneer city in performing Transportation Oriented Development activity. New Jersey has transit and smart growth initiatives that are included on the New Jersey Long Range Transportation Plan (NJDOT, 2008). The City of Austin's Strategic Mobility Plan incorporates parking and multimodal network (City of Austin, 2008, p. 1). In addition, Charlotte is employing the private to operate on-street through Park It! Program.

The coordination of institutions in parking, transit, and land-use

The best cases show different types of coordination for parking, transit and land use institutions. As the examples: San Francisco has combined city-county institution,

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Washington, D.C. acquires quasi-governmental agency and regional partnerships, Denver consolidates city-county institutions, New Jersey has coordination meetings, Austin employs the Capital Metro as independently operating agency, and Charlotte puts the coordination on the same level of government agencies.

The city of San Francisco has a single entity, the San Francisco Municipal Transportation Agency (SFMTA) that regulates both parking and transit. It also coordinates three other institutions: the San Francisco Municipal Railroad, the Division of Taxis and Accessible Services, and the Division of Parking and Traffic (SFMTA, 2010). SFMTA has complete roles in transportation system. Besides managing transit network and parking supplies, SFMTA also regulates pedestrians, traffic, bicyclists and taxis (SFMTA, 2010). Consequently, because of its roles, SFMTA enables not only to coordinate parking and transit policies but also to integrate multimodal transportation aspects into that coordination.

Two institutions in Washington, D.C. are the Washington Metropolitan Area Transit Authority (WMATA) and the District Department of Transportation (DDOT) that authorize transit and parking in Washington D.C area, respectively. WMATA, a quasi-governmental agency and funded by federal government, performs regional cooperation among states of Washington D.C, Maryland, and Virginia (Abass, N, personal communication, September 27, 2010). It also manages the metropolitan rail system that includes five lines and 86 stations, 319 bus routes, a downtown circulator, and park-and-ride outside the boundary of the District of Columbia (WMTA, 2010). Other institution, DDOT, handles public parking, management and maintenance of transportation infrastructure within the District boundary. Both institutions coordinate in reduced fare and other transit issues.

Denver (CO) is included in Regional Transportation District (RTD) services, which bus, light rail and sky-ride (RTD, 2012). Currently, Denver develops transportation systems and incorporates them into Transit Oriented Development (TOD). To achieve TOD goals, the city works with other agencies, such as the Denver Housing Authority, and has been formed a working group with various agencies. Relates to parking issues, Denver developed a Strategic Parking Plan (SPP) that provides the integration of parking into other city's goals, Consequently, Denver gives example of coordination in parking area, both between cities and within the greater Denver region.

The New Jersey Department of Transportation and NJ Transit have been collaborating to prioritize transit and smart growth, for instance, by creating partnerships at all levels of governments and private sector (NJDOT, 2008). Besides improving bus services, both institutions cooperate with the TMAs, hold biannual Transportation Coordinating Committee meetings, and revise or change manuals and plans document to increase the integration of land use and transportation

Austin (TX) employs distinctive institutional scheme in managing transit compared to previous cases. The state of Texas established an independent agency to operate transit in the Austin, which is funded from a reserved sales tax imposed from its jurisdiction (Steiner,

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2010b). Furthermore, this agency, the Capital Metropolitan Transportation Authority (Capital Metro), also runs nine park-and-ride facilities for express buses and rail stations as well as three shuttle routes to service unlinked areas from CBD station. Additionally, Capital Metro has programs to support Transportation Demand Management (TDM).

The City of Charlotte manages transit and parking within its two agencies, the Charlotte Department of Transportation (CDOT) and the Charlotte Area Transit System (CATS), respectively. Since both agencies reports to the same authority, the agencies have well-coordinated transportation system operation (Macdonald & Kimbler, personal communication, August 5, 2010). CDOT transferred the management for 1,100 on-street parking spaces in the CBD to the privately-managed, Park It! Program.

DISCUSSION

Generally, our findings suggest that the land use regulations are in place to promote sustainable land use, and transit is generally available in both CBDs. Coordination among transit institutions has been established. However, parking is readily available and pricing and other management strategies are not used strategically.

Abundant parking spaces are available in the study cases. It indicates that the means of parking supply and demand management could be enhanced. Both Fort Lauderdale and Miami CBDs can take the lesson learned from the best cases, for example by employing variable pricing as what San Francisco has (to ensure 85% parking occupancy) or what Washington DC do (based on location). To have effective pricing strategies, those should be implemented in parallel with any type of parking restriction in the CBD areas. Fort Lauderdale CBD has a kind of parking restriction, but it still has potential to be improved. Our best cases have implemented the freeze on off-street parking development (Boston) and the CBD infill development (Charlotte). In addition, San Francisco employs the city code for parking restriction that may be used as options if the strategy of parking reduction is going to be adopted. As a note, either pricing or parking reduction should be supported by the readiness of transit or other multimodal transportation to accommodate possible shifting demand of car users.

