**March 8, 2022**
PK# 4255-19.124

# Parking Management Study

*Project:*
**City of Cedar Hill – Downtown Complete Streets Master Plan**
*In Cedar Hill, Texas*

*Prepared for:*
***City of Cedar Hill***

*On behalf of:*
**Cedar Hill Economic Development Corporation**

*Prepared by:*


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# Parking Management Study
# City of Cedar Hill – Downtown Complete Streets Master Plan

Cedar Hill, Texas

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# INTRODUCTION

The services of **Pacheco Koch** (PK) were retained by **Cedar Hill Economic Development Corporation**, to conduct a Parking Management Study (PMS) for the *City of Cedar Hill Old Town District - Complete Streets Master Plan* (the "Project"). A site location map (**Exhibit A**) is provided following the report.

This PMS was prepared to determine the total parking needs expected as the Old Town continues to develop and become a more pedestrian friendly setting.

## *Purpose*

A PMS is an investigation of actual and published parking demand characteristics for a specific site with specific land use(s). The analysis is designed to take into consideration any site-specific factors that may affect parking demand as well as consider future parking needs as the Old Town District develops.

Parking demand is theoretically represented by local zoning ordinances. However, in many cases, these ordinances are overly-simplified and/or over-generalized and do not sufficiently reflect actual parking needs. The purpose of this PMS is to compare the actual parking needs with the corresponding code requirements and national parking data and provide parking quantities to be considered in the complete streets master plan. The ten specific items requested include:

1. An assessment of current parking requirements and recommendations for changes. (see Tables 2 and 3 and Page 8)
2. A parking assessment of peak hours based upon current occupancies and supply. (see Tables 6 and 7)
3. A parking assessment of peak hours based upon planned occupancies and supply within 3 years taking into consideration identified alternative modes of transportation. (see Tables 4 and 5)
4. A parking assessment of peak hours based upon maximum occupancy and complete build-out taking into consideration identified alternative modes of transportation.
5. A plan of options that addresses the current and future parking demand.
6. Identification of potential locations for new parking facilities (surface and/or structured). (see Page 8)
7. Identification of funding costs, mechanisms and sources for the identified parking options. (see Page 9)
8. Recommendation on modifications to the parking element of the City's zoning ordinance where necessary. (see Page 8)
9. An assessment of existing parking signage and opportunities for improvements. (see Page 8)
10. Identification of measures regarding access, signage, protective barriers and striping that facilitates pedestrian safely. (see Page 8)

This report covers the existing and current parking demands. It also anticipates demand at build-out. The land use plan shows the proposed parking locations and

detailed signage and pedestrian safety plans will be included in the roadway design plans.

## *Project Description*

The City of Cedar Hill developed the Historic Downtown Vision plan to transform the downtown into a "more walkable, mixed-use destination with a sense of place." Based on this plan and the proposed re-development of the northwest corner of Cedar Street and Broad Street, it was determined the future land uses in the Old Town District could include restaurants, retail, office, churches, and residential property. Existing building footprints were used to measure square footage of existing buildings and a proportional analysis was used to determine what could be developed on existing vacant land. A summary of the potential future development and current occupancies is provided in Table 1. The information is only based upon the study area shown in **Exhibit A**.

Table 1. Old Town Development Summary

| USE | EXISTING AMOUNT | PROJECTED AMOUNT |
|---|---|---|
| Retail | 28,000 SF | 36,350 SF |
| Restaurant | 22,500 SF | 57,950 SF |
| Office | 11,700 SF | 19,600 SF |
| Residential | 31 units | 58 units |
| Church* | 47,000 SF | 59,000 SF |

*NOTE: The development program provided above is based upon the most current and complete information available at the time of this study publication.*
** The Church square footage is based off measuring the Baptist Church and Church of Christ building footprints in aerial photos along with the proposed Church of Christ expansion plans.*

The study area has an existing parking supply of 513 spots, of which 255 are on-street parking, 131 spaces for the Baptist Church lots, and127 spaces in other lots. The total breakdown of the 513 spots can also be separated into 291 publicly owned parking spaces and 222 that are privately owned. The Church of Christ also proposes 74 parking spaces that will be available to the public during certain hours. The parking space count is based on counting on-street parking and parking lots within the study area shown in **Exhibit B**. Some locations do not have defined parking spaces, but assumptions were made based on site observations.

# PARKING CODE REVIEW

The current land uses in downtown include churches, residential, retail, restaurants, office space, art gallery and personal services. As the Old Town District evolves, the land uses are expected to increase in density. As outlined in Section 23-5.1.6 of the City of Cedar Hill Code of Ordinances, and Zoning Ordinance Article 5 5.1.6 Schedule of Parking Space Requirements the parking requirement for the assumed future land uses is calculated by direct application of the rates provided in the Cedar Hill Development Code (see Appendix A). The current codes are based upon suburban, auto-oriented development patterns. In order to preserve the current block pattern, parking requirements must be revisited. Square footage was calculated using existing building footprints and projected developments. The Masonic Lodge was combined with Office square footage for calculations.

A summary of the resulting generalized net parking requirement based on current City Code is summarized in Table 2 and Table 3. The current City codes are more specific on the parking required for retail and office style developments to account for the number of workers and customers they may have. For instance, a medical office (high density) will need more parking than an architect's office (low density) since the medical office will have clients visiting all day. The data from Tables 2 and 3 were used to consider a range of parking based on future development since the types of businesses cannot be predicted.

Table 2. City Code Projected Parking (High Density)

| LAND USE | | AMOUNT [A] | RATE | DIRECT PARKING REQUIRED |
|---|---|---|---|---|
| Typical Use | Parking Group | | | |
| Single Family | 4 | 58 units | 2 sp/ unit | 116 |
| Restaurant | 7 | 36,350 SF | 1 sp/ 100 SF | 364 |
| Retail | 8 | 57,950 SF | 1 sp/ 200 SF | 291 |
| Office | 8 | 19,600 SF | 1 sp/ 200 SF | 98 |
| Church | 29 | Seats | 1 sp/ 4 seats | 184* |
| | | | **Total** | **869** |

Table 3. City Code Projected Parking (Low Density)

| LAND USE | | AMOUNT [A] | RATE | DIRECT PARKING REQUIRED |
|---|---|---|---|---|
| Typical Use | Parking Group | | | |
| Single Family | 4 | 58 units | 2 sp/ unit | 116 |
| Restaurant | 7 | 36,350 SF | 1 sp/ 100 SF | 364 |
| Retail | 10 | 57,950 SF | 1 sp/ 300 SF | 196 |
| Office | 10 | 19,600 SF | 1 sp/ 300 SF | 66 |
| Church | 29 | Seats | 1 sp/ 4 seats | 184* |
| | | | **Total** | **742** |

* The parking shown is assumed to meet City codes since the number of seats in the sanctuary was not available to analyze the churches based on City codes.

