JUNE 26, 2019 (REVISED)

The purpose of this technical memorandum is to fulfill the NCTCOG Parking Garage and Transportation Interface Study scope deliverables for downtown Arlington, which includes a high-level parking needs assessment/shared parking model based on the new uses envisioned in the Arlington Downtown Master Plan Existing Conditions Market Assessment and conceptual costing for parking facilities.

Walker uses the ULI/ICSC *Shared Parking* methodology. The Urban Land Institute (ULI), International Council of Shopping Centers (ICSC), Institute of Transportation Engineers (ITE), and Parking Consultants Council of the National Parking Association all endorse this approach as the best way to determine parking needs for mixed-use projects. For this project we are employing a draft version of the 3rd Edition Excel model, which is expected to go to print in the summer of 2019. While not the final published model, it represents the best opinion of the leading parking consultants in the United States as of this writing.

Our key findings are as follows:

- Assuming similar transportation behavior characteristics to existing conditions, the base shared parking scenario projects a need for 3,351 parking spaces to serve the additional land uses in the Downtown Master Plan area envisioned in the Market Assessment.
- Assuming more aggressive implementation of transportation and parking demand management measures, unbundling (separating the cost to rent a parking space from the cost to rent an apartment) and sharing of residential parking, and a district-wide transportation/parking management authority, the aspirational parking scenario estimate is 2,360 parking spaces to serve the additional land uses in the Downtown Master Plan area envisioned in the Market Assessment.
- The eventual location of new development within the Downtown Master Plan Area will influence the ultimate number of net new parking spaces needed, as there may be existing parking capacity that will remain in place, that could accommodate a portion of the parking demand associated with additional uses. Conversely, displacement of existing surface parking by new development could increase the number of new spaces needed in the downtown area.
    - An example of the former is the City of Arlington's contribution to the construction of parking at the 101 Center project, and designation of 89± parking spaces in the development for public parking. The presence of this existing supply could reduce the number of spaces needed as future development occurs.

To the extent possible, parking should be developed in central locations with the ability to serve multiple uses and destinations.

Table 1 summarizes the results of the shared parking analysis. This table depicts estimated peak month, day, and hour parking demand by major user group (customer/visitor, employee/resident, and reserved parking unavailable for sharing) for the base (meaning moderate) and aspirational scenarios. Note that due to some differences in assumptions between the base and aspirational scenarios, the projected peak month for parking demand is different (December for the base scenario and May for the aspirational scenario).

Table 1: Shared Parking Analysis Summary

Base Shared Parking Model						Aspirational Shared Parking Model					
Weekday			Weekend			Weekday			Weekend		
Peak Hr Adj	Peak Mo Adj	Estimated Parking	Peak Hr Adj	Peak Mo Adj	Estimated Parking	Peak Hr Adj	Peak Mo Adj	Estimated Parking	Peak Hr Adj	Peak Mo Adj	Estimated Parking
7 PM	December	Demand	7 PM	December	Demand	10 PM	May	Demand	11 PM	May	Demand
Customer/Visitor	980		Customer	1,053		Customer/Visitor	614		Customer	649	
Employee/Resident	483		Employee/Resident	483		Employee/Resident	1,747		Employee/Resident	1,638	
Reserved	1,815		Reserved	1,815		Reserved	-		Reserved	-	
Total	3,278		Total	3,351		Total	2,360		Total	2,288	

Note: Adj = Adjustment, meaning that the data has been adjusted to the peak hour or peak month conditions.

Source: Walker Consultants, 2019.

BACKGROUND AND CONTEXT

The City of Arlington completed a Downtown Master Plan in late 2018. The parking-related recommendations included a reduced reliance on surface parking, and promotion of structured parking that could be centrally located and support a shared parking approach to Downtown parking planning. In support of this effort, the City of Arlington, through the North Central Texas Council of Governments (NCTCOG), requested a projection of parking needs based on the new uses envisioned in the Downtown Master Plan Existing Conditions Market Assessment, and an opinion of conceptual costs for providing additional structured parking in the downtown area.

For this analysis, Walker has prepared two shared parking analysis scenarios for the envisioned land use additions to the downtown area.

The first scenario, which we have called the 'base' scenario, involves taking current conditions and transportation behaviors as they are currently observed, and projecting the additional parking need assuming those behaviors remain consistent. Note that the specific methodology used for the shared parking analysis is outlined in this section.

The second scenario, which we have called the 'aspirational' scenario, starts with the same future land uses, but takes a more progressive approach, in line with Arlington's vision of creating a connected, bikeable, walkable downtown, with credible first/last-mile alternatives to the single-occupant vehicle.

SHARED PARKING ANALYSIS – BASE SCENARIO

Shared parking analysis, in accordance with *Shared Parking (Urban Land Institute, 3rd Edition, 2019)* is the generally accepted methodology for determining the appropriate parking supply for a mixed-use environment. Shared parking is the use of a parking space by vehicles generated by more than one land use. The ability to share parking spaces is the result of two conditions:

- Variations in the accumulation of vehicles by hour, by day or by season at the individual land uses.
- Relationships among the land uses that result in visiting multiple land uses on the same auto trip.

For example, office buildings require parking spaces during daytime hours on weekdays, while restaurants and entertainment venues have peak parking needs during the evening and weekends.

Although the ULI methodology for shared parking analysis was developed in the early 1980s, the concept of shared parking was already well established: a fundamental principle of downtown planning from the earliest days of the automobile has always been to share parking resources rather than to have each use or building have its own parking. The resurgence of many central cities resulting from the addition of vibrant residential, retail, restaurant and entertainment developments continues to rely heavily on shared parking for economic viability. There are numerous benefits of shared parking to all parties to development, including the community at large, not least of which is the environmental and economic benefit of significantly reducing the square feet of parking (usually in surface lots) needed to serve the development.

As a result of this analysis, Walker developed a recommended parking supply to serve the additional land uses envisioned in the Downtown Master Plan, based on the projected peak hour of design day parking demand. The peak in this analysis refers to the "design day" or "design hour," one that recurs frequently enough to justify providing spaces for that level of parking activity. This does not represent the maximum ever projected to be generated by the additional development in downtown. In Walker's experience, designing a parking system for the absolute peak busiest day of the year leads to overbuilding of parking spaces. Similarly, one does not build for an average day and have insufficient supply for the peak hours on 50 percent of the days in a year. The 85th percentile of peak-hour observations is generally recommended by *Shared Parking*.

METHODOLOGY

The first edition of *Shared Parking* was published in 1983 and then updated in 2005. The Third Edition is currently being finalized and is expected to go to print in the summer of 2019. In accordance with the Second and Third Editions of *Shared Parking*, parking demand is analyzed separately for employees and customers to improve both the reliability of the projections and the tools for parking management planning. The succeeding sections of the shared parking analysis will follow the steps in order.

ANALYSIS

STEP 1: GATHER AND REVIEW PROJECT DATA

Based on input from the City of Arlington, this shared parking analysis encompasses the additional development envisioned in the Downtown Master Plan, using an average of the High and Low scenarios from the Downtown Master Plan Existing Conditions Market Assessment.

We have also used a slightly higher ratio for the designated patio space as part of the restaurants, based on our experience.