The integration between parking, transportation and land use requires solid coordination among institutions. Many entities and different levels of government are involved in land-use, parking and transportation sectors in the study cases. Improving the coordination of those entities is a concern, including internal, vertical and horizontal coordination. The best cases show different alternatives of coordination that may or may not be adapted to the cases of Fort Lauderdale and Miami. San Francisco has single entity, SFMTA, which control all transit improvement, parking management, and transportation demand management. Although this approach offers efficiency and great coordination, adoption of the approach needs careful examination and may not be implemented in the short term. A combined city/county form of government, as what Denver has, cannot be fully endorsed to Miami and Fort Lauderdale CBD cases. Other coordination in Denver, such as in TOD approach, that involves Housing

Authority can be a useful resource to be consider in those CBDs.

In addition, better coordination between city agencies of parking and transit and regional entities has been a concern in the CBD cases. Washington, D.C. displays the example of a regional partnership and New Jersey applies the coordination between The New Jersey DOT and NJTransit. Based on New Jersey approach, the FDOT should build the partnership with regional and local agencies in multimodal planning.

Having initiatives and programs on parking, transit and transportation demand management can also embrace stronger coordination of related-institutions. Taking as examples are Denver with its living street program, New Jersey with transit and smart growth initiatives, and Austin with the Austin Strategy Mobility Plan. Those programs requires intensive coordination and subsequently that coordination may reinforce the relationship among institutions-related.

Planning and policy documents should accommodate those abovementioned coordination and programs. Having the documents means developing the formal coordination among institutions. Denver owns documents that may formalize the coordination of institution for related topic. For example are: Blueprint Denver that coordinates land use and transport, and Strategic Parking Plan that examines parking with other goals of livability and economic development.

The study cases experience the lack of coordination between private-owned and public-owned parking. Actually, current projects in Fort Lauderdale CBD and Miami CBD to have uniform signage and way finding system are initial efforts to build the coordination. The potential to have better coordination is by incorporating the private-owned parking providers in the program. In addition, the regulation of uniform pricing or other measurement for variable pricing has been called as the need in both CBDs. Currently, not even signage of pricing is not similar for users to be familiar with. Although this effort may seem complicated, San Francisco shows the good case where the coordination between private and public owned can be established through SF*park* way finding system and also variable pricing system.

The availability of lesser intensity market may indicate that utilized lands of those markets are less productive that those potentially could be. San Francisco taxes 25% for garages and lots in the city. This strategy can be adapted to reduce the lesser intensity market because by taxing high enough, the providers or land owners are expected will search more productive activities to pay the tax.

Another challenge in parking management implementation is the standards of parking infrastructure and transit provisions. Although Fort Lauderdale and Miami CBD have information for parking locations and payment system use, those can be enhanced by acknowledging the way finding, the pricing information, and the integration of system to the multimodal information. San Francisco by its SF*park* program has efforts to have this kind of

way finding and pricing information. However, the integration to multimodal transportation, for example is with park-and-ride, has not been introduced.

CONCLUSIONS

Parking and transit have a reciprocal relationship because of their nature as a mode choice problem. If parking supply remains available and affordable, or even free, it hinders a transit-oriented development. Downtown as an activity center experiences the importance of parking and transit policies' synergy. Consequently, transportation entities, in general, and parking and transit providers, in particular, need to coordinate their policies and operations.

However, parking and transit institutions faces challenges in coordination and other conditions. First, coordination involves many institutions, for instances: among different layers of institution, within the same level but different agencies, and between private parking providers and public providers. In the study cases, these collaborative efforts have been initiated, but comprehensive approach for parking coalition with transit system, and for those in reverse, still need significant improvement. The best practices offer the possibility of different institutional arrangements. Although the exact entity type cannot be adopted, the process and flow in the coordination can be carried out. For example, the coordination can be accomplished through initiatives and program, and formal coordination can be obtained through the policy documents, such as liveability studies, strategic parking plans, or TOD coordination.

Other measures of parking management strategies, such as way finding, Intelligent Transportation System (ITS) on user and pricing information, parking restriction in CBDs, variable parking pricing, and tax on commercial parking spaces, may help in handing following conditions. First, the high standard of parking and transit system can be achieved with good way finding and ITS system. Then, abundant parking in CBDs that may hinder transit utilization can be managed through parking restrictions and variable parking pricing. Last, the availability of lesser intensity market, which may hinder the parking policy enforcement, can be lessened by having tax on commercial parking spaces.

With various parking management strategies, transit systems should be ready to accommodate the expected shifting demand of automobile to transit. With the coordination on city and regional transit and parking institutions, they should be able to provide additional frequency and improve the reliability of transit service, as well as integrate information system on transit and parking. Most importantly, the main challenge is the commitment and tough willingness from varied entities to coordinating in planning, parking and transit to support their downtown areas.

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