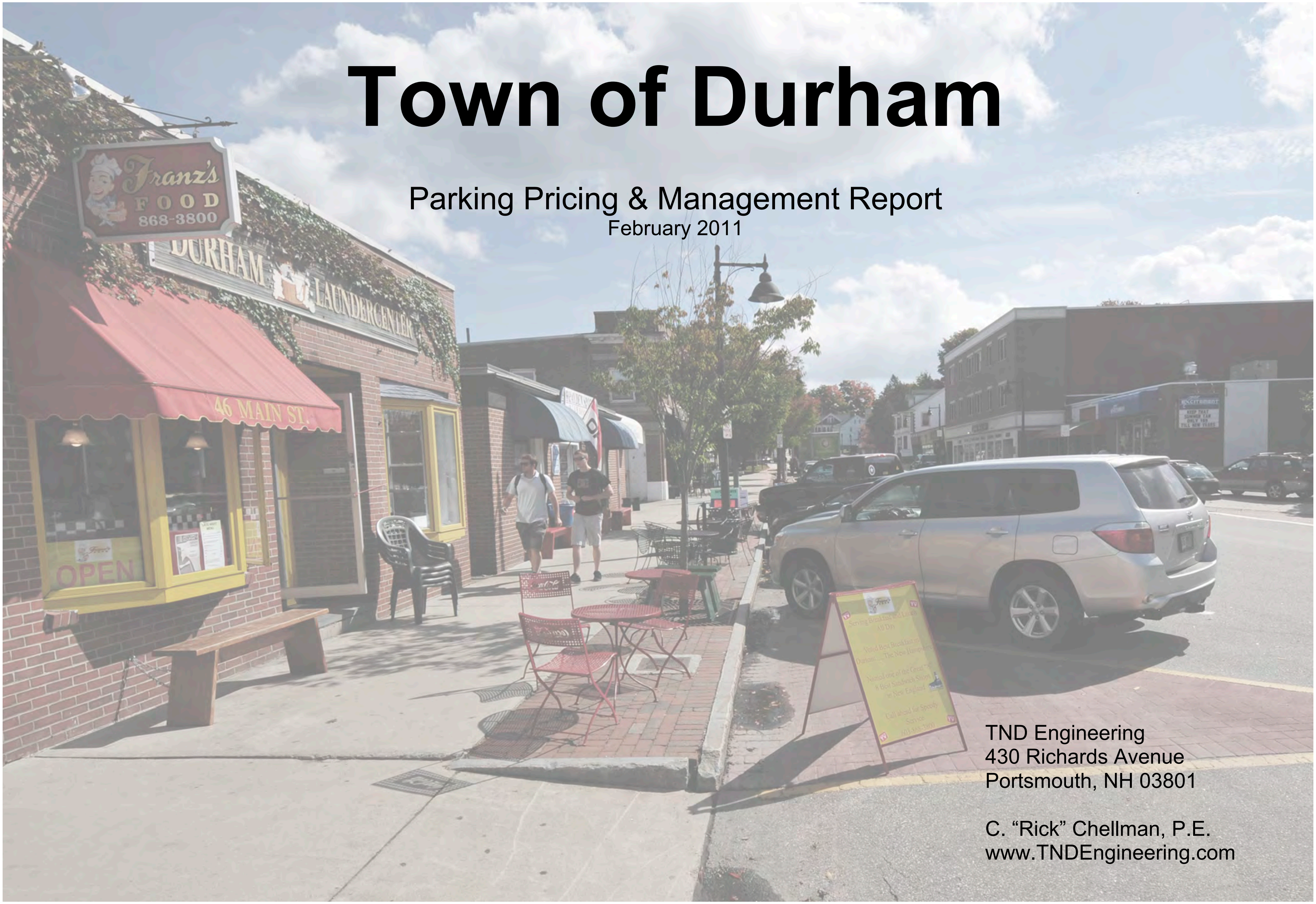

Town of Durham

Parking Pricing & Management Report

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1.1. Introduction

The Town of Durham has a downtown area that was the partial focus of a master planning effort by B. Dennis & Co approximately one year ago. That report contains many references and recommendations and is a stand-alone document.

This report describes and discusses many current methods pricing, management and enforcement of downtown parking. It is intended as an informational source as well as a report with observations and recommendations.

Demand Management

Demand management strategies focus on influencing behavior of those traveling to the destination with the intent of balancing the number of vehicles at levels the supply can handle. Demand management influences traveler behavior to maintain occupancy levels of 85-percent considered the ideal level of utilization for on-street parking. This is most effectively achieved through the pricing of parking to influence use and create more balance in the parking system. The following section explains the potential management of parking demand through the use of pricing. This is followed by descriptions of series of revenue collection technologies that facilitate pricing and offer different improvements to customer benefits, enforcement, revenue collection, and availability for customers,

AN 85% OCCUPANCY RATE IS A WIDELY-ACCEPTED INDUSTRY STANDARD FOR OPTIMAL ON-STREET PARKING OCCUPANCIES AND 90% FOR OFF-STREET PARKING FACILITIES. THESE ARE TARGET RATES FOR PREVENTING THE ADDITIONAL AND UNNECESSARY TRAFFIC CIRCLING FOR A SPACE WHILE STILL MAKING GOOD USE OF THE PARKING SUPPLY AND ATTRACTING CUSTOMERS.

employees, residents, and visitors.

1.1.1. Demand Responsive Pricing

Demand responsive pricing involves altering the cost of parking according to level of demand using market principles. In other words, drivers pay what they are willing to pay; in areas with higher demand, parking has a higher price; areas with lower demand, have a lower price. For some places, the market rate for parking is free. Prices generally will not change in real time based on current occupancy, but will instead be adjusted a few times a year based on recent occupancy data. By refining the price of parking periodically, it is possible to keep parking occupancy rates relatively close to the optimal 85-percent.

Figure 1 Demand Responsive Pricing

Case Study City Redwood City, CA

In 2007, Redwood City, CA implemented a demand responsive parking pricing strategy to maintain an ideal utilization rate of 85% at their more desirable "front-door" curb spaces along Broadway, their primary commercial street. Prior to 2007, Broadway had 1-hour time limits but no meters, which resulted in nearly 100-percent utilization all day, every day. The strategy involved installing multi-space meters and pricing different zones according to the observed demand. The initial approach instituted a clearly communicated $0.75/hour price on the main commercial strip and removing time limits completely. The program is revisited four times a year by evaluating occupancy data and adjusting pricing by increments of $0.25 up to four times a year. The goal of this quarterly adjustment is to achieve the target 85-percent utilization rate in each of the three designated pricing zones. Following the implementation of this hourly charge, the occupancy rate has averaged roughly 82-percent, parking stays have averaged 72-minutes, and off-street parking lot permit sales have increased by 50-percent.