Table 2: Downtown Arlington - Projected Land Use Additions

Land Use	Quantity
Retail	54,000 sf GLA
Supermarket	27,000 sf GLA
Fine/Casual Dining	27,000 sf GLA
Family Restaurant	5,000 sf GLA
Fast Casual/Fast Food/Food Hall	27,000 sf GLA
Hotel	100 Rooms
Restaurant/Lounge	5,000 sf GLA
Meeting/Banquet Space	5,000 sf GLA
Residential	
Studio	180 DU
1-Bedroom	728 DU
2-Bedroom	727 DU
3-Bedroom	180 DU
Office	25,000 GSF

GLA = Gross Leasable Area, DU = Dwelling Unit
GSF = Gross Square Feet

Source: Walker Consultants, 2019.

While the Downtown Master Plan discusses goals and strategies for four key areas (Downtown Core, East Main Street, Front Street, West Main Street), a zone or location-based analysis would be speculative at this time, as the Market Assessment is silent on where within downtown development can be expected to occur.

For the base scenario, this analysis assumes that one (1) reserved space is provided per residential unit, in a pool of reserved parking, gated and accessible only to residents, with the rest of the residential parking supply being shared with other uses. Note that neither the base nor aspirational scenarios are related to parking required pursuant to zoning regulations in the City of Arlington; rather, they are based on projected actual demand from forecasted development by use and various listed assumptions related to transportation behaviors.

STEP 2: SELECT PARKING RATIOS

Walker employed the *Shared Parking* base parking ratios for most of the land uses as previously discussed, as seen in **Table 3**.

Table 3: Base Parking Ratios

Land Use	Weekday		Weekend		Unit
	Visitor	Employee	Visitor	Employee	
Retail (<400 ksf)	2.90	0.70	3.20	0.80	ksf
Fine/Casual Dining	13.25	2.25	15.25	2.50	ksf
Family Restaurant	15.25	2.15	15.00	2.10	ksf
Fast Casual/Fast Food/Food Court/Food Halls	12.40	2.00	12.70	2.00	ksf
Hotel-Business	1.00	0.15	1.00	0.15	keys
Restaurant/Lounge	6.67	1.20	7.67	1.33	ksf
Meeting/Banquet (20 to 50 sq ft/key)	20.00	1.50	10.00	1.50	ksf
Residential, Urban					
Studio Efficiency	0.10	0.22	0.15	0.22	du
1 Bedroom	0.10	0.25	0.15	0.25	du
2 Bedrooms	0.10	0.43	0.15	0.43	du
3+ Bedrooms	0.10	0.65	0.15	0.65	du
Office <25 ksf	0.30	3.50	0.03	0.35	ksf

Note: ksf = thousand square feet, du = dwelling units

Source: Walker Consultants, 2019.

STEP 3: SELECT PRESENCE FACTORS

After the land uses have been quantified and base parking ratios have been applied to these land use quantities, adjustments are made to account for parking demand variability by hour of day and month of year. These time-based adjustments are referred to as a "presence" adjustment.

Presence is expressed as a percentage of the peak hour demand on a design day for both time of day and month of the year. The fact that parking demand for each component may peak at different times generally means that fewer parking spaces are needed for the project than would be required if each component were a freestanding development.

STEPS 4 AND 5: ADJUST DEMAND FOR MODAL SPLIT AND PERSONS PER CAR

Each land use was evaluated and assigned a drive ratio for daytime and evenings on weekdays and weekends. The reason that driving ratio, rather than modal split, must be used is that it is applied against a "parking ratio" that reflects the number of cars parked at a stand-alone land use where nearly all persons arrive by car, and thus already reflects persons per car.

Walker utilized 2013-2017 American Community Survey (ACS) 5-year estimates for Means of Transportation to Work, which refers to what mode people utilize to get to work in a given area. Per the ACS data, the means of transportation to work for workers in Census Tract 1222 and Census Tract 1223 (which encompass the Downtown Master Plan Area) is 84%, when driving alone (SOV) and carpooling are combined. Arlington is striving to become an alternative mode-friendly locale, in particular leading the way with its autonomous vehicle Drive.ai program and its Via on-demand RideShare service. The Drive.ai program is the City's second autonomous vehicle pilot program after its Milo Autonomous Shuttle program which ended last year. The use and adoption of microtransit options and shared services have the potential to reduce parking demand since they provide an alternative to driving and parking at every destination.

To supplement the ACS means of transportation, Walker researched the Walk Score centered on City Hall (101 W Abram Street) which has a score of 83/100 and is classified as "very walkable," with most errands able to be

accomplished on foot. The City of Arlington has an average Walk Score of 36/100.[1] The bike score in Downtown is 67, which Walk Score considers "bikeable."

The Arlington area is not served by any traditional transit service (bus, rail).

Walker applied an 80% drive ratio to employees of service-related uses (retail, restaurant, hotel) and a drive ratio of 85% for office employees for the base scenario.

VEHICLE OWNERSHIP

Walker also used ACS data to evaluate vehicle ownership data to inform estimates of resident vehicle ownership in Downtown Arlington. 95% of the households in and around the Downtown Area reported that they had one or more vehicles available for use. Based on this finding, Walker applied a 95% vehicle ownership rate for residents for the base scenario.

STEP 6: ADJUST DEMAND FOR CAPTIVE FACTORS

A shared parking analysis recognizes that people often visit two or more establishments within the same development site, without increasing their on-site parking use. The ***"Noncaptive Ratio"*** is an estimate of the percentage of parkers at a land use in a mixed-use district who are *not* already counted as being parking at another of the land uses. The term "captive" has been borrowed from market researchers to describe people who are already present in the immediate vicinity and are likely patrons of a second use. However, the parking adjustment will not be precisely the same as the captive adjustments for either market researchers or traffic engineers. The key to non-captive adjustments is thinking through whether a car would already be counted as parked at another land use *at the specific time* a person patronizes the primary use. For example, employees in a district who are counted as parked at another land use, will not generate any parking demand when they patronize a coffee store, deli or shop for a few minutes while on a break. The car of a resident of a Downtown Arlington would be counted as being parked at the residence, particularly when resident parking is 100% reserved, even when the resident is going to have dinner in Downtown. Some employees may even live and work within Downtown.

Captive market adjustments have been taken in accordance with Walker's professional judgment and experience. Note that when applied to parking demand, we use the percent of customers who are "non-captive." Thus if 10% of a restaurants patronage at noon on a weekday is captive, the adjustment to parking is 90%.

STEP 7: CALCULATE REQUIRED PARKING SPACES FOR EACH SCENARIO

The model calculates the parking demand 18 hours a day for weekdays, Saturdays and Sundays for each of 12 months, plus a special period between Christmas and New Year's Day. In the latter period, office and other professional employment parking is reduced, while retail/dining/entertainment is high.

Table 4 below summarizes the Shared Parking analysis for weekdays and weekends, while ***Table 5*** provides the detail for weekdays and ***Table 6*** presents the weekend analysis.

[1] www.walkscore.com

Table 4: Shared Parking Demand Summary – Base Scenario

Weekday			Weekend		
Peak Hr Adj 7 PM	Peak Mo Adj December	Estimated Parking Demand	Peak Hr Adj 7 PM	Peak Mo Adj December	Estimated Parking Demand
Customer/Visitor		980	Customer		1,053
Employee/Resident		483	Employee/Resident		483
Reserved		1,815	Reserved		1,815
Total		3,278	Total		3,351

Note: Adj = Adjustment meaning that the data has been adjusted to the peak hour or peak month conditions.

Source: Walker Consultants, 2019.

