FEASIBILITY REPORT
2019 HOMEWOOD HILLS STREET RECONSTRUCTION

INTRODUCTION

The purpose of this report is to determine the feasibility of improving the following described streets by regrading, base reconstruction, necessary curb and gutter reconstruction, and resurfacing:

Bantom Drive - Miles drive to north end
Birchwood Place - Miles Drive to south end
Briarwood Drive - Oakwood Drive to Homewood Avenue
Fairway Lane - Miles Drive to Oxford Street
Green View Road - Miles Drive to Homewood Avenue
Homewood Avenue - West line of Homewood Hills Eighth Addition to Viking Road
Johnson Lane - Miles Drive to south end
Maplewood Drive - Oakwood Drive to Pinewood Drive
Miles Drive - Oakwood Drive to Diagonal Road
Oakwood Drive - Oxford Street to Briarwood Drive
Pinewood Drive - Maplewood Drive to north line of Homewood Hills Ninth Addition
Rust Road - Miles Drive to Homewood Avenue
Sally's Alley - Maplewood Drive to Oxford Street
Viking Road - Miles Drive to Diagonal Road

This report has been prepared pursuant to the Council resolution of March 25, 2019. The improvement has not been petitioned for and needs to proceed as a Council initiated improvement project. See Map A for the location of the subject streets and Maps A1 and A2 to better view abutting properties.

PROJECT NEED

All of the subject streets are residential streets constructed with flexible pavement (bituminous surface with aggregate base) and are concrete curb and guttered. All abutting land uses are residential. The nominal width of all the streets is 36 feet; however, the width of the circular ends on Bantom Place and Birchwood Place is 28 feet. The age of the streets or segments of them vary depending on the year of development or subsequent reconstruction. The oldest pavements were reconstructed in 1991 and the newest in 1998. All of the street segments have met or exceeded the 20 year design life.

The composition of the existing pavement structure of each of the street segments also varies depending on its year of construction or reconstruction. All of the pavement structures include edge tiles and fabric. The oldest pavements have no drainable material surrounding the tiles. The segments reconstructed in 1993 or later include drainable material around the drain tiles. Only Bantom Place, reconstructed in 1998, includes any drainable layer in the aggregate base. The drainable layer in the Bantom Place pavement structure is below a layer of Class 5 (gravel) base.

The streets' bituminous pavement no longer has the properties necessary to fulfill its function. The loss of the bituminous pavement qualities needed to sustain durable surfacing is generally due to material fatigue as well as material degradation. Fatigue develops from the accumulation of the minute deflections that occur with each wheel loading and is accelerated over time as natural factors reduce the pavement's ductility. These factors ultimately limit the usable life of the surfacing regardless of other factors or deficiencies affecting the total pavement structure. Seasonally saturated soil conditions contribute to a weakening of the subgrade and aggregate base. Although all the streets include edge tiles, the relatively impermeable nature of the gravel bases has been found to result in those bases becoming saturated for extended periods of time before the edge tiles are able to effectively drain them. Slow drainage of an aggregate base is particularly prominent during frost out conditions when free water from melting frost is trapped above underlying frost and saturates the base before traveling horizontally to the edge tiles. Free water may rise through the base and be visible in cracks in the surfacing. The weakening of the subgrade and base reduces the load bearing capability of the total pavement structure to the point that it will no longer support normal loadings without excessive deflection and ultimately failure. The effects of this weakening are typically recognized by surface deformation and extensive "map" or "an alligator pattern" cracking. Severe occurrences of this condition resulting from frost melt are commonly referred to as "frost boils". The results of this condition may be found throughout the length of the subject streets. The combination of factors has deteriorated the total bituminous pavement structure of the streets to the point they no longer are able to provide an acceptable level of service.

In the case of Bantom Place, the edge tile outlet has not been reliable through the years. Because of this, the upper layer of gravel base has been subject to saturation and may also be in the future.