Best Practices

- New York City, NY (Park Smart)
- Redwood City, CA

Figure 2 **Demand Responsive Pricing Evaluation**

Timing Considerations	
Timeframe for Implementation	Short
Timeframe for Impacts	Months
Economic Considerations	
Capital Cost	No direct capital cost. Systems are typically built on on top of other technologies such as electronic meters, variable message boards, and curbside sensors. Costs are listed for these technologies in other sections of this matrix
O&M Cost	Monitoring demand and adjusting pricing requires some administrative support. Systems are typically built on top of other technologies such as electronic meters, variable message boards, and curbside sensors. Costs are listed for these technologies in other sections of this matrix.
Fiscal Impact	Market rate pricing can result in high revenue.
Staffing Needs	Less enforcement needs because no/fewer time limits. Administrative staff needed to monitor demand and recommend price adjustments.
Facilities Considerations	
Effect on Demand	Helps achieve real-time supply/demand equilibrium potentially decreasing demand by 30-80%
Effect on Supply	No direct & independent effect.
User Impact Considerations	
Effect on Employee Parking Availability	Maximizes short-term parking availability and increases turnover likely shifting employees away from the most desirable locations.
Effect on Residential Parking Availability	Maximizes short-term parking availability and increases turnover likely shifting residents away from long term parking in the most desirable locations.
User Benefits/Customer Convenience	Ensures that there is always a short-term parking space available in high-demand areas. Decrease in traffic because it reduces "cruising" for parking. Encourages long-term parkers to park off-street in less desirable locations. Avoids "2-hour shuffle" of moving cars.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	No direct & independent effect.

1.1.2. Multi-Space Meters

Multi-space meters provide more payment options, including bills and credit/debit cards. This makes payment more convenient for parkers, as they do not need to carry around excessive amounts of coins and don't park illegally when they don't have a quarter. Pay stations eliminate the need for a post and meter head at every parking space, promoting more open, pedestrian-friendly sidewalks and possibly reducing visual blight. This is particularly true on block faces with angled parking, where single-space meters are placed closely together. Each pay station serves approximately 7 to 8 parking spaces.

This technology often results in a significant decrease in operation and enforcement costs over traditional meters, as the status of parking facilities can be monitored remotely from the central office. These stations also help improve accountability since the meter digitally accounts for all collected monies. Another advantage of this parking strategy is that if one kiosk is broken, parkers can easily use an adjacent kiosk to pay for their parking, thereby eliminating the issue of free parking at broken meters. This type of meter does cost notably more to install than do traditional parking meters, but anecdotal evidence suggests that these additional costs can be recouped quickly through savings in operations costs and higher revenues compared to traditional meters.

Pay-and-Display

Pay-and-Display meters allow drivers to purchase a "certificate" for paid parking time which can then be displayed on their dashboard to prove compliance. This eliminates the need to paint stalls, which may increase the parking supply by, as much as 20-percent. It is less convenient than pay-by-space stations because the driver must return to the car to place the certificate in the vehicle and again when the time has expired.


Figure 3 Multi-Space Pay & Display

Case Study City Park City, UT

Park City, Utah, a growing world-class summer and winter mountain resort destination nestled in the Wasatch Mountains and the home of over 7,300 full-time residents, implemented a multi-space pay and display program in 1998 in an effort to better manage parking on Main Street and to incentivize the use of transit. Modeled after Aspen, Colorado's multi-space pay-and-display parking program, it involved the installation of 32 multi-space pay stations along a half-mile stretch of Park City's historic Main Street. The meters replaced time-limited, free on-street parking with the objective of discouraging excessive employee parking and creating more parking availability for customers and visitors. To balance the strategy, free parking was made available in nearby garages within walking distance with frequent transit service available connecting the local garages with Main Street. In-car meters were also provided so that frequent users of Main Street could be given a discount on parking and experience less hassle with the new multi-space meters. Since the on-street meters were initially thought to be less intuitive than standard single-stall meters, Park City implemented a policy of issuing friendly educational citations with no monetary penalty for first time offenders.

Initially confronted with a significant amount of local business resistance, Park City identified a need to involve stakeholders and the local business community in the initial stages of the free to paid parking transition. Collaboration with businesses, and the selection of multi-space meters helped mitigate the negative feelings about converting to paid parking. Parking officials at Park City say that the business community is generally supportive. The multi-space pay and display units reduced the amount of equipment on the street minimizing the additional headache associated with snow removal (a big deal in Park City) and left more space on the narrow sidewalks available for pedestrians. Park City's system was the first in the U.S. to include Credit Card payment as an option. Patrons are happy to have multiple payment options, especially the Credit Card option because having proof of payment is viewed as a positive factor because it helps when disputing parking citations and provides a record for tax purposes.

Best Practices

- Boston, MA
- Philadelphia, PA
- Baltimore, MD
- Wilmington, MA
- Savannah, GA
- Northampton, MA
- Arlington, VA
- Cambridge, MA

Figure 4 Pay-and-Display Evaluation

Timing Considerations

Timeframe for Implementation	Medium
Timeframe for Impacts	Weeks
Economic Considerations	
Capital Cost	$580 - $1,500 (per space); multi-space meters cover an average of 7 spaces; additional signage needed.
O&M Cost	Fewer devices to maintain at $15 per month per meter and stations wirelessly communicate maintenance needs. No need to stripe/re-stripe stalls.
Fiscal Impact	Next driver does not use the money leftover from the driver beforehand, increasing meter revenue.
Staffing Needs	Reduced enforcement staff time required due to improved efficiency, potentially 1/3 the amount of time. Reduced collection staff time required due to credit and smart card payment system.
Facilities Considerations	
Effect on Demand	No direct & independent effect. Varies depending on circumstances. Increased access to data enables regulators to enact more effective pricing which can help regulate demand.
Effect on Supply	Increase in spaces per block of 15%-20% because spaces do not need to be striped.
User Impact Considerations	
Effect on Employee Parking Availability	No direct & independent effect. Effect is dependent on pricing structure and strategy. Commonly used for customer oriented parking, likely shifts employees away from ideal curb spaces.
Effect on Residential Parking Availability	No direct & independent effect. Effect is dependent on pricing structure and strategy. Commonly used for customer oriented parking but can be combined with residential permits.
User Benefits/Customer Convenience	Option to pay with debit/credit/smartcard and cash. Automatic receipts (permit on dashboard and credit card receipts). Better information (electronic screens with dynamic messaging).
Aesthetic Considerations	
Effect on Urban Design/Streetscape	Less visual clutter on sidewalk/streetscape compared to single space meters. Old meter poles can be reused for bicycle parking. Beneficial for historic districts (especially those with cobble streets) because of the lack of

Pay-by-Space

Pay-by-Space meters allow drivers to pay for parking by entering their specific space number into the kiosk when paying, rather than by providing a receipt for display on the dashboard. These stations allow customers to continue shopping or choose to stay for dinner without requiring drivers to return to their vehicle as time extensions can be paid remotely (i.e., another station, by cell phone, etc.). This method will also make space identification in snowy winter conditions easier, at the cost of additional "clutter" along sidewalks.

Figure 5

Multi-Space Pay-by-Space

Case Study City Lowell, MA

Lowell, MA uses pay-by-space multi-space parking kiosks for some on-street parking. These kiosks allow parkers to pay for parking on a given block by entering their specific space number into the kiosk when paying, rather than by providing a receipt for display on the dashboard. Lowell replaced roughly 250 traditional parking meters with 35 of the new kiosks, which each serve approximately 7 to 8 parking spaces. The Parking Department in Lowell estimates that these changes have resulted in a forty percent increase in parking collections and a twenty to thirty-five percent decrease in operations and enforcement costs, since the status of parking facilities can be monitored remotely from the central office. These kiosks also help improve accountability since all collected monies are digitally accounted for by the meter, and "digital chalk" parking enforcement technology means that enforcement officers no longer need to manually patrol meters. Though Lowell officials stress that their kiosks are highly reliable, another advantage of this parking strategy is that if one kiosk is broken, parkers can easily use an adjacent kiosk to pay for their parking, thereby eliminating the issue of free parking at broken meters. While these kiosks end up costing about 40% more than traditional meters to install, Lowell estimates that the additional capital cost was recovered within the first year of operation due to operational savings and higher revenues. The program has been so successful in Lowell that the city is hoping to add an additional 20 pay-by-space kiosks later this year.