The overall peak is projected to occur on a weekend in December at approximately 7:00 PM, at which time 3,351 parking spaces are recommended to serve the new land uses envisioned by the Downtown Master Plan Existing Conditions Market Assessment. On a weekday, the peak hour is also at 7 PM, with 3,278 spaces required.

It is noted that this baseline analysis assumed one space per dwelling unit reserved for residents. We have not assumed that any of the other residential or office employee parking is segregated and reserved. Changing that assumption would increase the parking spaces required.

Following Tables 4 and 5, Figure 3 presents the parking demand by time of day for both weekdays and weekends.

Table 5: Weekday Shared Parking Demand – Base Scenario

Land Use	Project Data		Weekday					Weekday		
	Quantity	Unit	Base Rate	Mode Adj	Non-Captive Ratio	Project Rate	Unit	Peak Hr Adj 7 PM	Peak Mo Adj December	Estimated Parking Demand
Retail (<400 ksf)	54,000	sf GLA	2.90	97%	93%	2.61	sf GLA	90%	100%	106
Employee			0.70	80%	94%	0.53		100%	100%	29
Supermarket/Grocery	27,000	sf GLA	4.00	97%	93%	3.60	sf GLA	85%	1.00	83
Employee			0.75	80%	94%	0.56		50%	1.00	8
Fine/Casual Dining	27,000	sf GLA	13.25	97%	92%	11.86	sf GLA	100%	100%	320
Employee			2.25	80%	94%	1.69		100%	100%	46
Family Restaurant	5,000	sf GLA	15.25	97%	92%	13.65	sf GLA	80%	100%	55
Employee			2.15	80%	94%	1.61		95%	100%	8
Fast Casual/Fast Food/Food Court/Food Halls	27,000	sf GLA	12.40	97%	66%	7.93	sf GLA	80%	96%	165
Employee			2.00	80%	94%	1.50		90%	100%	36
Hotel-Business	100	keys	1.00	47%	100%	0.47	keys	75%	60%	21
Hotel Employees	100	keys	0.15	80%	100%	0.12	keys	85%	50%	1
Restaurant/Lounge	5,000	sf GLA	6.67	40%	100%	2.67	sf GLA	20%	100%	8
Meeting/Banquet (20 to 50 sq ft/key)	5,000	sf GLA	20.00	45%	100%	9.00	sf GLA	100%	100%	45
Employee	10,000	sf GLA	13.34	80%	100%	10.67	sf GLA	30%	90%	4
Residential, Urban										
Studio Efficiency	180	units	0.22	95%	100%	0.21	units	55%	100%	21
1 Bedroom	728	units	0.25	95%	100%	0.24	units	55%	100%	95
2 Bedrooms	727	units	0.43	95%	100%	0.41	units	55%	100%	165
3+ Bedrooms	180	units	0.65	95%	100%	0.62	units	55%	100%	62
Reserved	1	sp/unit	1.00	100%	100%	1.00	sp/unit	55%	100%	1,815
Visitor	1,815	units	0.10	97%	100%	0.10	units	100%	100%	177
Office <25 ksf	25,000	sf GFA	0.30	97%	100%	0.29	sf GFA	0%	100%	0
Reserved		sp/ksf	0.00	100%	100%	0.00	sp/ksf	2%	100%	-
Employee			3.50	85%	73%	2.18		100%	100%	8
									Customer/Visitor	980
				Shared Parking Reduction					Employee/Resident	483
				23%					Reserved	1,815
									Total	3,278

Note: GLA = Gross Leasable Area, units = dwelling units, sp = space, GFA = Gross Floor Area, ksf = thousand square feet, sq ft = square feet

Source: Walker Consultants, 2019.

Table 6: Weekend Shared Parking Demand – Base Scenario

Land Use	Project Data		Weekend					Weekend		
	Quantity	Unit	Base Rate	Mode Adj	Non-Captive Ratio	Project Rate	Unit	Peak Hr Adj 7 PM	Peak Mo Adj December	Estimated Parking Demand
Retail (<400 ksf)	54,000	sf GLA	3.20	97%	90%	2.78	sf GLA	75%	100%	134
Employee			0.80	80%	94%	0.60		80%	100%	27
Supermarket/Grocery	27,000	sf GLA	4.00	97%	90%	3.48	sf GLA	33%	100%	31
Employee			0.75	80%	94%	0.57		40%	100%	6
Fine/Casual Dining	27,000	sf GLA	15.25	97%	93%	13.73	sf GLA	95%	100%	352
Employee			2.50	80%	94%	1.88		100%	100%	51
Family Restaurant	5,000	sf GLA	15.00	97%	93%	13.51	sf GLA	70%	100%	47
Employee			2.10	80%	94%	1.58		95%	100%	8
Fast Casual/Fast Food/Food Court/Food Halls	27,000	sf GLA	12.70	97%	68%	8.37	sf GLA	80%	96%	174
Employee			2.00	80%	94%	1.51		90%	100%	37
Hotel-Business	100	keys	1.00	40%	100%	0.40	keys	75%	60%	18
Hotel Employees	100	keys	0.15	80%	100%	0.12	keys	85%	50%	1
Restaurant/Lounge	5,000	sf GLA	7.67	40%	100%	3.07	sf GLA	20%	100%	9
Meeting/Banquet (20 to 50 sq ft/key)	5,000	sf GLA	10.00	45%	100%	4.50	sf GLA	100%	100%	23
Employee	10,000	sf GLA	0.15	80%	100%	0.12	sf GLA	30%	90%	11
Residential, Urban										
Studio Efficiency	180	units	0.22	95%	100%	0.21	units	0%	100%	21
1 Bedroom	728	units	0.25	95%	100%	0.24	units	55%	100%	95
2 Bedrooms	727	units	0.43	95%	100%	0.41	units	55%	100%	165
3+ Bedrooms	180	units	0.65	95%	100%	0.62	units	55%	100%	62
Reserved	1	sp/unit	1.00	100%	100%	1.00	sp/unit	55%	100%	1,815
Visitor	1,815	units	0.15	97%	100%	0.15	units	100%	100%	265
Office <25 ksf	25,000	sf GFA	0.03	97%	100%	0.03	sf GFA	0%	100%	-
Reserved		sp/ksf	0.00	100%	100%	0.00	sp/ksf	0%	100%	-
Employee			0.35	85%	100%	0.30		100%	100%	-
								Customer		1,053
				Shared Parking Reduction				Employee/Resident		483
				22%				Reserved		1,815
								Total		3,351

Note: GLA = Gross Leasable Area, units = dwelling units, sp = space, GFA = Gross Floor Area, ksf = thousand square feet, sq ft = square feet

Source: Walker Consultants, 2019.

Figure 1: Variation in Parking Demand by Time of Day

Weekday

Weekend

Source: Walker Consultants, 2019.

ASPIRATIONAL SHARED PARKING MODEL

The aspirational model scenario starts with the same future land uses as the base scenario, but takes a more forward-thinking approach, in line with Arlington's vision of being a connected, bikeable, walkable downtown, with credible first/last-mile alternatives to the single occupant vehicle. In this vision of the future, first/last-mile services such as the Via on-demand rideshare service and Drive.ai service become permanent fixtures in Arlington, and the use of ridesharing services in general increases as autonomous vehicles penetrate the market. Assumptions in the aspirational model that differ from the base model include:

- Lower drive ratios used under the assumption that multi-modal vision is achieved through planning and potential implementation of a transportation management authority (70% drive ratio for office workers, 50% drive ratio for service workers).
- Assumption that no resident parking is reserved, instead all parking is shared.
- 80% resident vehicle ownership rate (versus 95% in the base model). 80% is commensurate with residential car ownership statistics for cities and areas within cities with the density projected in the Downtown Master Plan.