It is recommended that the existing pavement structure (base and surfacing) be removed on all streets except Bantom Place and replaced as part of a street reconstruction in order to restore the total pavement system. As indicated in the Pavement Design section below, the extent of base replacement depends on the choice of pavement type. In general, the existing curb and gutter may remain in place. Sections of dislocated concrete curb and gutter should be removed and replaced as necessary to maintain reasonable water flow, with a performance goal of containing any ponding water within the width of the concrete gutter. Curb and gutter removal as planned at the time of this report is shown on Map B.

PAVEMENT DESIGN

The City's Assessment Ordinance provides that residential streets shall be of "5 ton" design and that collector streets (including commercial and industrial access streets) shall be of "9 ton" design. Although the terminology "5 ton" or "9 ton" design reflects what might be considered outdated pavement design methodology, the intent of the standard is clear in defining that the pavement of residential streets should reflect the adjacent residential land use rather than being designed to potentially serve a collector or arterial function. A residential street design would therefore typically account for traffic consisting of predominately automobiles and light trucks together with minor quantities of trucks and buses to reflect normal residential services such as garbage hauling, school busing, and deliveries. All of the subject streets are subject to only such traffic and can be designed accordingly.

Pavement Type

As previously noted, the existing pavement on all the streets consists of bituminous surfacing and gravel bases. As also indicated, this pavement type relies on the strength of the base in addition to the surfacing to distribute a wheel load (weight) over a large enough area of the underlying soils to minimize the deflection in the pavement surface so that it can withstand years of traffic before it fails. Based on the history of early failure of this pavement type throughout the community and the nature of soils and gravel in the area, it was found to be cost effective to implement steps to enhance subsurface drainage of the pavement system. The drainage improvements do not reduce the reliance on the gravel base but are intended to ensure maximum performance through yearly cycles, particularly the spring melting period when the moisture from melting frost tends to be trapped in and just below the aggregate bases. Relatively sharp increases in the cost of base materials being used warrants consideration of changes in the pavement type being utilized for local low volume streets.

Concrete pavement is considered a rigid pavement. A wheel load is, in general, distributed over a large area within the concrete surface reducing reliance on the strength of the aggregate base and underlying soils. While such an explanation may be an over simplification of the dynamics occurring within a pavement system, it is intended to describe the fundamental difference in the pavement types that allows for exploration of cost effectively utilizing concrete pavements for low volume streets. Other factors that can not be disregarded in designing a concrete pavement system include the transfer of wheel loads between pavement panels, wheel loadings at the outer edges of panels, pavement warping and size fluctuations that occur during temperature changes, and interactions occurring at the interface of panels (pavement joints). While these factors can not be disregarded in use of concrete pavement for low volume roads, the extent of the measures needed to satisfactorily address them tends to diminish as the volume of traffic, particularly that of heavy trucks, decreases.

The selection of pavement type for relatively low volume roads could be argued to be subjective given the irregular local performance history of certain pavement types. Life cycle cost analyses which include consideration of initial and maintenance costs can be formulated to provide a reasonable recommendation on roadways that deteriorate in a manner having somewhat of a relationship to traffic loadings. Life expectancies of 20 years for bituminous and 35 years for concrete pavements prior to the need for a minimal structural improvement are commonly used in such analyses. Lower volume streets in Worthington have historically shown a much wider range of usable lives. Residential bituminous streets have functionally performed from as little as 10 years to over 50 years. Very specific changes in design have been initiated to address those deficiencies that have been identified with poor performance of bituminous pavements and a useful life of at least 20 years now appears to be a reasonable expectation. Residential concrete streets other than those subject to certain aggregate failures or detrimental material reactions have performed well in the community and are commonly found to be over 50 years old. It is important to note that the provisions of the City's Assessment Ordinance relating to street reconstruction establish a 20 year design life for bituminous pavements and a 35 year design life for concrete pavements. Assessments for reconstruction are prorated to the design life should the street fail to achieve the design life.

Some consideration in selection of pavement type may also include the length of time required to return the street to full traffic use. Concrete paving will require up to 10 additional days for pavement

placement and curing prior to through traffic being allowed on the street. Since curbing is involved at certain locations in either pavement option, traffic entering the street from driveways affected by the curb replacement will be restricted for approximately 7 additional days.