Best Practices

- Lowell, MA
- Redwood City, CA
- Whiterock, BC
- San Francisco, CA (motorcycle only)
- Charlotte, NC (pilot)
- Glendale, CA

Figure 6 Pay-by-Space Evaluation

Timing Considerations	
Timeframe for Implementation	Medium
Timeframe for Impacts	Weeks
Economic Considerations	
Capital Cost	$580 - $1,500 (per space); multispace meters cover an average of 7 spaces; additional signage needed.
O&M Cost	Fewer devices to maintain at $15 per month per meter and stations wirelessly communicate maintenance needs.
Fiscal Impact	Next driver does not use the money leftover from the driver beforehand, increasing meter revenue.
Staffing Needs	Reduced enforcement staff time required due to improved efficiency, potentially 1/3 the amount of time. Reduced collection staff time required due to credit and smart card payment system.
Facilities Considerations	
Effect on Demand	Potential for a minor effect. Varies depending on circumstances. Increased access to data enables regulators to enact more effective pricing which can help regulate demand.
Effect on Supply	Varies - Potentially increases supply in areas previously designated as no parking. Likely decreases supply if spaces were unmetered and not striped.
User Impact Considerations	
Effect on Employee Parking Availability	No direct & independent effect; Effect is dependent on pricing structure and strategy. Commonly used for customer oriented parking, likely shifts employees away from ideal curb spaces.
Effect on Residential Parking Availability	No direct & independent effect; Effect is dependent on pricing structure and strategy. Commonly used for customer oriented parking but can be combined with residential permits.
User Benefits/Customer Convenience	Option to pay with debit/credit/smartcard and cash. No need to return to car after paying meter. Better information (electronic screens with dynamic messaging). Can pay for additional time on space using any other pay-by-space machine (or by cellphone). Pay only for time used (can reenter space number when leaving to refund debit/credit cards).
Aesthetic Considerations	
Effect on Urban Design/Streetscape	Less visual clutter on sidewalk/streetscape compared to single space meters. Old meter poles can be reused for bicycle parking. Less litter on the street compared to pay and display meters because receipts are not required.

1.1.3. Pay by Cellphone

Paying for parking by cellphone is a strategy that allows parkers to pay without cash while eliminating the need to install new credit-card capable revenue collection infrastructure on the street. This strategy eliminates the need for coins, allow people to receive text messages notifying them that their time is about to expire as well as extend legal parking time by paying remotely. Additionally, upon returning to their vehicle, a person may terminate the parking session and avoid paying for time that will not be used.

Figure 7 Pay by Cellphone

Case Study City	Montgomery County, VA	
Montgomery County began a 90-day pilot program for drivers to pay for parking by their cell phones, and the success of the pilot has determined that the program will be expanded to the entire county. Begun on January 4, 2010, the test area includes approximately 1,200 meters in a parking lot and garage, as well as on-street meters. The program eliminates the need for coins, allow people to receive text messages notifying them that their time is about to expire as well as extend their legal parking time by paying remotely. Additionally, upon returning to their vehicle, a person may terminate the parking session and avoid paying for time that will not be used. While the County does not have customer survey data for the program, it has received a significant amount of positive feedback from the public regarding the program. Between the initiation of the pilot and April 2, 2010, more than 1,900 people have signed up for the program using it 6,749 times. At this point, there is an average of more than 150 pay-by-cell sessions per day, constituting approximately 6% of daily use within the study area. By expanding the program to the full County, 14,000 meters will be changed to accommodate this new technology.		
Best Practices	• Coral Gables, FL • Los Angeles, CA • Vancouver, BC	• West Palm Beach, FL • Montgomery County, MD (pilot 2010) • Washington, DC

Figure 8 Pay by Cellphone Evaluation

Timing Considerations	
Timeframe for Implementation	Medium
Timeframe for Impacts	Weeks
Economic Considerations	
Capital Cost	Includes cost of labeling each meter to provide clear space identity.
O&M Cost	Can eliminate maintenance of meters (some systems keep physical meters in place); Requires maintenance of pay-by-phone system.
Fiscal Impact	Increases revenue due to improved compliance.
Staffing Needs	Officials utilize PDAs that have web-browsing capabilities to identify cars that are non-compliant. No reports of a need for additional training.
Facilities Considerations	
Effect on Demand	No direct & independent effect. Varies depending on circumstances. Increased access to data enables regulators to enact more effective pricing which can help regulate demand.
Effect on Supply	Potentially introduces new parking areas.
User Impact Considerations	
Effect on Employee Parking Availability	No direct & independent effect. Effect is dependent on pricing structure and strategy. Commonly used for customer oriented parking, likely shifts employees away from ideal curb spaces.
Effect on Residential Parking Availability	Not applicable.
User Benefits/Customer Convenience	No cash or credit card needed onsite. Only charged for the time actually parked. No walking back and forth to meters. Can dial to extend time from any location. Can receive text messages to warn of almost-expired meters.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	Adds minimal signage, typically to existing parking meter heads and additional signage may also be required.

1.1.4. Smart Cards

Smart cards represent another alternative payment system for metered parking that eliminates the need to carry cash without using multi-space kiosks. Smart cards are stored-value cards that can be inserted in the meters to add time. Users insert the card when they first arrive at the meter and allow the meter to increase the time increment purchased in $0.25 steps; users remove the card when the amount of time displayed is adequate. Users are billed only for the time actually spent parking – rounded to the nearest minute by swiping the card again when they leave the space. This is another advantage over coin systems, where users may need to run back to the meter to add more time, or may overpay initially and lose the money.

Figure 9 Smart Cards

Case Study City	Princeton, NJ	
In the past few years, the Borough of Princeton, NJ has replaced roughly 1,200 on-street meters with new meters capable of accepting both coins and smart card technology. The smart cards add a level of convenience by replacing the need to carry coins. Smart cards are stored-value cards that can be inserted in the meters to add time. Users insert the card when they first arrive at the meter and allow the meter to increase the time increment purchased in $0.25 steps; users remove the card when the amount of time displayed is adequate. Users are billed only for the time actually spent parking – rounded to the nearest minute by swiping the card again when they leave the space. This is another advantage over coin systems, where users may need to run back to the meter to add more time, or may overpay initially and lose the money. Smart cards may be "loaded" or "recharged" with $20 (minimum) and up to $60 (maximum). Since this approach requires pre-payment, users receive a 10% bonus on the cash they load on the card. In addition to on-street meters, the cards can also be used at a 540-space garage. The system has been well received in the community because it has been successful at increasing convenience and fairness for users, resulting in a 20-percent drop in issued tickets since the initiation of the project.		
Best Practices	• Minneapolis, MN • Greenwich, CT • Princeton, NJ	• Bel Air, MD • Philadelphia, PA • Washington, DC

Figure 10 Smart Card Evaluation

Timing Considerations

Timeframe for Implementation	Short
Timeframe for Impacts	Months
Economic Considerations	
Capital Cost	Installation of meters and card loading stations. Roughly $600/meter including cards, software and meter.
O&M Cost	Reduced maintenance costs.
Fiscal Impact	Potential for nearly 25% increase in net revenue.
Staffing Needs	Same as standard meter enforcement.
Facilities Considerations	
Effect on Demand	No direct & independent effect. Varies depending on circumstances but pricing can help regulate demand.
Effect on Supply	No direct & independent effect.
User Impact Considerations	
Effect on Employee Parking Availability	No direct & independent effect.
Effect on Residential Parking Availability	No direct & independent effect.
User Benefits/ Customer Convenience	Unused time is refunded. No coins needed. Especially beneficial for those that park frequently.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	More streamlined, attractive, modern meters.