The City and property owners may need to work co-operatively to achieve the vision of the aspirational scenario. This could entail creation of a Downtown Transportation Management Authority and or Parking District which would allow for comprehensive and collaborative management and monitoring of the parking system.

Table 7 below summarizes the Shared Parking analysis for weekdays and weekends, while ***Table 8*** provides the detail for weekdays and ***Table 9*** presents the weekend analysis.

Table 7: Shared Parking Demand Summary – Aspirational Scenario

Peak Hr Adj 10 PM	Peak Mo Adj May	Estimated Parking Demand	Peak Hr Adj 11 PM	Peak Mo Adj May	Estimated Parking Demand
Customer/Visitor		614	Customer		649
Employee/Resident		1,747	Employee/Resident		1,638
Reserved		-	Reserved		-
Total		2,360	Total		2,288

Source: Walker Consultants, 2019.

The overall peak is projected to occur on a weekday in December at approximately 10:00 PM, at which time 2,360 parking spaces are recommended to serve the new land uses envisioned by the Downtown Master Plan Existing Conditions Market Assessment. On a weekend, the peak hour is at 11 PM, with 2,288 spaces required. The number of parking spaces needed in the aspirational scenario is about 1,000 less than in the base scenario.

It is noted that this analysis assumed no reserved parking for residential uses. Changing that assumption would increase the parking spaces required.

Following Tables 7 and 8, Figure 2 presents the parking demand by time of day for both weekdays and weekends.

Table 8: Weekday Shared Parking Demand – Aspirational Scenario

Land Use	Project Data		Weekday					Weekday		
			Base Rate	Mode Adj	Non-Captive Ratio	Project Rate	Unit	Peak Hr Adj	Peak Mo Adj	Estimated Parking Demand
	Quantity	Unit						10 PM	May	
Retail (<400 ksf)	54,000	sf GLA	2.90	80%	95%	2.20	sf GLA	30%	72%	27
Employee			0.70	50%	96%	0.34		40%	82%	6
Supermarket/Grocery	27,000	sf GLA	4.00	80%	95%	3.03	sf GLA	20%	0.97	17
Employee			0.75	50%	96%	0.36		20%	1.00	2
Fine/Casual Dining	27,000	sf GLA	13.25	80%	90%	9.55	sf GLA	95%	99%	270
Employee			2.25	50%	96%	1.08		100%	100%	29
Family Restaurant	5,000	sf GLA	15.25	80%	90%	10.99	sf GLA	55%	99%	34
Employee			2.15	50%	96%	1.03		65%	100%	3
Fast Casual/Fast Food/Food Court/Foc	27,000	sf GLA	12.40	80%	70%	6.92	sf GLA	20%	100%	41
Employee			2.00	50%	96%	0.96		30%	100%	8
Hotel-Business	100	keys	1.00	47%	100%	0.47	keys	95%	95%	42
Hotel Employees	100	keys	0.15	50%	100%	0.08	keys	95%	95%	1
Restaurant/Lounge	5,000	sf GLA	6.67	47%	80%	2.51	sf GLA	20%	96%	6
Meeting/Banquet (20 to 50 sq ft/key	5,000	sf GLA	20.00	45%	100%	9.00	sf GLA	50%	100%	23
Employee	10,000	sf GLA	13.34	50%	100%	6.67	sf GLA	0%	100%	-
Residential, Urban										
Studio Efficiency	180	units	0.85	80%	100%	0.68	units	85%	100%	104
1 Bedroom	728	units	0.95	80%	100%	0.76	units	85%	100%	471
2 Bedrooms	727	units	1.65	80%	100%	1.32	units	85%	100%	816
3+ Bedrooms	180	units	2.50	80%	100%	2.00	units	85%	100%	306
Reserved		sp/unit	0.00	100%	100%	0.00	sp/unit	85%	100%	-
Visitor	1,815	units	0.10	80%	100%	0.08	units	100%	100%	155
Office <25 ksf	25,000	sf GFA	0.30	80%	100%	0.24	sf GFA	0%	100%	-
Reserved		sp/ksf	0.00	100%	100%	0.00	sp/ksf	0%	100%	-
Employee			3.50	70%	80%	1.97		100%	100%	-
									Customer/Visitor	614
				Shared Parking Reduction					Employee/Resident	1,747
				45%					Reserved	-
									Total	2,360

Note: GLA = Gross Leasable Area, units = dwelling units, sp = space, GFA = Gross Floor Area, ksf = thousand square feet, sq ft = square feet

Source: Walker Consultants, 2019.

Table 9: Weekend Shared Parking Demand – Aspirational Scenario

Land Use	Project Data		Weekend					Weekend		
			Base Rate	Mode Adj	Non-Captive Ratio	Project Rate	Unit	Peak Hr Adj	Peak Mo Adj	Estimated Parking Demand
	Quantity	Unit						11 PM	May	
Retail (<400 ksf)	54,000	sf GLA	3.20	85%	93%	2.54	sf GLA	92%	72%	93
Employee			0.80	50%	96%	0.39		45%	82%	3
Supermarket/Grocery	27,000	sf GLA	4.00	85%	93%	3.17	sf GLA	5%	97%	3
Employee			0.75	50%	96%	0.36		10%	100%	1
Fine/Casual Dining	27,000	sf GLA	15.25	85%	90%	11.66	sf GLA	90%	99%	295
Employee			2.50	50%	96%	1.20		100%	100%	28
Family Restaurant	5,000	sf GLA	15.00	85%	90%	11.47	sf GLA	25%	99%	9
Employee			2.10	50%	96%	1.01		65%	100%	3
Fast Casual/Fast Food/Food Court/Foc	27,000	sf GLA	12.70	85%	75%	8.14	sf GLA	20%	100%	22
Employee			2.00	50%	96%	0.96		30%	100%	5
Hotel-Business	100	keys	1.00	40%	100%	0.40	keys	95%	95%	38
Hotel Employees	100	keys	0.15	50%	100%	0.08	keys	95%	95%	1
Restaurant/Lounge	5,000	sf GLA	7.67	47%	60%	2.16	sf GLA	20%	96%	4
Meeting/Banquet (20 to 50 sq ft/key	5,000	sf GLA	10.00	45%	100%	4.50	sf GLA	50%	100%	-
Employee	10,000	sf GLA	0.15	50%	100%	0.08	sf GLA	0%	100%	1
Residential, Urban										
Studio Efficiency	180	units	0.85	80%	100%	0.68	units	0%	100%	98
1 Bedroom	728	units	0.95	80%	100%	0.76	units	70%	100%	443
2 Bedrooms	727	units	1.65	80%	100%	1.32	units	70%	100%	768
3+ Bedrooms	180	units	2.50	80%	100%	2.00	units	70%	100%	288
Reserved		sp/unit	0.00	100%	100%	0.00	sp/unit	70%	100%	-
Visitor	1,815	units	0.15	85%	100%	0.13	units	100%	100%	186
Office <25 ksf	25,000	sf GFA	0.03	85%	100%	0.03	sf GFA	0%	100%	-
Reserved		sp/ksf	0.00	100%	100%	0.00	sp/ksf	0%	100%	-
Employee			0.35	70%	0%	0.00		100%	100%	-
								Customer		649
								Employee/Resident		1,638
								Reserved		-
								Total		2,288

Note: GLA = Gross Leasable Area, units = dwelling units, sp = space, GFA = Gross Floor Area, ksf = thousand square feet, sq ft = square feet

Source: Walker Consultants, 2019.