Bituminous Pavement Option

It is proposed that the subject streets be reconstructed utilizing a residential street section consisting of 2.5" of bituminous surfacing and 9" of aggregate base. It is recommended that the aggregate base be a single layer of drainable material which is a change from former pavement recommendations. The recently revised Minnesota Department of Transportation construction specifications now include standards for a Drainable Stable Base (DSB) material which is reported to cost less to produce and be easier to handle than the Open Graded Aggregate Base (OGAB) previously used in only the lower 4" of the aggregate base. The DSB is also intended to accommodate paving equipment better than OGAB allowing it be used for the complete depth of the base eliminating the alternating placement of drainable and Class 5 (gravel) base which has been associated with increased construction costs. The stability of DSB through a wide range of moisture conditions also warrants reducing the minimum depth of bituminous surfacing for residential streets from 3" as recommended in recent years to 2.5".

Use of the drainable base material together with proper edge drain tiles will yield free drainage of that base material and intercept free water rising from below that layer. Per current design practice, geotextile reinforcement fabric would also be installed in conjunction with the aggregate base. The geotextile fabric reduces the migration of the subgrade clay into the drainable base material and reinforces the subgrade material (clay) during wet periods, particularly the spring transitional period when frost is melting and the subgrade's bearing strength is the weakest. Due to the need to remove the existing aggregate base in the bituminous pavement option, it is not feasible to utilize any existing fabric or edge drain tiles on the subject streets. Removal and replacement of the existing geotextile fabric and edge tiles will be necessary.

Certain exceptions to the recommendations above would be made for Bantom Place which already has 4" of an open graded (drainable) base layer in place. The target pavement section would remain the same for Bantom Place; however, the fabric, edge drains, and lower layer of drainable base can remain. The existing gravel base above the drainable layer would be replaced with DSB base to provide a base that less susceptible to retention of excess moisture and resulting loss of strength.

Concrete Pavement Option

It is proposed that the subject streets be reconstructed utilizing a residential street section consisting of 6" of concrete surfacing and 4" of aggregate base. The 4" of aggregate base tends serves as a platform for constructing the concrete surfacing and to minimize migration of underlying soils through the pavement joints rather than a significant structural component of the pavement system. This pavement system is similar to that found in concrete streets throughout the community constructed prior to 1995. Although it would be recommended that higher volume concrete streets, particularly those subject to heavy truck traffic, incorporate a drainable base and subsurface drainage, using the proposed concrete pavement section offers a significantly lower cost than a section

incorporating a drainable base and subsurface drainage. The fabric and/or edge drain tiles currently in place on the streets will be able to remain utilizing the concrete pavement option. To the extent possible, the existing aggregate base in all the streets would be utilized to provide the recommended 4" of aggregate base. Whereas the concrete option involves utilization of the existing fabric, edge drain tiles and, to the extent possible, aggregate base, no exceptions to the above recommendations are applicable to Bantom Place. Consideration may be given to the proposed concrete pavement section as a reasonable alternative to a bituminous pavement.

Utilizing concrete pavement to reconstruct a street has certain significant disadvantages when perpetuating the existing curb and gutter. Sections of curb and gutter that are displaced to the extent that water ponds beyond the concrete gutter will be replaced; however, the gutter surface will remain somewhat uneven along the majority of the streets. The uneven gutter surface will tend to reflect into the new street surface because the gutters act as the outside form in the concrete paving operation. In other words, the ride of street is not likely to be as smooth as it would be with complete curb and gutter replacement.

A second disadvantage is that the curb and gutter will not become a contiguous part of the concrete pavement system as it would with complete curb and gutter replacement. Movement of the curb and gutter that is different from that of the pavement should be expected. The additional support of the outer edge of the concrete pavement panel provided by structurally contiguous curb and gutter will also not be provided. An alternate to having the curb and gutter structurally isolated from the street pavement would be to drill and secure steel bars into the existing curb and gutter that would extend into the pavement being poured. Drilling the bars poses the risk of damaging sections of the existing curb and gutter. Comparable estimates made for a similar residential street reconstruction project indicates the cost for installing the connecting steel bars will increase the total project costs by approximately 4% and increase the estimated assessment rates about 15%. Higher costs will be incurred if curb and gutter is damaged during installation. Drilling in the bars is not being proposed given the benefits, costs, and risks.