1.1.5. First Few Minutes Free

A frequent argument against charging for parking in commercial areas is that requiring payment for quick trips to the store might discourage shoppers, particularly those who just need to pick up a single item. One strategy employed to help alleviate this problem is offering the *first few minutes of parking free of charge*. This technique does reduce meter revenues, but because it is necessary to push a button on the meter to credit the free minutes it is generally too cumbersome for parkers to return every few minutes to reset the meter during longer-duration visits. Generally, this strategy is employed at metered spaces near destinations with high levels of quick-errand activity, such as the pharmacy or coffee shop.

Figure 11 First Few Minutes Free

Case Study City	Des Moines, IA
As a way of facilitating short-term parking for quick errands, the Downtown Community Alliance, working with the City of Des Moines, designated certain downtown parking meters in high traffic areas that would offer a short period of free parking. These meters, marked by green signs indicating they are for 30-minute parking, have a button the driver can push for fifteen minutes of free parking. The program began ten years ago, when one space close to the arena football box office was converted to a short-term meter, allowing people to park quickly and purchase tickets. The change was very popular, and the City has since expanded the program to include meters close to other high demand locations, including City Hall, the Des Moines Register (newspaper), the Iowa State Bank, as well as coffee shops and performance venues. The program does not have any goals in terms of the number of short-term meters, instead responding to the needs of the downtown demand, and installing or removing these meters as demand changes.	
Best Practices	• Des Moines, IA • Concord, MA

Figure 12 First Few Minutes Free Evaluation

Timing Considerations	
Timeframe for Implementation	Short
Timeframe for Impacts	Weeks
Economic Considerations	
Capital Cost	$350 to $500 per unit.
O&M Cost	Same as standard meters
Fiscal Impact	Reduces meter revenue.
Staffing Needs	Same as standard meters.
Facilities Considerations	
Effect on Demand	May stimulate demand for free spaces for short trips.
Effect on Supply	No direct & independent effect.
User Impact Considerations	
Effect on Employee Parking Availability	No direct & independent effect.
Effect on Residential Parking Availability	No direct & independent effect.
User Benefits/Customer Convenience	Free very short term parking. Improves customer-parking availability.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	Same as standard meters.

1.1.6. In-Car Meters

In-car meters are small devices which are loaded with pre-paid parking time. The user displays the meter in their car, often on the dashboard or hanging from the rearview mirror, and activates the device when parked at a metered space. The digital display counts down the amount of paid parking time remaining, allowing a parking enforcement officer to see through the window that the car is legally paying for the parking time. This strategy is popular with frequent users of metered parking areas, especially those who are constantly “in and out”.

Figure 13 In-Car Meters

Case Study City	Park City, UT	
Park City, Utah made in-car meters available to residents while it simultaneously implemented a multi-space pay and display program. In-car meters are available for purchase from the city for $50.00 and provide slightly discounted parking compared to the meter stations. The limited number of vendors that offer in-car meters is an important consideration when designing an in-car meter program. Park City was sure to acquire a sufficient supply of meters to ensure continuity of the program during a potential vendor search if the current vendor were to cease production. The in-car meters have been well received by those who are willing to pay for the convenience of on-street parking without having to visit the pay-and-display station each time they park. According to Park City Public Works Director Kent Cashel, the program is frequently used by Real Estate agents and business owners who need to ‘get in and get out’ quickly. Many residents who frequent main-street clubs, restaurants and shopping also use the in-car meters. Employees typically don’t use in-car meters because it is too expensive for all-day parking instead parking in one of the free public garages or using the free public transit service.		
Best Practices	• Miami Beach, FL • Ft. Lauderdale, FL • University of Wisconsin-Madison • Buffalo, NY	• Tampa, FL • Aspen, CO • Grand Rapids, MI

Figure 14 In-Car Meter Evaluation

Timing Considerations	
Timeframe for Implementation	Medium
Timeframe for Impacts	Months
Economic Considerations	
Capital Cost	$30 to $50 per unit if purchased by municipality.
O&M Cost	Reduced operational costs (no coin collection, management of petty cash, and reconciling pay-and-display tickets). Owner or vendor assumes maintenance cost.
Fiscal Impact	Better revenue management. Enables revenue collection in previously unpriced locations, expanding revenue stream.
Staffing Needs	Most users outsource operations to vendor. Enforcement similar to traditional meters.
Facilities Considerations	
Effect on Demand	No direct & independent effect. Varies depending on circumstances but pricing can help regulate demand.
Effect on Supply	Increase in spaces per block of 15%-20% because spaces do not need to be striped.
User Impact Considerations	
Effect on Employee Parking Availability	Favors people who commonly park for longer periods in the same location every day. Potentially increases parking available for long-term parking.
Effect on Residential Parking Availability	Not applicable.
User Benefits/Customer Convenience	No need for coins or cards. Better for frequent or quick in and out parkers. Do not need to walk back and forth to car. Good for those that park in the same place regularly (can be used for monthly spaces). User pays for only actual time parked.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	Traditional meters are unnecessary, removing clutter from the streetscape.

1.1.7. Pay by Plate

Pay by Plate is relatively technology similar with pay by cell phone and pay by space, as it does not require a round trip to the vehicle.

Both Vancouver, BC: http://vancouver.ca/engsvcs/parking/enf/parksmart/meters.htm

And Surrey, also in Canada have implemented pay by plate systems:

http://www.surrey.ca/bylaws-policies-licenses/4703.aspx

The Surrey site has an informative and illustrated list of parking regulations and practices, including how to use the meters.

The manufacturer (MacKay) is also based in Canada. Global/Metro also has a system and Parkeon is about to have another.

Figure 15: Pay by Plate Station

1.2. Enforcement

Most parking management systems rely heavily on enforcement to ensure that the desired policy goals of the regulations are met. However, every regulation and parking strategy can be undercut by those who attempt to ‘game the system’, reducing the efficacy of parking policy. Improved enforcement can be very helpful in reaching the parking goals set by the regulatory framework. This consists of technologies that simplify or streamline the enforcement procedures in some way, either tools that enhance the enforcement officer’s ability or automating monitoring procedures. This section includes descriptions of handheld ticket units, curbside sensors, and automated license plate readers.

1.2.8. Handheld Units

Handheld ticketing units are small, computerized devices that aid parking enforcement officers in issuing accurate and legible citations. Units can improve recordkeeping and reduce errors by directly communicating with central records; account for more complicated regulatory structures such as fines that escalate with each additional violation; and print the citations which improves legibility over handwritten notices.