# PARKING DEMAND ANALYSIS

The Parking Demand Analysis was developed as a tool to plan future parking needs of the Old Town District.

## *Approach*

To project the parking demand for the Old Town District as it develops, information was compiled from two sources: (1) published parking demand data from credible industry sources; and (2) actual parking demand data collected on site. These data points were then compared with the existing parking trends to develop a recommended parking for the Old Town District.

## *Published Parking Data*

Institute of Transportation Engineers (ITE) Parking Data

The *Parking Generation* manual, 5th Edition (2019), published by the **Institute of Transportation Engineers** (**ITE**), is the preeminent source of technical parking demand data. The manual is a compilation of actual parking generation data and statistics by land use as collected over several decades by creditable sources across the country. Though the manual is not comprehensive, data are provided for several land uses. Use of the ITE equations and rates to project peak parking demand is widely recognized, when applicable; however, application of engineering judgment to interpret the data is strongly advised.

Table 4 provides a summary of the projected parking demand based on ITE rates for the anticipated land uses as the Old Town District develops. Land use code 820 was used with the combination of square footages of all retail, restaurant, and office spaces. This code was selected since it accounts for the shared parking between the land uses as well as the flexibility of the downtown. Residential was estimated by assuming square footage of undeveloped tracts being developed with two to three story structures and being approximately 40,000 square feet. Residences are also assumed to provide some on-site parking. Excerpts from the ITE *Parking* Generation manual are provided in the **Appendix**.

Table 4. Parking Generation Summary Based Upon ITE Data

| LAND USE | ULTIMATE BUILD-OUT QUANTITY | RATE | PROJECTED PEAK PARKING DEMAND |
|---|---|---|---|
| Shopping Center (820) | 113,900 SF | 1.49(X)+100.32 Where X=1000 SF | **219** |
| Church | 30,000 SF* | 9.44(X) Where X=1000 SF | **284** |
| Total | -- | -- | **503** |

*Estimated based on measurements from aerial photos and field data

As shown in **Table 4** above, the projected peak parking demand in the study area, based on ITE's methodology, is 503 parking spaces. Comparing the ITE projections

for the mixed-use developments (office, retail, and restaurant) with the City Code for the corresponding land uses shows at least 30% difference in the values. The City code is higher because it does not account for the time of day variable or the shared parking between land uses. Additionally, by including the Church parking into the total Peak Parking demand based on ITE data, the difference in peak times from churches to shopping centers are also not considered.

Urban Land Institute (ULI) Parking Data

The downtown area was also analyzed as a utilizing the shared use parking guidelines developed by the Urban Land Institute (ULI). The concepts of shared parking were developed by the Urban Land Institute (ULI) and published in the technical report titled Shared Parking (2nd Edition). The ULI shared parking data takes into consideration the fluctuations in parking demand intensity for each individual land use over a typical day (week, month, etc.) and sums the corresponding parking demands of all uses together to demonstrate the complementary nature that occurs.

Table 5 provides a summary of the projected parking demand based on ULI rates for the anticipated land uses as the Old Town District develops. The ULI data is based on hourly projections, which for this data set shows the weekday and weekend peaks occurring around midday. Churches are not included in the ULI data since the churches in downtown have Sunday morning peaks, which is when most businesses are closed.

Table 5. Parking Generation Summary Based Upon ULI Data

| LAND USE | AMOUNT | | Weekday Peak Parking Demand | Weekend Peak Parking Demand |
|---|---|---|---|---|
| ***Existing Parking Demand*** | | | | |
| Retail/Restaurant | 50,500 | SF | 182 | 202 |
| Office | 11,700 | SF | 38 | 3 |
| | | **Total** | **220** | **205** |
| ***Projected Parking Demand*** | | | | |
| Retail/Restaurant | 94,300 | SF | 340 | 377 |
| Office | 19,600 | SF | 64 | 4 |
| | | **Total** | **404** | **382** |

As can be seen in Table 5, applying the ULI rates to the existing square footage in the study area yields a peak parking demand of 220 on the weekday and 205 on the weekend; which is 55% higher on the weekday and 13% higher on the weekend than observed peaks (presented in the next section). The weekday data assumes higher midday traffic patterns than is currently occurring in downtown; therefore, utilizing the projected parking demand of 404 parking spaces in the current Old Town core district (as shown in Exhibits B and C) would allow growth for the evolution of development.

## *Observed Parking Demand*

Actual, observed parking utilization counts are considered to be the best representation of site-specific parking demand characteristics. Factors affecting parking demand such as time of day shared parking, tenant occupancy, etc. can be accounted for in this approach. For this reason, Pacheco Koch conducted on-site parking accumulation counts on Wednesday, May 15, 2019 and Sunday, June 9, 2019. The data collection times were selected based on peak usage for the major traffic generator in the study area – First Baptist Cedar Hill. A Wednesday night gives a perspective of a peak weeknight, while Sunday morning shows an overlap of church peak along with the beginning of the downtown retail/restaurant peak. A summary of those parking occupancy data is summarized in Table 6 and Table 7, and graphically summarized in **Exhibit C**. Exhibit C also shows the usage by parking zone based on assumptions between which parking zones/lots are private versus public.