Various manholes are located along each street. The type of castings (frame and lid) in place on these manholes do not vary in height as the pavement is lifted by frost action or other changes in the volume of the underlying soil. The affects of the differential movements at manholes in bituminous pavement is less significant than in concrete pavements due to the flexibility of the pavement. It is common for castings in bituminous pavements to have a fixed height and are typically only adjusted as needed for pavement replacement. In concrete pavements the movement at manholes reflects movement of the concrete panel(s) around the manhole. The affects of the movement in concrete pavement is that the castings are essentially lifted off of the manhole when soils expand which can be detrimental to the pavement and/or manhole and/or utility the manhole is located on. If the concrete pavement option is chosen, it is proposed that all the manhole castings be replaced with variable height (telescoping castings). The relatively low cost of adjusting manholes is, by practice, assigned as an assessment rate determining cost. Due to the high cost of replacing each casting, currently estimated at $1,560 more than only adjusting the casting, and the variable number of manholes within each street, it is proposed that the incremental cost for replacing castings be designated as a non-assessable cost.

Construction Schedule

It is proposed that construction be divided into several segments to minimize the duration of disruption of access to individual homes and the distance to available on street parking. Map C shows the phasing as currently planned. Revisions may occur prior to construction. In the concrete option each phase would be completed with the concrete placed and cured prior to construction of the adjacent segment commencing. In the bituminous option each phase would be completed up to placement of the bituminous surfacing. Groups of phases would then be surfaced.

It is anticipated that in a concrete option, the completion of all segments would not be required until 2020. All streets would be open for use during the winter of 2019 and 2020 whether reconstructed or not.

RELATED IMPROVEMENTS

ADA Compliance

The existing sidewalk curb ramps on the streets do not comply with the specifics of current Americans with Disabilities Act (ADA). At a minimum, each is deficient in that the lip that currently exists between the street gutter and ramp is not allowable. Many of the ramps are steeper and/or higher than permitted under the ADA standards and most of the existing ramps do not include tactile warning (truncated dome) panels.

The total estimated cost for this work is $87,900 to $88,600 depending on the pavement option. The cost for this work is included in the total street improvement cost but is not included in the determination of the assessment rate.

Sidewalk Extensions to Form Street Crossings

Several sidewalks in the project area do not extend to the streets at intersections. Whereas these existing sidewalks do not provide for block to block pedestrian use, compliance with ADA is not applicable. The gaps in the sidewalk infrastructure is not consistent in providing for a more walkable community and was identified as a deficiency in the City's Active Living Plan.

The project as proposed at this time includes several sidewalk extensions to form street crossings. Each of these crossings would be constructed to current ADA guidelines. The Active Living Plan also identified other gaps in the sidewalk system that do not involve street crossings; however, only the extensions involving street crossings are proposed at this time due to their interface with the street work. Other gaps can be completed independent of the street project without impacting street pavements.

The total estimated cost for this work is $115,600 to $116,600 depending on the pavement option. The cost for this work is included in the total street improvement cost but is not included in the determination of the assessment rate. The 2019 Construction (401) Fund budget included $103,200 for the sidewalk crossings. This budgeted amount could be used for financing the sidewalk

extensions or their cost could be financed with the project as noted in the following section. It is recommend, however, that the budgeted funds be held in reserve for future ADA compliance as may be needed to finance ADA compliance work that is not able to funded as part of a street project.

Proposed sidewalk and curb ramp work is shown on Map D. Green identifies the optional extensions. Blue identifies those crossings that must be brought up to current guidelines.

COSTS AND FINANCE

In general, the distribution of assessable costs for the project is proposed as outlined in the City's Assessment Ordinance.

City share will include all costs for reconstruction of the center 24 feet of pavement with the costs for reconstructing the remaining width of pavement and for curb and gutter reconstruction being assessed to the benefitted properties. Side yard lot allowances and intersecting public right-of-way frontages are also a city share of the project. Side yard allowances and rate determining intersection frontages are depicted on Map E.