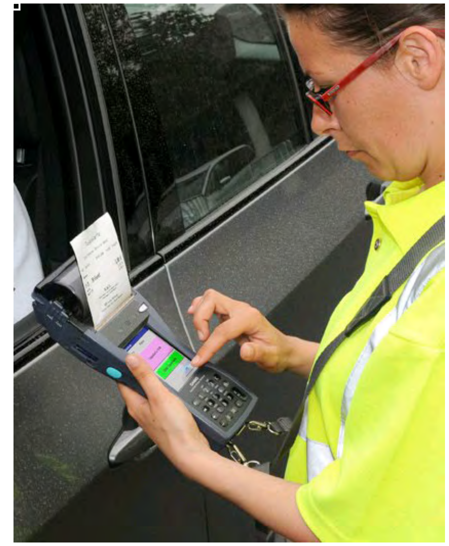

Figure 16 Handheld Ticketing Unit

Case Study City	Provincetown, MA
Provincetown, MA has utilized handheld computer technology to enforce parking regulations and issue tickets for the past eight years. The handheld system accommodates the different parking permit privileges for year-round residents, property owners, and full summer residents, as well as the varying permitted parking times for meters. After incorporating handheld technology into their enforcement practices, Provincetown now issues 12,000 citations a year using this system with only one to two enforcement officers on the street.	
Best Practices	• White Rock, BC • Provincetown, MA • Portsmouth, NH

Figure 17 Handheld Ticketing Unit Evaluation

Timing Considerations	
Timeframe for Implementation	Short
Timeframe for Impacts	Weeks
Economic Considerations	
Capital Cost	$10k to $13k per unit (includes associated software costs, staff training, etc.)
O&M Cost	Maintenance of units is minimal. Operating costs for enforcement are reduced.
Fiscal Impact	Improved revenue due to more efficient enforcement.
Staffing Needs	Can reduce the need for enforcement staff while simultaneously increasing revenues.
Facilities Considerations	
Effect on Demand	No direct & independent effect.
Effect on Supply	No direct & independent effect.
User Impact Considerations	
Effect on Employee Parking Availability	Improved enforcement can reduce violations, thus increasing availability in some areas.
Effect on Residential Parking Availability	Improved enforcement can reduce violations, thus increasing availability in some areas.
User Benefits/Customer Convenience	Reduced error rate in transcribing tickets. Faster response to public inquiries. Improved ticket payment and compliance with regulations (fewer repeat offenders). Improved legibility of parking violation notices.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	No direct & independent effect.

1.2.9. Curbside Sensors

Curbside sensors are embedded in the pavement and linked with advanced parking meters (single-head or multispace) enabling the parking system to determine when a car is actively occupying a space. This allows several advantages over regular meters in terms of revenue generation and improved enforcement. Because the meter is able to determine when a car leaves, it is able to reset the paid time on the meter to zero even if the previous occupant had paid time remaining, thus increasing revenues. In the case of time-limited paid parking, since the meter is able to determine the vehicle's length of stay, curbside sensors can help reduce the problem of "meter feeding" by preventing patrons from returning to add more money once the time limit has been reached.

Despite the manufacturer's representations to the contrary (www.streetlinenetworks.com) these would likely not be practical in Durham due to winter conditions.

Figure 18 Curbside Sensors

Case Study City	Pacific Grove, CA
Pacific Grove, California installed 100 Smart Meters near the American Tin Cannery, a destination shopping neighborhood, and the Monterey Bay Aquarium. This area has more than two million visitors annually, and as a result, a very high demand for parking. Applying this technology involved installing a sensor in the curb to detect when a car enters or leaves a space, which re-sets the meter time (i.e. no one can find a meter that still has time paid for by the previous occupant). Monitoring the time a car is parked in a space aids significantly with enforcement, utilizing technology to reduce the burden of oversight by employees, and as the city notes, "do more with less." The use of Smart Meters has allowed the City to encourage turnover of parking spaces by utilizing progressive rates which increase the amount charged as more time is spent in the parking space, rather than imposing a time limit on how long a car may remain in the space. In a study conducted with the cooperation of the neighboring City of Monterey, the two cities compared Smart Meter daily collections with standard meters in Monterey. The Smart Meters yielded $10.50 per day, while the standard meters provided $7.50 per day, demonstrating a 40% revenue benefit from the technologically advanced meters, helping to cover their higher installation costs and promote good parking management at the same time.	
Best Practices	• San Francisco, CA (SFpark) • Reading, PA • Decatur, GA • Pacific Grove, CA • Florida International University

Figure 19 Curbside Sensors Evaluation

Timing Considerations	
Timeframe for Implementation	Short
Timeframe for Impacts	Weeks
Economic Considerations	
Capital Cost	$250-$800 per space for vehicle sensor and up to $150 per meter for data management.
O&M Cost	$20 per month per space for data management.
Fiscal Impact	Improves revenue due to increased enforcement productivity.
Staffing Needs	Potentially significant reductions in enforcement staffing.
Facilities Considerations	
Effect on Demand	No direct & independent effect.
Effect on Supply	No direct & independent effect.
User Impact Considerations	
Effect on Employee Parking Availability	Improved enforcement can reduce violations, thus increasing availability in some areas.
Effect on Residential Parking Availability	Improved enforcement can reduce violations, thus increasing availability in some areas.
User Benefits/Customer Convenience	Higher turnover rate. Automatically relays all relevant violation data to ticket writer. Improves compliance.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	No direct & independent effect.

1.2.10. Automatic License Plate Readers

Automatic License Plate Readers, also sometimes referred to as “digital chalk” allow a fast-moving vehicle to scan the license plates of parked cars and check for vehicles that overstay the maximum time. This allows a single enforcement officer to check for parking compliance much faster than on foot. Automated license plate readers are capable of processing 2 vehicles per second at 30 mph/50 km/h and 1500 to 3000 parallel-parked vehicles per shift in typical city situations. It significantly improves the enforcement officer’s range and productivity (typically 3 to 5 times better than walking with a handheld), thereby reducing enforcement cost and parker cheating. Because vehicle photos facilitate quicker and more accurate appeal resolution, overall revenue from tickets generally increases.

Figure 20 Automated License Plate Reader

Case Study City Fredericksburg, VA

The City of Fredericksburg, Virginia is nestled in a region which is home to a number of civil war battle sites that generate a large volume of tourism activity for the city. Downtown boasts a thriving, charming business district with time-limited parking spaces. Monitoring the usage of spaces was a challenge to the City’s lone parking enforcement officer. The officer could handle only a small amount of the downtown area, to the exclusion of other parts of the city; to sweep the whole city would take five hours. Moreover, drivers were beginning to cheat the system by moving their cars according to the officer’s walking schedule; many of these drivers were not downtown patrons but employees consuming spaces intended for business patrons. To deal with these issues, a proposal was made to add two additional parking enforcement officers and additional handheld units, for a total cost of $110,000-$120,000 in the first year and $80,000 in years after. Instead, the city invested in drive-by digital chalking technology – or automated license plate readers – which scan license plates as the vehicle drives around the city. The system cost half of what the proposed handheld ticket writers and additional staff would have cost. Automated license plate readers are capable of processing 2 vehicles per second at 30 mph/50 km/h and 1500 to 3000 parallel-parked vehicles per shift in typical city situations. It has significantly improved the enforcement officer’s range and productivity (typically 3 to 5 times better than walking with a handheld), thereby reducing enforcement cost and parker cheating.