Figure 2: Variation in Parking Demand by Time of Day – Aspirational Scenario

Weekday

Weekend

Source: Walker Consultants, 2019.

NET PARKING NEED AND FUTURE PARKING SUPPLY LOCATIONS

There are already several off-street parking facilities in the Downtown Master Plan area, including surface and structured parking. Some of these may disappear to make may for new development, while some, particularly existing structured parking, will remain. Those remaining may have excess capacity today that could support a portion of the potential development program in the Downtown Master Plan.

The number of parking spaces needed may increase if development occurs on surface parking lots that are highly utilized. Conversely, any additional excess capacity in the current system remaining would reduce the overall number of parking spaces needed to support future development in the Downtown Master Plan area.

For example, the City of Arlington contributed to the construction of structured parking for the 101 Center project. As a result, 89± parking spaces within the development's structure have been designated for public parking and are available to the general public. This public parking could be utilized by new development in the vicinity of City Hall, potentially reducing the number of net new spaces needed when development occurs.

Walker has developed the following guiding principles for parking planning in Arlington, based on industry best practices and the principles contained in the Downtown Master Plan.

- Encourage a "park once" policy intended to limit internal vehicular circulation within downtown Arlington.
- Develop efficiency of existing and new parking facilities through shared-use parking strategies and strategic locations that maximize the ability of parking structures to conveniently serve as many user groups as possible.
- Develop parking structures that act as multimodal hubs integrated with existing and future active transportation, micro transit and shared mobility options.

Walker recommends that the location of planned multi-use parking facilities be determined based on a specific set of criteria, as depicted below in Figure 3. Note that Figure 3 references Walking Distance LOS (Level of Service); Walking Distance LOS categories are shown in Figure 4.

Figure 3: Arlington Preliminary Garage Siting Criteria

Criteria	Purpose/Intent
Easy transfer to future potential micro transit option such as a bike hub, scooter hub, or fixed route AV shuttle stop	B+ Walking Distance LOS or better Encourages a park once environment
Accessibility to main road	Reduce internal circulation and traffic on roads planned to be pedestrian/bicycle friendly
Potential to incorporate with transit	Support ridership goals of potential future transit lines and provide a flexible, shareable parking supply Encourages a park once environment
Potential for sharing among multiple uses	Efficient use of parking assets, reduction in the number of spaces needed to be built

Source: Walker Consultants, 2019.

Figure 4: Walking Distance LOS

Maximum Walking Distance from Parking to Destination	LOS D	LOS C	LOS B	LOS A
Climate Controlled	5200'- about 1 mile	3800'- about 0.7 miles	2400'- about 0.5 miles	1000'- about 0.2 miles
Outdoors, Covered	2000'- about 0.4 miles	1500'- about 0.3 miles	1000'- about 0.2 miles	500'- about 0.1 miles
Outdoors, Uncovered	1600'- about 0.3 miles	1200'-about 0.25 miles	800'- about 0.1 miles	400'- <0.1 miles

Source: Walker Consultants, 2019.

To the extent possible, parking should be developed in central locations with the ability to serve multiple uses and destinations. With strategically located parking, most of the Downtown Master Plan area can be reached within a one-quarter mile walking distance. The Figure below shows a basic illustration of this idea.

Figure 5: Parking Siting Concept

Image Source: City of Arlington Downtown Master Plan (September 2018)

Source: Walker Consultants, 2019.

FUTURE PARKING DEMAND

Many planners and consultants expect that using driverless ride-hailing (with or without transit for some trips) will cost significantly less than owning a personal vehicle in the future. We employ the airport term for Uber and Lyft, which is Transportation Network Companies (TNC), as many other players including Waymo, Ford and GM are poised to enter this market.

A study recently released by the California Department of Transportation (Cal DOT) posits that while autonomous TNCs will begin to penetrate the market in the next decade, the majority of vehicles will continue to be privately owned. [2]

[2] Gordon et al, 2018. The Future of Autonomous Vehicles: Lessons from the Literature on Technology Adoption. Cal DOT: CA 17-2796-3.

We have evaluated the impact on parking demand based on sales and other projections by international business and auto consultancies. We rely primarily on a McKinsey study[3], which projects that 10% of all passenger vehicles sold in 2030 will be to ride-hailing services, resulting in a potential reduction in private vehicle auto sales by 2.3 private vehicles sold per TNC vehicle sold. This would reduce overall vehicle sales by about 5 million vehicles, or about 25% of sales in 2030. However, there are 260 million cars on the road today, and millions more sold between now and 2030 that will be on the road for 10 to 20 years after that. Walker does not expect maximum impact on parking from autonomous TNCs until 2050. Even then, Walker anticipates that parking reductions from autonomous TNCs will fall in the range of only a 10 to 40% reduction *nationally*. Our model results in about 1/3 of vehicles owned by TNCs and 2/3 owned by private individuals by 2050. The TNC vehicles would comprise 72% of VMT, and private vehicles 28%. Therefore, we believe our high scenario is truly a maximum impact scenario.

For further discussion, white papers documenting the development of our opinions can be found in the attached white paper.

Another factor is that L2/3 autonomy, which refers to a technology that provides a specific set of functions that will allow autonomous parking to occur, will be available long before L5 cars (fully autonomous vehicles with no human interaction required) are driving around public streets. Fully autonomous parking with L5 vehicles means that the driver and passenger can get out of the vehicle and send the car off to park itself in the lot or structure. Because the car doors do not have to open at the parking stall, we expect to be able to park roughly four cars in three stalls.

This means that even without extensive driverless ride-hailing, the parking capacity will go up as the parking demand may be going down.

There are two main reasons that we raise this issue at this time. The first is that, due to the potential reduction of parking demand of 10% by 2050, as well as autonomous parking, we strongly recommend maintaining flexibility in the way the downtown Arlington parking system is planned and constructed, with centrally located garages being constructed first. The second is that due to these considerations, we cannot recommend extensive design for future adaptive reuse, which typically adds 30% or more to the initial cost of construction.

[3] http://www.mckinsey.com/industries/high-tech/our-insights/disruptive-trends-that-will-transform-the-auto-industry

PARKING COST OVERVIEW

The following section provides an overview of basic costs associated with building, operating, and maintaining parking district-wide in the City of Arlington. The following assumptions have guided this analysis:

- Walker has assumed that all parking structures will include architectural treatments to maintain contextuality with the surrounding neighborhoods.
- Walker has assumed that all parking will be actively managed and monitored.
- Walker has assumed industry-recommended standards for general garage maintenance.

PARKING COSTS- BASE DISTRICT-WIDE SHARED PARKING SCENARIO

As detailed in the previous section, Walker has projected a need for 3,351 shared parking spaces district-wide, assuming little to no active transportation demand management (the "Base Scenario"). The following figure (Figure 6) provides a general opinion of cost for construction of these spaces. Note that this figure excludes costs to obtain land and are in 2019 dollars.

Figure 6: Base Scenario Capital Cost Projection

# Spaces	Cost Per Space Range	Total Cost Range
3,351	$28,000 - $32,000	$93,828,000 – 107,232,000

The following figure (Figure 7) shows projected annual operations and maintenance costs for the system. General operations and maintenance include labor, utilities, basic general maintenance needs (restriping, repairing minor concrete damage, etc.), and other industry standard needs for parking in systems of this size and scope. In addition, Walker recommends that $30-35 per space per year be set aside for larger repair and maintenance issues, such as structural damage.