Table 6. Weekday On-Site Parking Accumulation Data Summary

| | ACTUAL PARKED VEHICLE ACCUMULATION BY BLOCK WEDNESDAY PM | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TIME** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** | **L** | **M** | **Peak Parking Demand** |
| **4:45 PM** | 3 | 16 | 16 | 5 | 0 | 8 | 12 | 13 | 1 | 0 | 0 | 0 | 0 | 74 |
| **5:00 PM** | 3 | 20 | 14 | 6 | 0 | 9 | 15 | 16 | 1 | 0 | 0 | 0 | 0 | 84 |
| **5:15 PM** | 1 | 24 | 16 | 7 | 0 | 9 | 13 | 24 | 0 | 0 | 0 | 0 | 0 | 94 |
| **5:30 PM** | 3 | 23 | 20 | 7 | 0 | 9 | 10 | 25 | 0 | 0 | 0 | 0 | 0 | 97 |
| **5:45 PM** | 2 | 32 | 27 | 5 | 0 | 9 | 8 | 30 | 0 | 0 | 0 | 0 | 0 | 113 |
| **6:00 PM** | 3 | 28 | 36 | 4 | 0 | 8 | 12 | 32 | 0 | 0 | 0 | 0 | 0 | 123 |
| **6:15 PM** | 2 | 34 | 31 | 5 | 0 | 5 | 16 | 37 | 0 | 0 | 0 | 0 | 0 | 130 |
| **6:30 PM** | 2 | 37 | 38 | 6 | 0 | 5 | 13 | 39 | 0 | 0 | 0 | 0 | 0 | 140 |
| **6:45 PM** | 2 | 43 | 32 | 6 | 0 | 5 | 10 | 43 | 1 | 0 | 0 | 0 | 0 | 142 |
| **7:00 PM** | 3 | 41 | 39 | 5 | 0 | 5 | 6 | 40 | 1 | 0 | 0 | 0 | 0 | 140 |
| **7:15 PM** | 3 | 41 | 35 | 5 | 0 | 5 | 11 | 39 | 1 | 0 | 0 | 0 | 0 | 140 |
| **7:30 PM** | 3 | 38 | 34 | 5 | 0 | 5 | 9 | 39 | 0 | 0 | 0 | 0 | 0 | 133 |
| **7:45 PM** | 3 | 30 | 27 | 4 | 0 | 5 | 6 | 38 | 0 | 0 | 0 | 0 | 0 | 113 |

Table 7. Sunday On-Site Parking Accumulation Data Summary

| TIME | ACTUAL PARKED VEHICLE ACCUMULATION BY BLOCK SUNDAY | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L | M | Peak Parking Demand |
| **10:30 AM** | 0 | 50 | 27 | 0 | 0 | 4 | 3 | 14 | 0 | 0 | 1 | 1 | 0 | 100 |
| **10:45 AM** | 3 | 41 | 30 | 0 | 0 | 4 | 2 | 15 | 0 | 0 | 1 | 1 | 0 | 97 |
| **11:00 AM** | 3 | 41 | 32 | 0 | 0 | 4 | 2 | 26 | 0 | 0 | 1 | 2 | 0 | 111 |
| **11:15 AM** | 4 | 44 | 32 | 0 | 0 | 0 | 3 | 33 | 0 | 0 | 0 | 3 | 0 | 119 |
| **11:30 AM** | 3 | 27 | 34 | 0 | 0 | 0 | 2 | 42 | 0 | 0 | 0 | 3 | 0 | 111 |
| **11:45 AM** | 3 | 19 | 24 | 1 | 0 | 0 | 3 | 45 | 0 | 0 | 0 | 3 | 0 | 98 |
| **12:00 PM** | 1 | 19 | 17 | 1 | 0 | 0 | 4 | 46 | 1 | 0 | 0 | 3 | 0 | 92 |
| **12:15 PM** | 1 | 26 | 24 | 1 | 0 | 1 | 12 | 47 | 8 | 0 | 0 | 3 | 0 | 123 |
| **12:30 PM** | 6 | 33 | 26 | 1 | 0 | 1 | 10 | 51 | 9 | 0 | 0 | 3 | 0 | 140 |
| **12:45 PM** | 7 | 34 | 36 | 1 | 0 | 2 | 16 | 52 | 10 | 0 | 1 | 3 | 0 | 162 |
| **1:00 PM** | 8 | 43 | 43 | 1 | 0 | 4 | 17 | 51 | 10 | 0 | 1 | 3 | 0 | 181 |

During the Wednesday observation, the data indicates that the peak parking demand very distinctly occurs during the evening/dinner period while the church was holding evening events. The highest observed parking demand included 142 parked vehicles, or 28% occupancy of the existing parking supply. When only the parking spaces within public right of way is considered, there is a maximum parking used of 82 spaces or 28% of the available public parking lots and on-street parking. It was observed that parking was shared between the church and the major restaurants within the area. Church attendees were observed parking at the local restaurants, attending the church activities, and then returning to the restaurant to eat before departing for the evening.

During the Sunday observation, the data indicates that the peak parking demand occurred during the lunch rush after the church members had time to leave the parking lots. The highest observed parking demand included 181 parked vehicles, or 35% occupancy of the existing parking supply. It was observed that restaurant patrons would use church parking once the restaurant parking lots were at capacity. There was no observed overlap between restaurant and church patrons within the same lot at the same time. The peak parking of 181 vehicles would still fit within the existing 255 on-street parking spaces.

# FUTURE PARKING RECOMMENDATIONS

Based on the analysis, the proposed Complete Streets Master Plan will provide adequate parking for development and redevelopment in the study area.

## Future Parking Locations and Signage

The Complete Streets Master Plan has identified the on-street parking locations and potential for future parking structures based upon development in the future. However, with the existing usage of Transportation Network Companies (TNCs), such as Lyft and Uber and the anticipated redevelopment, structured parking should not be necessary to meet parking demands within the next five years.

The option of providing a trolly service could be evaluated. This could be utilized for large civic events occurring in the Old Town District providing transportation from parking areas in other areas such as Midtown.

Incorporating mixed-use parking structures can blend into the existing and new development architecturally. If a parking structure is done, portions of the first floor, or entire first floor depending on street front, can be designed for retail or other commercial uses. Where this locate will depend on vacant property developed.

The existing signage relating to parking is currently limited to "No Parking" signs to delineate zones that cannot be used. There are also a few small signs guiding people to additional public parking locations. These signs will need to be incorporated into a comprehensive wayfinding signage program to guide drivers to the available parking.