In Fredericksburg, the initial ticket is a warning and tourists typically receive cautions so the rate of complaints to the police chief and mayor has dropped to virtually zero. Mailed tickets with initial warnings have been favorably received, and parkers overwhelmingly follow bylaws. The mailed tickets typically include a map of where to park and the reason for the ticket. Overall, parking space availability has improved by about 20%; and because vehicle photos facilitate quicker and more accurate appeal resolution, overall revenue from tickets has increased by about 50% each year even though the initial ticket is a warning. Benefits have included increased tourism, additional shoppers and more favorable visiting experiences.

Best Practices

- Petaluma, CA
- Napa, CA
- Sacramento, CA
- Tampa, FL
- Santa Barbara, CA
- Chicago, IL
- Ft. Collins, CO
- Fredericksburg, VA

Figure 21 Automatic License Plate Readers Evaluation

Timing Considerations	
Timeframe for Implementation	Short
Timeframe for Impacts	Weeks
Economic Considerations	
Capital Cost	Ranges from $50,000-$75,000 per unit.
O&M Cost	Scans 1,000 plates per hour on street (2-4 times faster than manual).
Fiscal Impact	Improves revenue due to increased enforcement efficiency, reduced enforcement costs and liability costs associated with injuries of enforcement officers.
Staffing Needs	Can more easily identify repeat offenders. Fewer contested tickets. 90% accuracy with license plate recognition. Greatly increases productivity of enforcers.
Facilities Considerations	
Effect on Demand	No direct & independent effect.
Effect on Supply	No direct & independent effect.
User Impact Considerations	
Effect on Employee Parking Availability	Improved enforcement can reduce violations, thus increasing availability in some areas.
Effect on Residential Parking Availability	Improved enforcement can reduce violations, thus increasing availability in some areas.
User Benefits/Customer Convenience	Given that many customers currently benefit from 'gaming' the system, this strategy could be perceived negatively. Image capture of violating vehicles simplifies contesting citations.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	No direct & independent effect.

1.2.11. Shared Parking/Park-Once

In areas mixed-use, it may be redundant to provide separate off-street parking for the wide range of users. For instance, many retail or office establishments will not need off-street parking overnight during the hours that residents have a high demand. Mixed-use settings offer the opportunity to *share parking* spaces between various uses, thereby reducing the total number of spaces required compared to the same uses in stand-alone developments. This is a primary benefit in mixed-use development contexts of moderate-to-high density. Shared parking operations offer many localized benefits to the surrounding community, including a more efficient use of land resources and reduced traffic congestion.

This also serves to help to create a "park-once" environment where folks arriving by vehicle literally park one time and then patronize several locations. Downtown Portsmouth, NH is a good local example of this.

Figure 22 Shared Parking

Case Study City	Middleborough, MA
Middleborough, MA altered its zoning code to eliminate parking requirements for second or third story downtown residential units above retail which are also within a quarter-mile of overnight public parking. The effect was to encourage sharing of the existing commercial use parking that was otherwise vacant most evenings and weekends with the recognition that residential and commercial uses have peak parking demand at opposite times of day. Lifting the automatic construction of parking spaces associated with new residential units has had a significant positive impact upon the downtown for both those looking to live in the downtown as well as business owners. Property owners have been able to generate additional income from their buildings by opening upper floors as residences, while at the same time allowing them to keep rents low for businesses on the street level. Improvements to downtown properties have yielded increased property value, which in turn, has boosted property tax revenues. The Town has assisted several property owners in receiving four Housing Development Support Grants to provide 25 downtown affordable housing units.	
Best Practices	• Montgomery County, MD • Boulder, CO • Cambridge, MA • Middleborough, MA • Portsmouth, NH

Figure 23 Shared Parking Evaluation

Timing Considerations	
Timeframe for Implementation	Short
Timeframe for Impacts	Years
Economic Considerations	
Capital Cost	Parking supply required for new developments can be reduced 40-60%; May require reconfiguration of existing lots to accommodate new pedestrian circulation movements.
O&M Cost	Varies - fewer spaces to maintain mean lower maintenance costs, but shared parking generally requires more enforcement and administrative effort.
Fiscal Impact	Shared parking alone has no direct fiscal impact. When combined with In-Lieu fees, however, shared parking can generate revenue to support other parking and transportation management strategies.
Staffing Needs	Could require assigning or hiring a facility manager, or possibly a third-party parking brokerage service.
Facilities Considerations	
Effect on Demand	Managing supply at near-capacity can deter demand, especially when alternatives are readily available.
Effect on Supply	10%-30% reduction in requirements; 20% parking available at peak times (Arlington County, VA)
User Impact Considerations	
Effect on Employee Parking Availability	Although the objective of shared parking is to provide an amount such that there is always 10 - 30 percent availability, employees could perceive this strategy as a reduction in availability.
Effect on Residential Parking Availability	Unless combined with other strategies such as residential parking permits, could result in increased spill-over parking in residential neighborhoods.
User Benefits/Customer Convenience	'Park-once' trips reduce the amount of travel and cruising and reduces traffic congestion; Shared spaces may, however, be perceived as a loss of prestige.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	Shared parking support a more compact urban environment creates more attractive streetscapes and can aid historic preservation efforts by reducing the land-area needed for new construction.

1.2.12. Parking Maximums

Parking maximums are designed to use regulatory frameworks to set an absolute upper limit on how much parking may be provided at any given building or site. Doing away with parking minimum requirements removes a significant barrier to residential in-fill development, effectively reducing the cost by not requiring parking. Implementing parking maximums also prevents developers from oversupplying parking for a particular land use. In addition, there are environmental benefits due to the reduction in area devoted to paved surfaces.

Figure 24 Parking Maximums

Case Study City	Eugene, OR	
Eugene, OR has adopted parking maximum restrictions for residential land uses, which sets a limit on the amount of parking that can be provided for each residential unit, rather than parking minimums, which mandate a certain number of parking spaces be supplied for each residential unit. The use of parking maximums removes the requirement for the property owner to supply a set minimum amount of parking while still allowing a limited supply of parking. In doing away with parking minimum requirements, Eugene removed a significant barrier to residential in-fill development, effectively reducing the cost by not requiring parking. In implementing parking maximums, Eugene prevented developers from oversupplying parking for a particular land use. In addition to parking maximums, Eugene's zoning code allows certain reductions in parking requirements if a parking study demonstrates that the proposed amount will be sufficient to meet demand. While at the same time encouraging the use of other modes of transportation and helping to decrease congestion, Eugene has implemented these changes to increase density and reduce the amount of land dedicated to parking, advancing efforts to improve the quality of water and lessen the amount of storm water runoff.		
Best Practices	• Burlington, MA • Somerville, MA	• Cambridge, MA • Belmont, MA • Boston, MA

Figure 25 Parking Maximums Evaluation

Timing Considerations

Timeframe for Implementation	Medium
Timeframe for Impacts	Years
Economic Considerations	
Capital Cost	None
O&M Cost	None
Fiscal Impact	Increases taxable property by reducing land consumed by parking.
Staffing Needs	Planning staff will need to revise ordinances.
Facilities Considerations	
Effect on Demand	Long term parking demand may decrease due to limited supply.
Effect on Supply	Long-term reduction of excessive growth of supply.
User Impact Considerations	
Effect on Employee Parking Availability	Unless combined with other strategies such as remote parking, could result in less parking available for employees in the future.
Effect on Residential Parking Availability	Unless combined with other strategies such as a residential parking permits, in the long term, it could increase spillover parking in residential neighborhoods.
User Benefits/Customer Convenience	Unless combined with other strategies that provide alternate means of transportation and prevent spillover, customers may perceive this strategy negatively.
Aesthetic Considerations	
Effect on Urban Design/Streetscape	Parking maximums support a more compact urban environment, create more attractive streetscapes and can aid historic preservation efforts by reducing the land-area needed for new construction.