Figure 7: Base Scenario Annual Maintenance Cost Projection

# Spaces	Cost Per Space Range (General O&M)	Cost Per Space Range (Reserves)	Total Per Space Range
3,351	$170-190 per year	$30-35 per year	$670,200 – 753,975 per year

PARKING COSTS- ASPIRATIONAL DISTRICT-WIDE SHARED PARKING SCENARIO

As detailed in the previous section, Walker has projected a need for 2,360 shared parking spaces district-wide, assuming active transportation demand management (the "Aspirational Scenario"). The following figure (Figure 8) provides a general opinion of cost for construction of these spaces. Note that this figure excludes costs to obtain land and are in 2019 dollars.

# Spaces	Cost Per Space Range	Total Cost Range
2,360	$28,000 - $32,000	$66,080,000 – 75,520,200

The following figure (Figure 4) shows projected annual operations and maintenance costs for the system. General operations and maintenance includes labor, utilities, basic general maintenance needs (restriping, repairing minor concrete damage, etc.), and other industry standard needs for parking in systems of this size and

scope. In addition, Walker recommends that $30-35 per space per year be set aside for larger repair and maintenance issues, such as structural damage.

# Spaces	Cost Per Space Range (General O&M)	Cost Per Space Range (Reserves)	Total Per Space Range
2,360	$170-190 per year	$30-35 per year	$472,000 – 531,000 per year

RECOMMENDED ITEMS FOR ADDITIONAL STUDY

District-wide shared parking is complex to manage and requires unified and decisive parking and transportation demand management, active support of modes of circulation outside of the single-occupancy vehicle, and participation from new development. Given the coordination needed to develop and run an efficient shared parking system, Walker recommends the City of Arlington consider additional study of the following:

- **Off-Street Parking Requirements and In-Lieu Fee Program:** Without amendments to off-street parking requirements for new development, developers will construct parking to serve their individual projects, eliminating the efficiency and effectiveness of a shared parking program. Walker recommends that the City examine its off-street parking requirements and possibly consider an in-lieu fee program for downtown Arlington wherein developers could contribute to a fund to build, operate, and maintain shared parking structures rather than constructing their own parking.
- **Transportation/Parking Management Authorities/Management Options:** A district-wide shared parking program typically requires management and oversight by a single entity. There are many options for this entity, such as a transportation/parking management authority, a business or general improvement district, or a parking benefit district, among others. Walker recommends that the City explore its options for managing the parking program and complementary programs, collecting and spending monies, coordinating with relevant agencies, etc.
- **Transportation Demand Management Planning:** Transportation Demand Management—active programming to reduce single occupancy vehicle usage—is an essential component to the shared parking program, especially if achieving a lower parking supply figure is an important goal. As such, Walker recommends that the City develop a transportation demand management plan and implementation program for the district.

ATTACHMENTS

“Parking in the Age of Uber and AVs” by Walker Consultants

PARKING IN THE AGE OF UBER AND AVs

An overview created by Walker Consultants

Image Source: (By Dllu - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=53174002)

Autonomous vehicles are currently being developed and most industry experts believe these vehicles will available within the next decade, first to ride-hailing companies (or transportation network companies, TNCs), like Uber and Lyft, and then to consumers. AVs could disrupt transportation since households would likely need fewer cars to meet transportation needs. For example, one AV could drop off a family member, and drive itself to pick up another. Once the service is driverless, it is generally expected that the cost of using ride-hailing for daily travel for urban residents will be 30 to 50% less than owning a personal vehicle. Numerous players, including tech companies like Google, Apple and Amazon as well as auto manufacturers such as Ford and GM, are reportedly planning to enter the ride-hailing market and competition will likely be strong. If many urban residents then give up their cars and use TNCs, personal vehicle ownership rates could decline significantly and parking could be significantly impacted.

Walker has developed a series of whitepapers looking at the development of AVs and their possible impact on parking in the future. These white papers include:

- *Levels of Autonomy*
  The stepping stones to driverless vehicles
- *AV Challenges and Benefits*
  Many issues can and will affect the timeline
- *Ride-hailing Impacts on Parking*
  Understanding TNC impacts today to understand the future if/when TNCs go driverless
- *The 90% Fallacy*
  Why a 90% reduction, as some project, in parking won't happen
- *Timing of AVs and Parking Disruption*
  When and how much will parking be impacted?
- *Airport Parking in the Age of Uber*
  What airports need to know to manage change today and plan for the future
- *IT Connectivity in the Age of AVs*
  AVs, Connected Cars and Big Data hold the potential for revolutionary change in parking
- *Designing Parking Structures for the Future*
  What you need to consider in planning new parking structures, today
- *Adaptive Reuse of Parking Structures*
  What is practical to design today…and what isn't

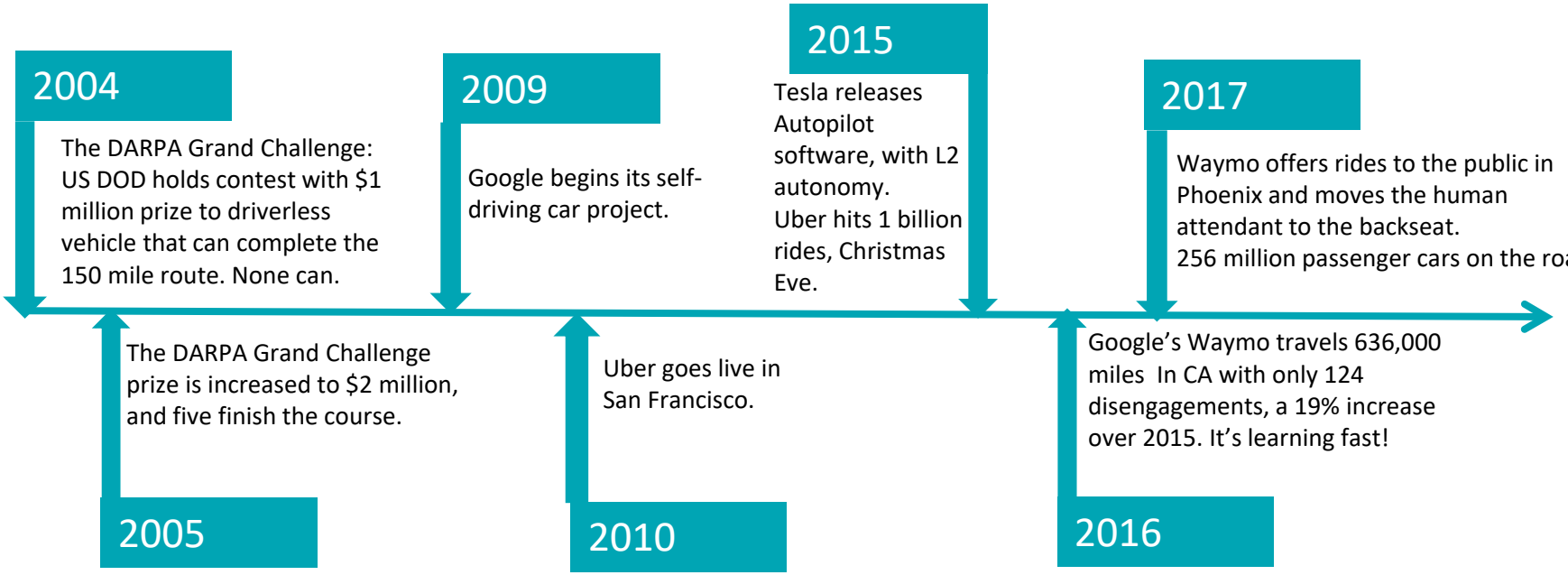
This paper summarizes the "big picture" of our findings.