At build-out, the City can consider installing a dynamic wayfinding system. This system would track the parking spaces that are open and guide visitors to those locations. Implementation of this type of system will require a communication system (a fiber backbone in downtown or a wireless option). Installing conduit during the roadway construction would allow for an easier installation of a future communication system.

In order to provide a safe walking environment, handicap parking spaces need to meet ADA guidelines and ADA ramps should be provided at all intersections and access locations to handicap parking spaces. Crosswalks will be delineated with patterned stamped concrete to help indicate pedestrian zones. Detailed designs for measures that improve pedestrian safety including access, signage, protective barriers and striping are included in the Complete Streets plans.

## City Parking Code Modifications

The current city codes are based upon auto-oriented, suburban development patterns that anticipate all parking being provided on the same lot where the business is located. Therefore, the block pattern for which the city's downtown was designed cannot both meet suburban parking standards and maintain a pedestrian-oriented environment.

While there are some provisions for shared parking in the current code, the path to obtaining such agreements has proven to be cumbersome. Even taking into consideration the redevelopment at the northwest corner of Cedar Street and Broad Street, the parking supply in the first two phases of the plan is sufficient to meet the anticipated demand.

Based upon the findings presented in this study, code amendments should consider a 40 percent reduction of the current off-street requirements for new development on undeveloped property. However, based on the amount of provided (on street) shared parking versus the projected parking demand and the requirement in the current code for a parking study on a case-by-case basis; a reduction of up to 40% seems to still be sustainable.

## *Possible Funding Sources*

The City of Cedar Hill is proposing several changes in the Old Town district area to create a more mixed-use, pedestrian friendly environment. However, additional funding can help support these plans. There are local options, state programs, and private responsibilities that can be used to pay for construction and operation of the proposed changes. Some of the options include municipal bonds, tax increment re-finance zone (TIRZ) district, possible NTCCOG funding, dynamic parking pricing, and business/employee assessment programs.

Municipal bonds can be general obligation bonds, which are backed by a community's general taxation revenues, or revenue bonds, which are typically paid off through revenues such as parking fees. Establishing pay parking and utilizing revenue from parking enforcement might also be used for this purpose, but typically money from parking tickets is deposited directly into a community's general fund.

If a TIRZ district is established, the additional taxes generated from the increase in property values due to new Old Town Master Plan can be obligated or pledged to pay off the bond.

The North Central Texas Council of Governments (NCTCOG) has funding available in several different categories. In particular, Category 9: Transportation Alternative Program (TAP) funding could apply to the project. TAP funding is to implement bicycle and pedestrian facilities where they don't currently exist. These sources are generally divided into trail funding and Safe Routes to School where schools are present. The suitability of the funding sources would be evaluated, and a pursuit strategy could be implemented.

Dynamic parking pricing balances the varying demand for parking based on the fixed supply of parking. The parking fees can be placed in a special fund to address additional improvements to Old Town including parking lots or structures.

Business/Employee Assessment programs are utilized and funded by a special assessment on businesses in an area based on floor area, revenues or number of employees. These fees can also help generate funds to assist with maintenance.

# SUMMARY OF FINDINGS

*NOTE: Recommendations presented in this report reflect the opinion of Pacheco Koch based solely upon technical analysis and professional judgment. With the highly variable nature of a developing downtown, future development may need to do parking studies for their sites to account for the latest uses of downtown.*

The following findings and recommendations are based upon potential development and redevelopment of downtown and proposed and existing parking trends. The existing land uses downtown were compared with City codes, national data, and existing parking data. Based on the comparisons, the national data tended to yield results closer to the observed parking data.

As the existing downtown re-develops, it is recommended to maintain at least **410 parking spaces** in addition to the existing church parking lots. These can be in existing parking lots or on-street parking. The parking quantity takes into account the shared parking that will occur as downtown becomes a "more walkable, mixed-use destination with a sense of place." The current amount of public parking spaces planned for Old Town is 459, which should accommodate the typical future parking needs. If the churches were willing to create shared parking agreements, additional parking in the core downtown area would be available.

During special events, it is recommended to look for nearby vacant land that could be used a parking lots for extra people, such as the lot to the west of the railroad tracks between Cedar Street and Brandenburg Street.

Finally, as larger parcels are developed, it is recommended that each development provides on-site parking. Parking studies should be developed as the land uses are determined to verify that the combination of on-site parking and on-street parking will satisfy the nature of downtown.