1.3. Parking Ratios & Quantities in Durham

Thanks to the data collection and initial analysis by James Lawson, we know that Durham downtown area currently has 367 parking spaces that are not handicapped or Post Office spaces (81 of which are on private property). The downtown also has commercial building floor area of 112,270 sq. ft., with 35,150 sq. ft. of the commercial space being restaurant or restaurant-related. This equates to a parking ratio of 3.3/1,000 sq. ft. of commercial space.

Robust park-once downtown areas typically have shared parking ratios in the range of 2 to 2.3 spaces/1,000 square feet of commercial, while "sprawl" such as a mall typically has 5/1,000 or more, and downtown Portsmouth has 2/1,000 (Boston's financial district has a 1/1,000 maximum parking regulation).

For Durham, the data shows, especially overall, that is an adequate parking supply today. Assuming an 85% occupancy of 286 public spaces monitored, 43 spaces would be available and between September 10th and 15th last year, Mr. Lawson's inventory found a minimum number of available spaces of 93, and an average of 116 spaces available. Stated differently, the downtown has a maximum usage ratio of public parking of 67%, compared with the industry 85% standard.

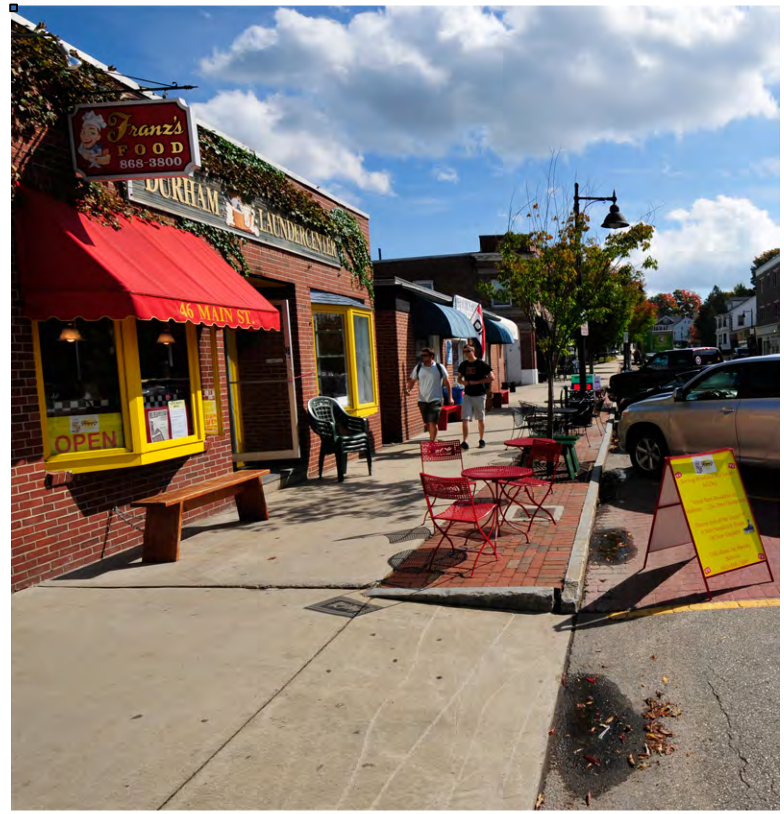

Figure 26: Free Main Street Area

1.3.13. Parking Usage

Again, thanks to the data collection efforts of Mr. Lawson, there is parking occupancy data for the public spaces to review.

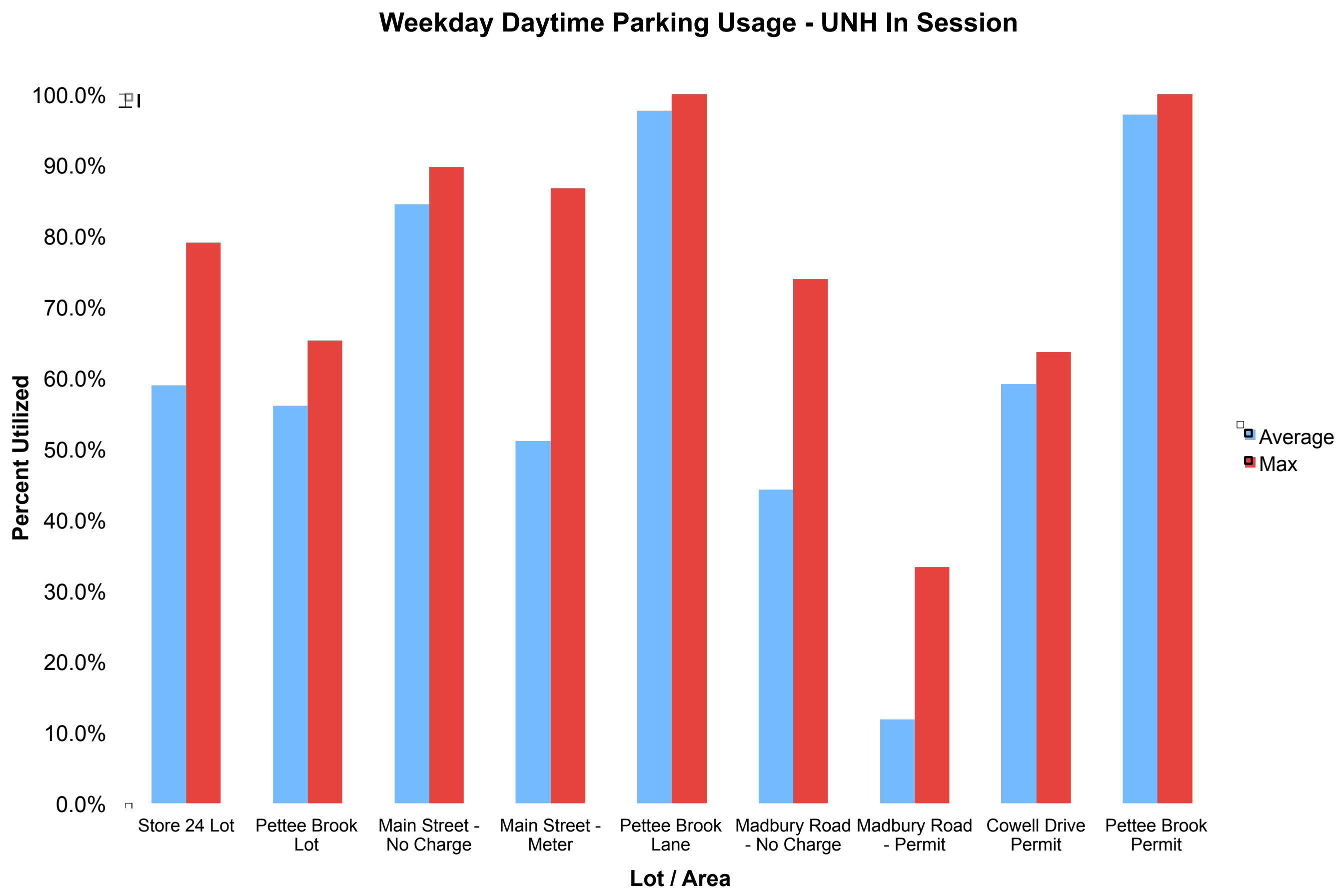

Figure 27: Parking Usage (Lawson)

As noted, the industry standard is that an overall occupancy of 85% provides a good balance between available spaces and drivers circulating looking for those spaces. Higher occupancy percentages are possible with sophisticated driver real-time information systems showing available parking, usually in parking garages, but for Durham the typical 85% rate seems appropriate.