LEVELS OF AUTONOMY

The Society of Automotive Engineers has categorized six levels of automation, which have subsequently been adopted by the National Highway Traffic Safety Administration (NHTSA). [1]

- Level 0 has no automation.
- Level 1 has function-specific automation such as adaptive cruise control.
- Level 2 has a combination of automated functions that work together, such as today's Teslas.
- Level 3 automation will provide a complete set of functions for self-driving, but will still require a driver at the wheel to take over control in the event of the system's inability to deal with a problem.
- L4 vehicles can be driverless, but only in specific areas that have been mapped and where operations have been tested.
- L5 vehicles will be able to operate driverless in any conditions, in any area. Snow and heavy rain are among the conditions that have yet to be solved before L5 can be come a reality.

Where we are today…



WHY AV's? Who benefits, who doesn't

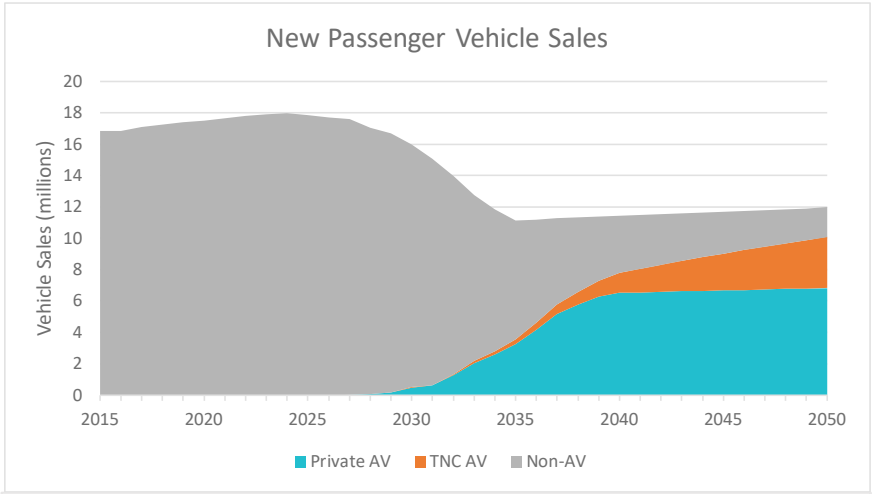
BENEFITS OF AVS:

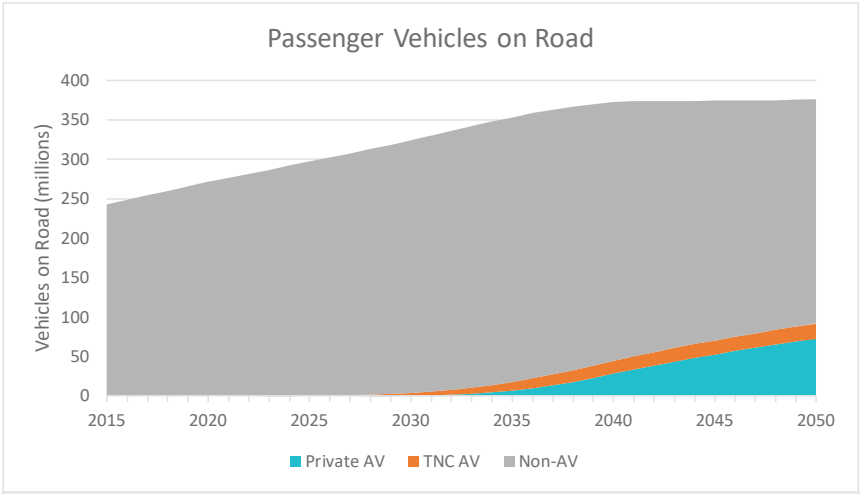
- Safety: Up to 90% reduction in accidents, fatalities and injuries. AVs won't drive drunk, distracted or dangerously aggressive.
- Significant reduction in household transportation costs and increased household disposable income
  - When driverless, TNC use for all local rides will be 30 to 50% less than owning car for urban dwellers.
  - Reduced cost of transit due to driverless vehicles. TNCs will solve the first mile/last mile problem for transit. Unsustainable bus routes will be eliminated. Transit will focus on mainlines.
  - Paying for a personal AV will be a lot easier if household is able to reduce the number of vehicles owned.
  - Potential revenue from sponsorship & services (Starbucks on commuter buses), info/entertainment further reduces cost to riders.
  - Decreased cost of goods and services, due to driverless freight and deliveries
- Reduction in congestion due to vehicles talking to each other and infrastructure like traffic signals which optimizes roadway utilization. (Cost of congestion in US is $300 billion.)
  - Reduction in pollution and dependence on foreign oil, particularly due to increased use of electric vehicles by TNCs.
- Reduction in stress of driving, particularly commuting.
- Increased productivity.
- Improved mobility for the elderly, disabled and poor that can't/shouldn't/don't drive.
- Reduction in area required for parking will enhance the urban fabric. Parking closest to destinations will no longer be critical.
- Significant improvements in parking management due to connected vehicles, with dynamic parking, parking availability with reliance on signs, and gateless parking if/when all vehicles have an IP address and a credit card on file.

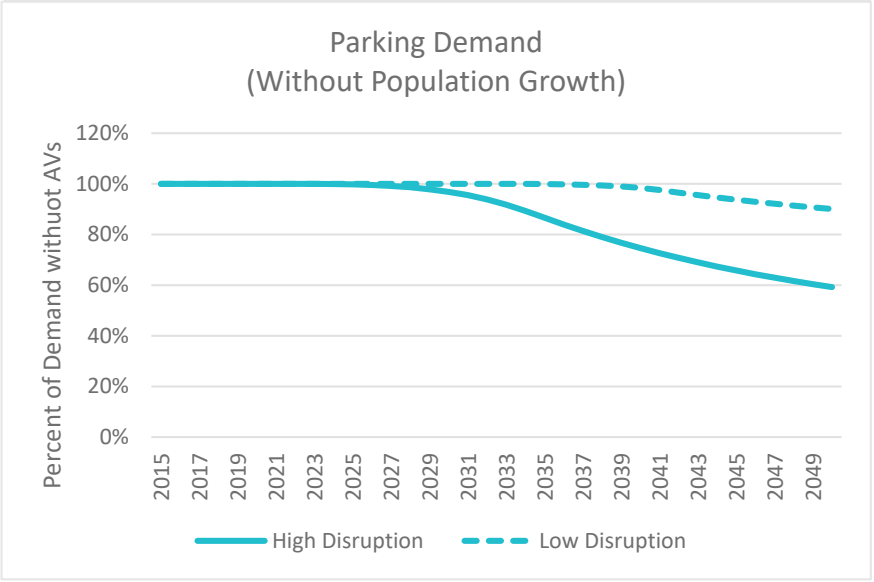
CHALLENGES OF AVS:

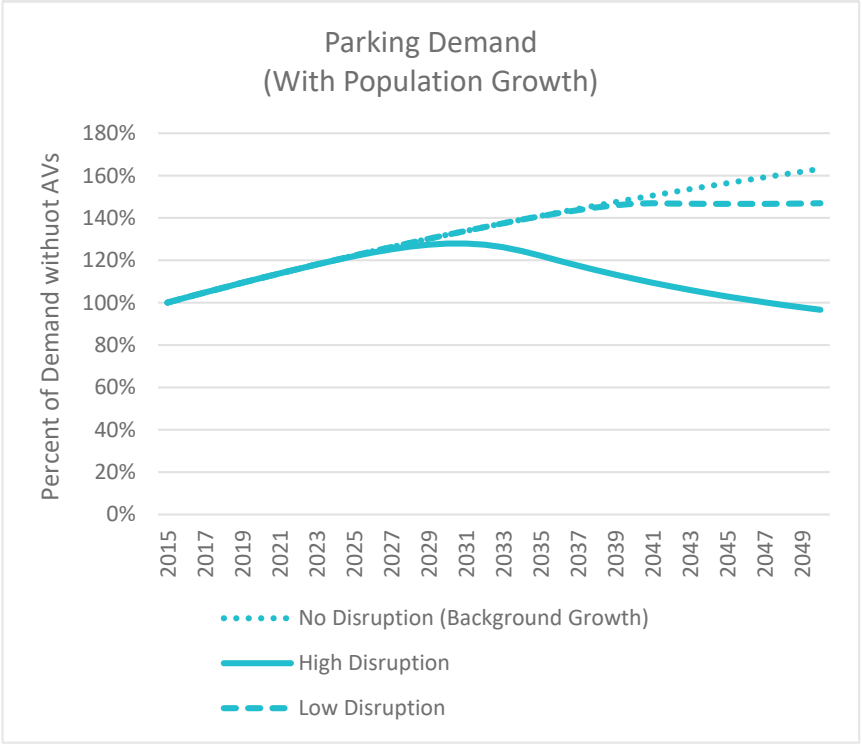
- Consumer Acceptance: Likely to be the biggest influence on timeline and ultimate penetration of AVs.
  - Only 22% of consumers today say they trust AVs or are willing to pay for L4/L5 vehicles. About 50% do expect to ride in AVs in the future. Studies show however, that those that have L2 features on cars are more likely to say they will trust and use AVs.
  - Serious accidents with L3 vehicles could significantly impact and delay acceptance with AVs.
  - There will be a long and difficult transition period when there are still many L0/1/2 vehicles on the road.
- Experts think that "shared" or pooled TNC rides (UberPool rather than Uber X) will be necessary to avoid significant increases in traffic due to vehicles driving around empty. Will consumers accept pooled rides?
- Significant technical and cost of technology issues to reach L5. While the US government indicates full intent to approve AVs, there are a lot of regulatory, legal and insurance issues to be resolved.
- Significant improvements in infrastructure are required for full benefits of AVs to be achieved: upgrading traffic signals, mapping, and communication grid, etc. How will it be upgraded and maintained, when we can't find the money to repair crumbling bridges?
- Cybersecurity is a looming issue yet to be resolved.
- TNCs will result in loss of gas taxes, on-street parking and revenue (for passenger loading).
- Huge disruption of jobs and businesses in transportation, auto manufacturing/service/repair, insurance.

Walker's Parking Demand Impact Projections:









Walker's analysis is based on McKinsey's "high disruption" scenario for sales of AVs, US DOT data on cars on the road and scrappage rates, and on US Census Bureau population projections.

TimeLine for AVs and Disruption of Parking (Walker High Disruption Scenario)

2021

TNC's are offering driverless rides commercially in selected cities. Laws, regulations etc. are in place for L4 AVs.

2025

Parking owners provide passenger loading zones (PLZ) for autonomous parking inside facilities (cars that can park themselves on site, after dropping occupants). Cities have to remove parking on-street for TNC PLZs.

2030

12% of new cars are AVs sold to TNCs, & another 3% are L4/L5 sold to consumers. Car sales have declined 42%* but stabilize. 3.6 million AVs on the road (1% of total cars on road in US). Decline in parking demand becomes noticeable at individual land uses; overall parking demand reaching peak and levels out before turning down.

2027

L5 AVs are sold to consumers. New car sales down 1 million vehicles* due to people switching to TNCs. Insurance is provided by manufacturer, with new ownership/lease models, including using car most of the time, a pickup on the weekend, and larger vehicles for family trips.

2033

US parking demand peaks and begins to decline, as decline in auto ownership outweighs population growth. Decline in parking demand begins for downtowns, airports, and campuses where demand typically grows with population and economic activity. Parking serving individual land uses down avg 10%. **

2035

1/3 of new cars sold to TNCs but still only 3% of cars on the road. Private AVs are another 2% of vehicles on the road. Overall vehicles on road reduced by 20 million, roughly 12%* due to TNC users not replacing cars

Surface lots in core areas are redeveloped with little or no parking, using available area parking. Parking for downtowns moves to the perimeter, as private AVs can drop occupants and go park at lower rates.

2040

AV's reach 90% of sales. Still 327 million L0-L3 cars on the road (sold before 2040). Older standalone garages that are deteriorated or expensive to maintain are torn down and sites redeveloped, with little parking.

2049

1/3 of cars on road are TNCs, 2/3 private. Parking demand nationally has declined 40% **per unit of land use** (which will be felt by parking that serves individual land uses). Parking demand for downtowns, campuses and airports that tend to grow over time with population and economic activity, is about the same as it was in 2015 and will begin to grow again, albeit much more slowly than it does today.

* Compared to what would have happened this year without AVs.

**Average nationally. More urban core, less suburban and very little impact rural.

WHAT PARKING INDUSTRY NEEDS TO THINK/PLAN/DO

Provide “just enough” parking, use mixed uses and shared parking, and allow flexibility to increase or decrease parking over time.

Cities and Airports need to prepare curb management and transition plans, to allow for changing pickup/drop off needs, and implement TNC use fees.

Plan for IT connectivity. Conduit pathways are key.

Plan for significantly increased EV recharging. Power management systems will reduce power requirements, which are bigger issue than number of charging units

Plan for passenger loading zones inside parking structures; a significant issue is 9’6” clear height required by ADA.

Do plan for some future changes, such as future retail at grade, adding floors, or converting the roof parking, residential wrap around the outside and strategic demolition at expansion joints.

Designing new parking structures for complete conversion is not likely to be cost-effective or appropriate for most facilities; see *Adaptive Reuse* whitepaper for the reasons why. While it may only cost 1% to increase floor to floor heights are many recommend, that merely puts off and actually increases the very significant costs to convert to other uses, which will still be constrained by parking design parameters.

ABOUT THE AUTHOR

Walker Consultants is the global leader in providing parking consulting and parking design services. Founded in 1965, we pioneered the field of parking consulting. Today the firm has over 300 employees delivering a wide range of parking planning, design, engineering, and restoration services.

The firm is based in the U.S. with 17 domestic offices and 1 in the United Arab Emirates, is ranked #240 in Engineering News Record’s Top 500 Design Firms and #13 in Building Design + Construction’s Giants 300 Engineering/Architecture Firms.

We serve a broad spectrum of markets including healthcare, education, government, aviation, residential, retail and commercial development, entertainment, hospitality and athletic venues. This diversity allows our staff the luxury of collaborating with a large cross section of client types and developing best practices for their specific development needs, helping them unlock the potential of their projects.

WALKER CONSULTANTS