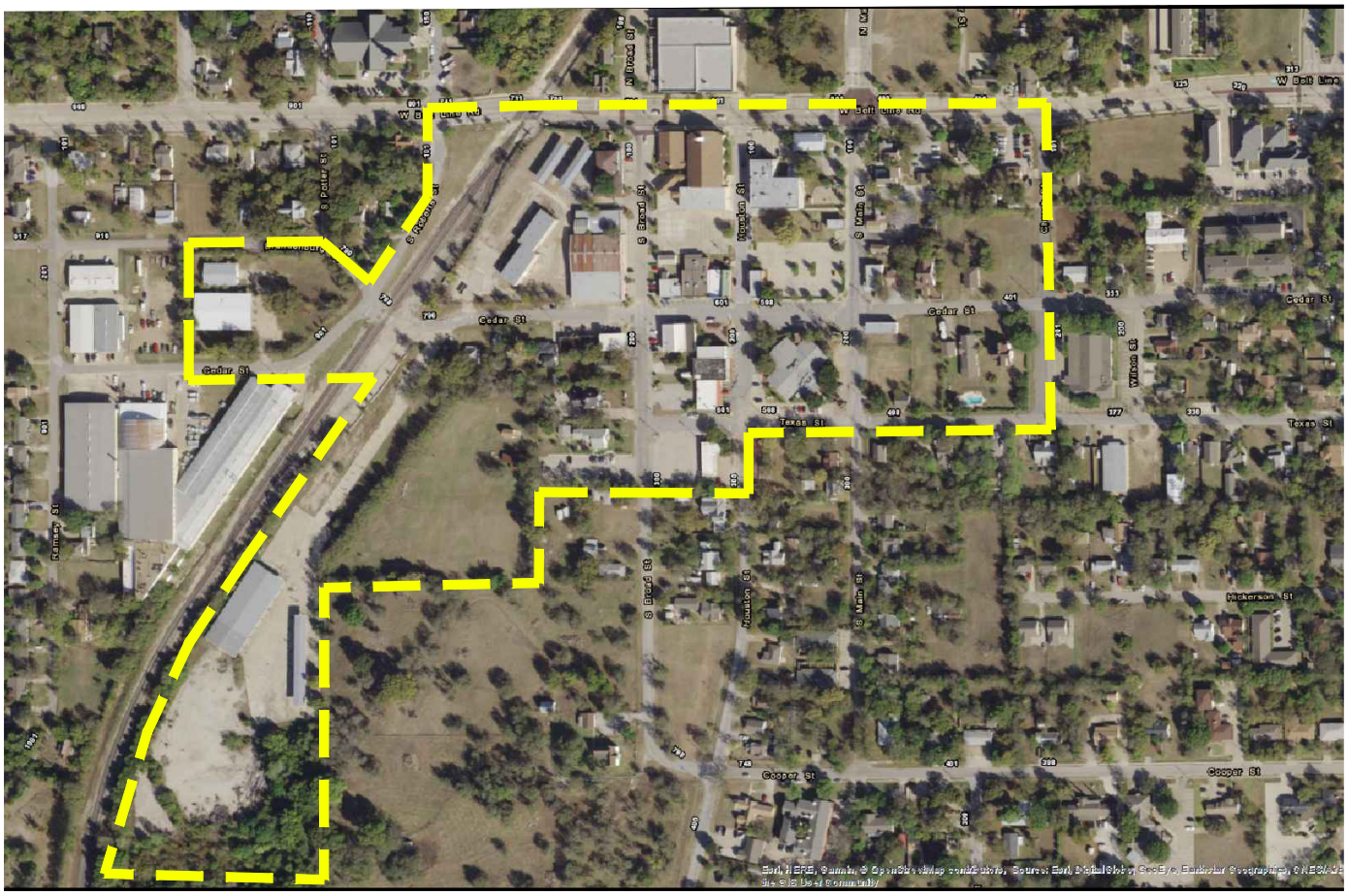
Table 8. Phased Parking Summary

| Current Demand | | After Lake-Moreno | | Re-development Build-out | |
|---|---|---|---|---|---|
| Demand | Provided | Demand | Provided | Demand | Provided |
| 181 | 587 | 201 | 587 | 410 | 459 |

# EXHIBIT "A"

# SITE LOCATION MAP

## DOWNTOWN HISTORIC PARKING, CEDAR HILL, TEXAS




— — — - Study Area


Pacheco Koch

6100 WESTERN PLACE, SUITE 1001
FORT WORTH, TX 76107 817.412.7155
TX REG. ENGINEERING FIRM F-469
TX REG. SURVEYING FIRM LS-10008001


| DRAWN BY | CHECKED BY | SCALE | DATE | JOB NUMBER |
|---|---|---|---|---|
| GLR | JLB | N.T.S. | 06/10/2019 | 4255-19.124 |

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# EXHIBIT "B"

# TOTAL PARKING BY BLOCK

## DOWNTOWN HISTORIC PARKING, CEDAR HILL, TEXAS



Pacheco Koch
6100 WESTERN PLACE, SUITE 1001
FORT WORTH, TX 76107 817.412.7155
TX REG. ENGINEERING FIRM F-14439
TX REG. SURVEYING FIRM LS-10193824


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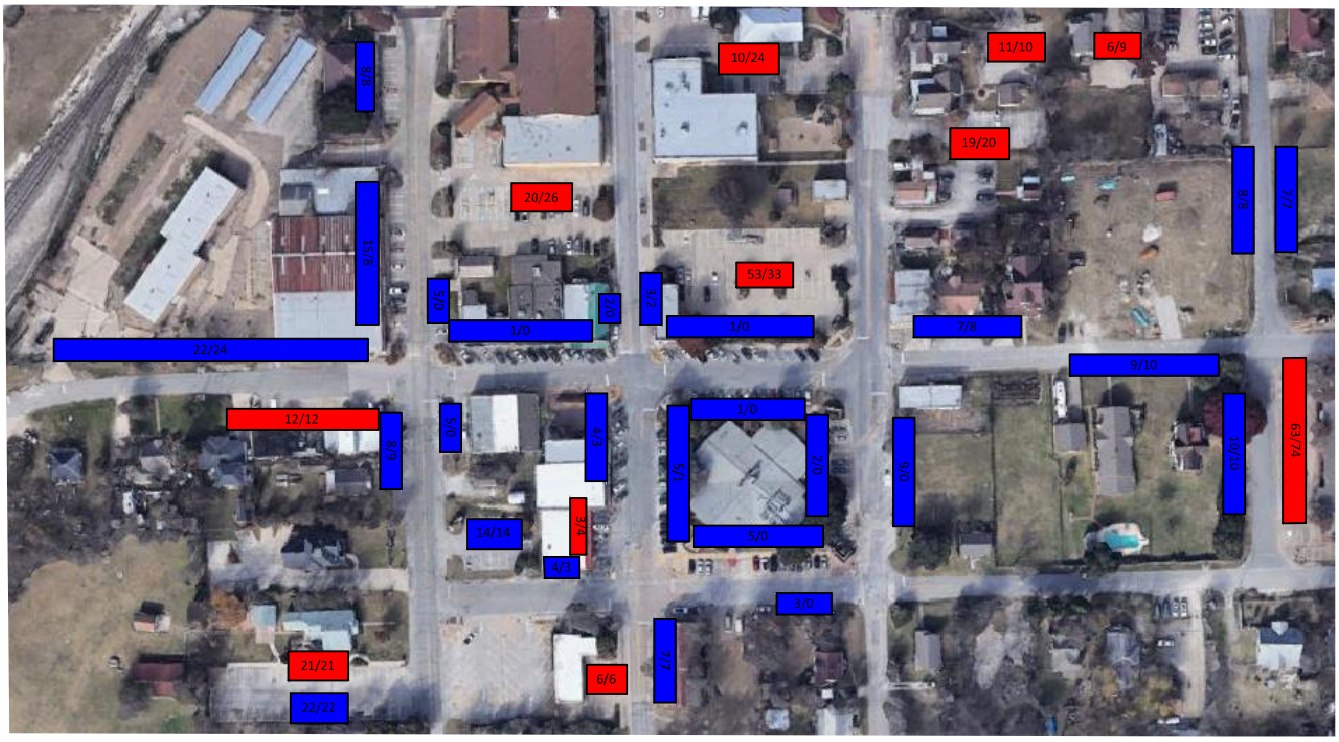
# EXHIBIT "C"