In this case, the data shows that the on-street Pettee Brook Lane parking exceeds this percentage of occupancy, followed by the Pettee Brook Lane permit-only and Main Street free spaces. The recently added Pettee Brook Lane parallel spaces appear to have added supply where demand is highest, and being free no doubt adds to their appeal.

However, looking more closely at the occupancy data, it is apparent that the current quality of the pedestrian realm may be impacting where people are wiling to park and where they are, in fact, parking.

Figure 28: Madbury Road

The Madbury Road parking seems to be a good example of this. Both the permit and the free parking on Madbury are under-utilized, even though this parking is literally only a few hundred feet farther from Main Street or the campus than are the highly-utilized spaces on Pettee Brook Lane. The free Main Street parking spaces are highly used not simply because they are free, but because the adjacent pedestrian realm is quite pleasant (Figure 25).

If the Madbury Road parking information is removed from the calculations, we find a maximum occupancy (usage) of the public spaces of 74% at Noon on a Friday and an overall supply ratio of 2.8 spaces/1,000.

Regarding the usage, however, the downtown was also sampled by Mr. Lawson during five other time periods, all weekdays. The average occupancy of the non-Madbury spaces for these other times was only 64%. Absent very high non-motorized travel (NMT) or transit service, these occupancy rates are not indicators of a vibrant downtown area. With the relatively low parking supply, one would expect higher rates of occupancy than the extant data indicates.

Choosing a ratio of parking for a downtown is not a simple matter of applying a fixed formula, but more of a combination of art and experience. In an environment of high quality pedestrian spaces, pedestrians may be expected to walk further than in areas of lesser pedestrian quality. TND Engineering has documented this in Portsmouth where a walking radius of approximately one-half mile exists in the Market Square are with a walking radius of only about 200 feet in the more “sprawl” setting near the State liquor store off Islington Street.

Interestingly, if the restaurant space downtown is assumed to be primarily patronized by students, and one further assumes that most of them walk there (which may or may not be a valid assumption), then the parking ratio for non-restaurant commercial space is 4.2/1,000, and if half of the restaurant space is included, the ratio is 3.4/1,000.

Last in the discussion of existing parking ratios, the private parking ratio is only 1.1/1,000, so the private parking clearly needs to be supplemented off site.

The existing usage, and available parking show the ability to support some additional development without new parking, if that parking is shared. There are currently an average of 120 spaces open out of the 239 public spaces (w/o Madbury). An 85% occupancy level would have 36 open (“reserve”), so there is an excess supply currently.

If we subtract the 36 reserve from the 120, and calculate what these remaining spaces could service if 85% occupied with a 3.3/1,000 usage rate (below), this shows the possibility of another 21,500 sq. ft. using existing parking. This is predicated in part on the NMT enhancements discussed later.

If the Town ensures that parking is shared, and essentially treated like the public infrastructure it should be, the Town should consider a program of monitoring development and for the near term not requiring any additional parking for new development (unless a project is proposed for the downtown area which would add more than 21,500 sq. ft., in which case the entire topic may be revisited).

As parking occupancy approaches 85% on a regular basis, additional supply should be considered, and a discussion of how much (if any) should be private and how much should be public should ensue. TND Engineering suggests that an overall ratio of 3.2 to 3.4/1,000 which drops over time as and if/when Durham becomes a true park-once destination, coupled with the NMT enhancements discussed below, seem appropriate.

1.3.14. Mill Plaza, or Colonial Durham Center

Figure 29: Mill Plaza Notice

It is difficult to review parking in Durham without considering Mill Plaza, its commercial and Civic uses and especially its large parking lot.

However, given its relative detachment from the Town, and the complete stance to avoid parking sharing in any fashion, it may take some time before this property is considered to be where it is- in the center of Durham- and not on an isolated highway.

For the purposes of this analysis, both its land uses and its parking were excluded. This is unfortunate, but a current reality.

1.3.15. University of New Hampshire (UNH) and Fire Station

Recently, some preliminary drawings have been prepared showing the possible construction of a parking garage/fire station combined structure on UNH property.

Such a possibility is in keeping with the ideas of shared parking, park-once and of treating parking as public infrastructure; this should be explored further.

1.3.16. UNH & Traffic

The traffic impacts of a large number of UNH-related vehicles departing during a PM peak hour in an office park like traffic pattern presents problems for the enhancement of the downtown and the possible conversion of Main Street back to its former two-way operation.

The Town & UNH seem much more teamed recently to discuss this sort of issue, and transportation demand management techniques as simple as staggered starting and stopping times for employees would reduce the current traffic peaking. This, in turn, could allow more downtown enhancements to occur.

1.3.17. UNH & Parking

UNH has significant parking lots in and near the downtown area. In addition to the potential Fire Station cooperation noted above, it may be reasonable to have an overall sharing of some of the UNH parking lots during what are off-peak times for the University. The area being considered for the potential joint parking structure/Fire Station is certainly prime among these possible sharing sites.

1.4. Recommendations

1.4.18. Enhance Non-Motorized Travel (NMT)

The Town recently re-striped Pettee Brook Lane to one lane of vehicles, a bike lane and on-street parking. These changes have palpably changed the character of that street.

Figure 30: Pettee Brook Lane Before (top) & After Striping

However, and as a reminder of TND Engineering work from the B Dennis charrette, the Town should continue to consider ways to enhance all of its downtown streets-especially the NMT portions of them.

This is a simple Photoshop overlay of Figure 30, purposely leaving the side areas showing the present contexts there. It is, however to scale and theoretically possible if the Town wished to do what it depicts.

Figure 31: Pettee Brook Lane- Potential?

When parking areas change into buildings, and mature trees separate sidewalks from the travel parts of a street, it becomes a much different place.

The reason these images are shown are to make the point that the more walking is enhanced, the farther folks will walk and the "pedestrian shed" or area within which all parking is truly shared will increase in size. If Madbury Lane were detailed like Figure 31, even without the buildings, the parking there would no doubt have a very high occupancy rate, and more folks would likely be walking to and from there.

1.4.19. Pay Station Locations

While it has been difficult to communicate with one manufacturer (MacKay), the pay by license plate technology seems like a good, user-friendly (no trips back to the vehicle) and eco-friendly (no slips of paper) option. Pay and display has a proven track record as well.

Pay Station Locations for Pay & Display Technology are shown below, with green stars indicating phase one and red stars being phase 2.

Figure 32: Proposed Pay Station Locations

1.4.20. Pricing

There is already precedent in Durham for parking pricing, both at UNH (Figure 33) and parts of the downtown (Figure 34). However, at $1/hour UNH and Durham are higher than many NH communities with Portsmouth and Manchester at $0.75/hour with a general two hour limit and Concord at $0.50/hour and limits varying from one to ten hours. Concord was considering doubling its rate last Spring.

Given the flexibility of Pay Stations, and the abilities to easily adjust rates, the Town could start with $1/hour on Main Street and $0.75 on Pettee Brook Lane- and tune the rates over time (see section 1.1.1, above).

Figure 33: UNH Pricing

Figure 34: Durham Pricing