# PEAK PARKING

## DOWNTOWN HISTORIC PARKING, CEDAR HILL, TEXAS

## WEEKNIGHT/SUNDAY




PRIVATE PARKING SPACES

PUBLIC PARKING SPACES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# Appendix A. Excerpts from Development Code

Sec. 23-5.1.6. - Schedule of parking space requirements.

In all districts, the minimum number of off-street parking spaces to be provided shall be as follows (refer to section 23-4.1.2 for relation of parking groups to permitted uses): (Ord. No. 2001-71 § 12, 07-21-01) (Ord. No. 2006-276, § 18, 01-10-06)

| Group | Minimum Number of Off-Street Parking Spaces Required |
|---|---|
| 1. | 1 per unit |
| 2. | 2 per unit |
| 3. | 2 per unit |
| 4. | 2 per unit — 2-car garage |
| 5. | 2 per unit — 1-car garage |
| 6. | 1 per 50 sq. ft. of gross floor area + 12 |
| 7. | 1 per 100 sq. ft. of gross floor area |
| 8. | 1 per 200 sq. ft. of gross floor area |
| 9. | 1 per 250 sq. ft. of gross floor area |
| 10. | 1 per 300 sq. ft. of gross floor area |
| 11. | 1 per 400 sq. ft. of gross floor area |
| 12. | 1 per 500 sq. ft. of gross floor area |
| 13. | 1 per 600 sq. ft. of gross floor area |
| 14. | 1 per 800 sq. ft. of gross floor area |
| 15. | 1 per 1,000 sq. ft. of gross floor area |
| 16. | 1 per 1,000 sq. ft. of gross site area |

| | |
|---|---|
| 17. | 1 per 1,500 sq. ft. of gross site area |
| 18. | 1 per 2,000 sq. ft. of storage yard |
| 19. | 1 per 3 students |
| 20. | 1 per 5 students |
| 21. | 1 per 15 students |
| 22. | 1 per 25 students |
| 23. | 1 per employee on largest shift + 1 per 1,000 sq. ft. |
| 24. | 1 per bay or pump island |
| 25. | 1 per guest room |
| 26. | 1 per 4 patrons |
| 27. | 1 per 4 beds |
| 28. | 1 per 2.5 seats |
| 29. | 1 per 4 seats |
| 30. | 1 per 6 machines |
| 31. | 5 per hole |
| 32. | 5 per alley or table |
| 33. | 3 queuing spaces per bay or stall |
| 34. | 5 queuing spaces per bay or stall |
| 35. | 1 per vehicle stored |

| | |
|---|---|
| 36. | 1 per each seat |
| 37. | Reserved |
| 38. | 1 per 20 units |
| 39. | 2 per caretakers unit |
| 40. | Less than 15,000 sq. ft. of gross floor area - 1 per 200 sq. ft.<br>15,001-75,000 sq. ft. of gross floor area - 1 per 225 sq. ft.<br>75,001 - 400,000 sq. ft. of gross floor area - 1 per 250 sq. ft.<br>400,001-600,000 sq. ft. of gross floor area - 1 per 275 sq. ft.<br>600,001 and greater sq. ft. of gross floor area - 1 per 300 sq. ft. |

* Surface parking shall not exceed 110% of minimum required.

(Ord. No. 2001-71 § 12, 07-21-01; Ord. No. 2006-276, § 18, 01-10-06)

# Appendix B. Excerpts from Published Data/Studies

# Land Use: 820 Shopping Center

## Description

A shopping center is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. A shopping center's composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands.

## Time of Day Distribution for Parking Demand

The following table presents a time-of-day distribution of parking demand **during the month of December** on a weekday (seven study sites), a Friday (eight study sites), and a Saturday (19 study sites).

| | Percent of Peak Parking Demand during December | | |
|---|---|---|---|
| Hour Beginning | Weekday | Friday | Saturday |
| 12:00–4:00 a.m. | – | – | – |
| 5:00 a.m. | – | – | – |
| 6:00 a.m. | – | – | – |
| 7:00 a.m. | – | – | – |
| 8:00 a.m. | – | – | – |
| 9:00 a.m. | – | – | – |
| 10:00 a.m. | – | 74 | – |
| 11:00 a.m. | – | 87 | 85 |
| 12:00 p.m. | 77 | 97 | 97 |
| 1:00 p.m. | 100 | 100 | 98 |
| 2:00 p.m. | 98 | 92 | 100 |
| 3:00 p.m. | 90 | 85 | 97 |
| 4:00 p.m. | 76 | 84 | 88 |
| 5:00 p.m. | 82 | 78 | 77 |
| 6:00 p.m. | 89 | 75 | 64 |
| 7:00 p.m. | 90 | 63 | – |
| 8:00 p.m. | 84 | – | – |
| 9:00 p.m. | – | – | – |
| 10:00 p.m. | – | – | – |
| 11:00 p.m. | – | – | – |

The following table presents a time-of-day distribution of parking demand **during a non-December month** on a weekday (18 study sites), a Friday (seven study sites), and a Saturday (13 study sites).

| | Percent of Non–December Peak Parking Demand | | |
|---|---|---|---|
| Hour Beginning | Weekday | Friday | Saturday |
| 12:00–4:00 a.m. | – | – | – |
| 5:00 a.m. | – | – | – |
| 6:00 a.m. | – | – | – |
| 7:00 a.m. | – | – | – |
| 8:00 a.m. | 15 | 32 | 27 |
| 9:00 a.m. | 32 | 50 | 46 |
| 10:00 a.m. | 54 | 67 | 67 |
| 11:00 a.m. | 71 | 80 | 85 |
| 12:00 p.m. | 99 | 100 | 95 |
| 1:00 p.m. | 100 | 98 | 100 |
| 2:00 p.m. | 90 | 90 | 98 |
| 3:00 p.m. | 83 | 78 | 92 |
| 4:00 p.m. | 81 | 81 | 86 |
| 5:00 p.m. | 84 | 86 | 79 |
| 6:00 p.m. | 86 | 84 | 71 |
| 7:00 p.m. | 80 | 79 | 69 |
| 8:00 p.m. | 63 | 70 | 60 |
| 9:00 p.m. | 42 | – | 51 |
| 10:00 p.m. | 15 | – | 38 |
| 11:00 p.m. | – | – | – |

### Additional Data

The parking demand database includes data from strip, neighborhood, community, town center, and regional shopping centers. Some of the centers contain non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs, and recreational facilities.

Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include outparcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied included peripheral buildings, it can be assumed that some of the data show their effect.

The parking demand data plots and analysis are based on the total gross leasable area (GLA) of the center. In cases of smaller centers without an enclosed mall or peripheral buildings, the GLA could be the same as the gross floor area (GFA) of the center.

The average parking supply ratios for the study sites with parking supply information are the following:

- 5.1 spaces per 1,000 square feet GFA (137 sites) in a general urban/suburban setting
- 4.7 spaces per 1,000 square feet GFA (five sites) in a dense multi-use urban setting

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alabama, Alberta (CAN), Arizona, California, Colorado, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, North Carolina, New Jersey, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Washington.

*Future data submissions should attempt to provide information on the composition of each study site (types and number of stores, restaurants, or other tenants within the shopping center).*

### Source Numbers

3, 18, 21, 32, 39, 47, 87, 88, 89, 103, 142, 145, 152, 153, 154, 174, 175, 176, 179, 202, 203, 204, 205, 209, 215, 219, 224, 241, 265, 274, 313, 314, 315, 431, 432, 433, 436, 438, 441, 511, 525, 527, 531, 533, 542, 556, 558, 565

# Appendix C. Field Data

| Weekday Parking Data | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1-1 | A1-2 | A1-3 | B1-1 | B1-2 | B1-3 | B1-4 | C1-1 | C1-2 | C1-3 | C1-4 | | |
| 4:45 | 0 | 0 | 3 | 3 | 2 | 10 | 1 | 3 | 6 | 5 | 2 | | |
| 5:00 | 0 | 0 | 3 | 6 | 2 | 10 | 2 | 3 | 5 | 3 | 3 | | |
| 5:15 | 0 | 0 | 1 | 7 | 3 | 13 | 1 | 5 | 5 | 3 | 3 | | |
| 5:30 | 0 | 0 | 3 | 9 | 2 | 11 | 1 | 9 | 5 | 3 | 3 | | |
| 5:45 | 0 | 0 | 2 | 15 | 3 | 12 | 2 | 12 | 7 | 5 | 3 | | |
| 6:00 | 0 | 1 | 2 | 15 | 2 | 11 | 0 | 16 | 10 | 6 | 4 | | |
| 6:15 | 0 | 0 | 2 | 19 | 2 | 13 | 0 | 17 | 9 | 3 | 2 | | |
| 6:30 | 0 | 0 | 2 | 20 | 2 | 13 | 2 | 20 | 10 | 7 | 1 | | |
| 6:45 | 0 | 0 | 2 | 29 | 2 | 11 | 1 | 19 | 6 | 6 | 1 | | |
| 7:00 | 0 | 1 | 2 | 28 | 1 | 11 | 1 | 18 | 6 | 12 | 3 | | |
| 7:15 | 0 | 1 | 2 | 27 | 1 | 12 | 1 | 16 | 5 | 12 | 2 | | |
| 7:30 | 0 | 1 | 2 | 24 | 1 | 12 | 1 | 16 | 5 | 12 | 1 | | |
| 7:45 | 0 | 1 | 2 | 18 | 1 | 11 | 0 | 12 | 3 | 11 | 1 | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | D1-1 | D1-2 | D1-3 | D1-4 | D1-5 | E1 | A2-1 | A2-2 | B2-1 | B2-2 | B2-3 | B2-4 | |
| 4:45 | 3 | 0 | 1 | 1 | 0 | 0 | 3 | 5 | 5 | 2 | 2 | 3 | |
| 5:00 | 3 | 0 | 1 | 2 | 0 | 0 | 2 | 7 | 8 | 2 | 2 | 3 | |
| 5:15 | 3 | 0 | 2 | 2 | 0 | 0 | 2 | 7 | 5 | 2 | 3 | 3 | |
| 5:30 | 3 | 0 | 2 | 2 | 0 | 0 | 2 | 7 | 4 | 1 | 3 | 2 | |
| 5:45 | 3 | 0 | 2 | 0 | 0 | 0 | 2 | 7 | 5 | 0 | 1 | 2 | |
| 6:00 | 3 | 0 | 1 | 0 | 0 | 0 | 3 | 5 | 7 | 0 | 1 | 4 | |
| 6:15 | 3 | 0 | 1 | 1 | 0 | 0 | 1 | 4 | 10 | 2 | 1 | 3 | |
| 6:30 | 3 | 0 | 2 | 1 | 0 | 0 | 1 | 4 | 11 | 0 | 0 | 2 | |
| 6:45 | 3 | 0 | 2 | 1 | 0 | 0 | 1 | 4 | 9 | 0 | 0 | 1 | |
| 7:00 | 3 | 0 | 1 | 1 | 0 | 0 | 1 | 4 | 5 | 0 | 0 | 1 | |
| 7:15 | 3 | 0 | 1 | 1 | 0 | 0 | 1 | 4 | 10 | 0 | 0 | 1 | |
| 7:30 | 3 | 0 | 1 | 1 | 0 | 0 | 1 | 4 | 8 | 0 | 0 | 1 | |
| 7:45 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 4 | 5 | 0 | 0 | 1 | |
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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C2-1 | C2-2 | C2-3 | C2-4 | D2-1 | D2-2 | D2-3 | D2-4 | E2 | | | | |
| 4:45 | 2 | 6 | 3 | 2 | 0 | 0 | 0 | 1 | 2 | | | | |
| 5:00 | 4 | 6 | 4 | 2 | 0 | 0 | 0 | 1 | 2 | | | | |
| 5:15 | 4 | 6 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | | | | |
| 5:30 | 4 | 7 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | | | | |
| 5:45 | 6 | 7 | 6 | 11 | 0 | 0 | 0 | 0 | 0 | | | | |
| 6:00 | 6 | 6 | 8 | 12 | 0 | 0 | 0 | 0 | 0 | | | | |
| 6:15 | 8 | 7 | 10 | 12 | 0 | 0 | 0 | 0 | 1 | | | | |
| 6:30 | 10 | 9 | 9 | 11 | 0 | 0 | 0 | 0 | 0 | | | | |
| 6:45 | 10 | 9 | 12 | 12 | 0 | 0 | 0 | 1 | 6 | | | | |
| 7:00 | 10 | 9 | 9 | 12 | 0 | 0 | 1 | 0 | 11 | | | | |
| 7:15 | 9 | 9 | 9 | 12 | 0 | 0 | 1 | 0 | 11 | | | | |
| 7:30 | 9 | 8 | 10 | 12 | 0 | 0 | 0 | 0 | 12 | | | | |
| 7:45 | 8 | 9 | 10 | 11 | 0 | 0 | 0 | 0 | 11 | | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | |
| | A3 | B3-1 | B3-2 | C3-1 | C3-2 | | | | | | | | |
| 4:45 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 5:00 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 5:15 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 5:30 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 5:45 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 6:00 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 6:15 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 6:30 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 6:45 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 7:00 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 7:15 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 7:30 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 7:45 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |

| Sunday Parking Data | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1-1 | A1-2 | A1-3 | B1-1 | B1-2 | B1-3 | B1-4 | C1-1 | C1-2 | C1-3 | C1-4 | |
| 10:30 | 0 | 0 | 0 | 44 | 1 | 4 | 1 | 10 | 16 | 0 | 1 | |
| 10:45 | 3 | 0 | 0 | 35 | 1 | 4 | 1 | 10 | 18 | 0 | 2 | |
| 11:00 | 3 | 0 | 0 | 35 | 1 | 4 | 1 | 10 | 18 | 1 | 3 | |
| 11:15 | 3 | 1 | 0 | 34 | 1 | 6 | 3 | 10 | 16 | 3 | 3 | |
| 11:30 | 2 | 1 | 0 | 17 | 1 | 4 | 5 | 8 | 18 | 5 | 3 | |
| 11:45 | 0 | 3 | 0 | 7 | 2 | 5 | 5 | 4 | 10 | 8 | 2 | |
| 12:00 | 0 | 1 | 0 | 7 | 1 | 5 | 6 | 2 | 3 | 10 | 2 | |
| 12:15 | 0 | 1 | 0 | 9 | 2 | 10 | 5 | 2 | 7 | 13 | 2 | |
| 12:30 | 0 | 6 | 0 | 14 | 2 | 12 | 5 | 2 | 9 | 13 | 2 | |
| 12:45 | 0 | 7 | 0 | 13 | 2 | 13 | 6 | 2 | 19 | 13 | 2 | |
| 1:00 | 0 | 8 | 0 | 21 | 3 | 13 | 6 | 2 | 25 | 13 | 3 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | D1-1 | D1-2 | D1-3 | D1-4 | D1-5 | E1 | A2-1 | A2-2 | B2-1 | B2-2 | B2-3 | B2-4 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 1 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 1 | 0 | 0 |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 1 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 |
| 12:00 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 12:15 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 10 | 1 | 0 | 1 |
| 12:30 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 8 | 1 | 0 | 1 |
| 12:45 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 10 | 2 | 0 | 4 |
| 1:00 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 10 | 1 | 0 | 6 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| | C2-1 | C2-2 | C2-3 | C2-4 | D2-1 | D2-2 | D2-3 | D2-4 | E2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10:30 | 3 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 31 | | | |
| 10:45 | 2 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 32 | | | |
| 11:00 | 7 | 10 | 4 | 5 | 0 | 0 | 0 | 0 | 32 | | | |
| 11:15 | 7 | 10 | 5 | 11 | 0 | 0 | 0 | 0 | 32 | | | |
| 11:30 | 8 | 12 | 9 | 13 | 0 | 0 | 0 | 0 | 32 | | | |
| 11:45 | 8 | 12 | 13 | 12 | 0 | 0 | 0 | 0 | 24 | | | |
| 12:00 | 8 | 12 | 14 | 12 | 0 | 0 | 1 | 0 | 13 | | | |
| 12:15 | 7 | 14 | 13 | 13 | 0 | 0 | 8 | 0 | 1 | | | |
| 12:30 | 11 | 14 | 13 | 13 | 0 | 0 | 9 | 0 | 0 | | | |
| 12:45 | 11 | 14 | 14 | 13 | 0 | 0 | 10 | 0 | 0 | | | |
| 1:00 | 11 | 14 | 13 | 13 | 0 | 0 | 10 | 0 | 0 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | A3 | B3-1 | B3-2 | C3-1 | C3-2 | | | | | | | |
| 10:30 | 0 | 0 | 1 | 1 | 0 | | | | | | | |
| 10:45 | 0 | 0 | 1 | 1 | 0 | | | | | | | |
| 11:00 | 0 | 0 | 1 | 2 | 0 | | | | | | | |
| 11:15 | 0 | 0 | 0 | 3 | 0 | | | | | | | |
| 11:30 | 0 | 0 | 0 | 3 | 0 | | | | | | | |
| 11:45 | 0 | 0 | 0 | 3 | 0 | | | | | | | |
| 12:00 | 0 | 0 | 0 | 3 | 0 | | | | | | | |
| 12:15 | 0 | 0 | 0 | 3 | 0 | | | | | | | |
| 12:30 | 0 | 0 | 0 | 3 | 0 | | | | | | | |
| 12:45 | 0 | 0 | 1 | 3 | 0 | | | | | | | |
| 1:00 | 0 | 0 | 1 | 3 | 0 | | | | | | | |