The following provides the estimated costs, city share, assessments receivable, and assessment rates for the street improvements:

BITUMINOUS PAVEMENT OPTION
All Sreets Except Bantom Place

City share for non-assessable costs[1]	$2,855,809.69	
City share of assessable costs	$0.00	
Total city share	$2,855,809.69	(75.7%)
Assessments receivable	$916,690.31	(24.3%)
TOTAL COST	$3,772,500.00	

The estimated base assessment rate is **$47.191/ft**

[1] City share for non-assessable costs includes $2,276,000.00 for the center 24 feet, $164,300.00 for salvaging aggregate base material, $117,968.15 for lot allowances, and $92,352.79 for intersection frontages, $88,600.00 for pedestrian ramp replacement, and $116,600.00 for sidewalk extensions.

Bantom Place

City share for non-assessable costs[1]	$71,899.94	
City share of assessable costs	$6,736.46	
Total city share	$78,636.40	(76.8%)
Assessments receivable	$23,763.60	(23.2%)
TOTAL COST	$102,400.00	

The estimated assessment rate is **$29.52/ft**

[1] City share for non-assessable costs includes $64,300.00 for the center 24 feet, and $7,600.00 for salvaging aggregate base material.

Total Improvement

The following provides the estimated costs, city share, assessments receivable, and assessment rates for the street improvement:

City share for non-assessable costs	$2,927,709.63	
City share of assessable costs	$6,736.46	
Total city share	$2,934,446.09	(75.7%)
Assessments receivable	$940,453.91	(24.3%)
TOTAL COST	$3,874,900.00	

CONCRETE PAVEMENT OPTION

All Streets

City share for non-assessable costs[1]	$3,260,005.55	
City share of assessable costs	$11,818.02	
Total city share	$3,271,823.57	(75.7%)
Assessments receivable	$1,047,676.43	(24.3%)
TOTAL COST	$4,319,500.00	

The estimated base assessment rate is **$51.788/ft**

[1] City share for non-assessable costs includes $2,672,000.00 for the center 24 feet, $87,600.00 for salvaging aggregate base material, $66,100.00 for incremental casting costs, $129,459.62 for lot allowances, $101,349.12 for intersection frontages, $87,900.00 for pedestrian ramp replacement, and $115,600.00 for sidewalk extensions.

It is proposed that the 2019 Homewood Hills Street Reconstruction project be initially financed by PIR bonding. Current Construction Fund reserves are not adequate to temporarily finance the entire project cost until bond proceeds are received. Bond proceeds will be needed during the construction season to ensure adequate funds are available to make all contract payments. Revenues from special assessments levied as a result of the project along with the annual special tax levy required to recover the city share of the project would be utilized for bond repayment. The annual average cost for debt service payment associated with only the City share of the project is estimated to be about $243,150 for the bituminous option and $271,100 for the concrete option. These estimates are based on a 15 year bond with an average annual interest rate of 2.85%.

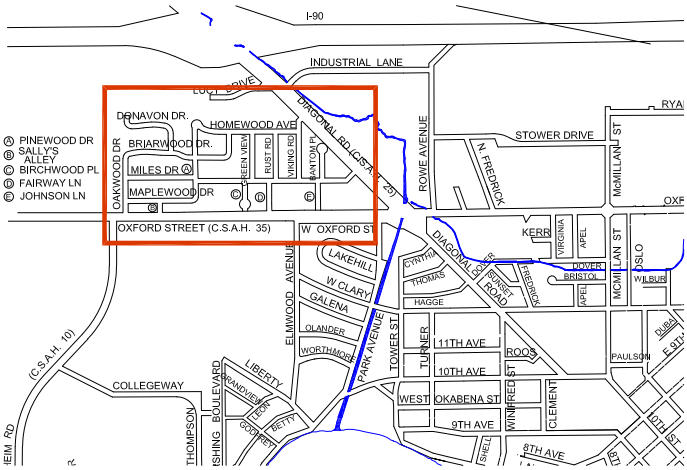
CONTRACT COMBINATION WITH OTHER IMPROVEMENTS

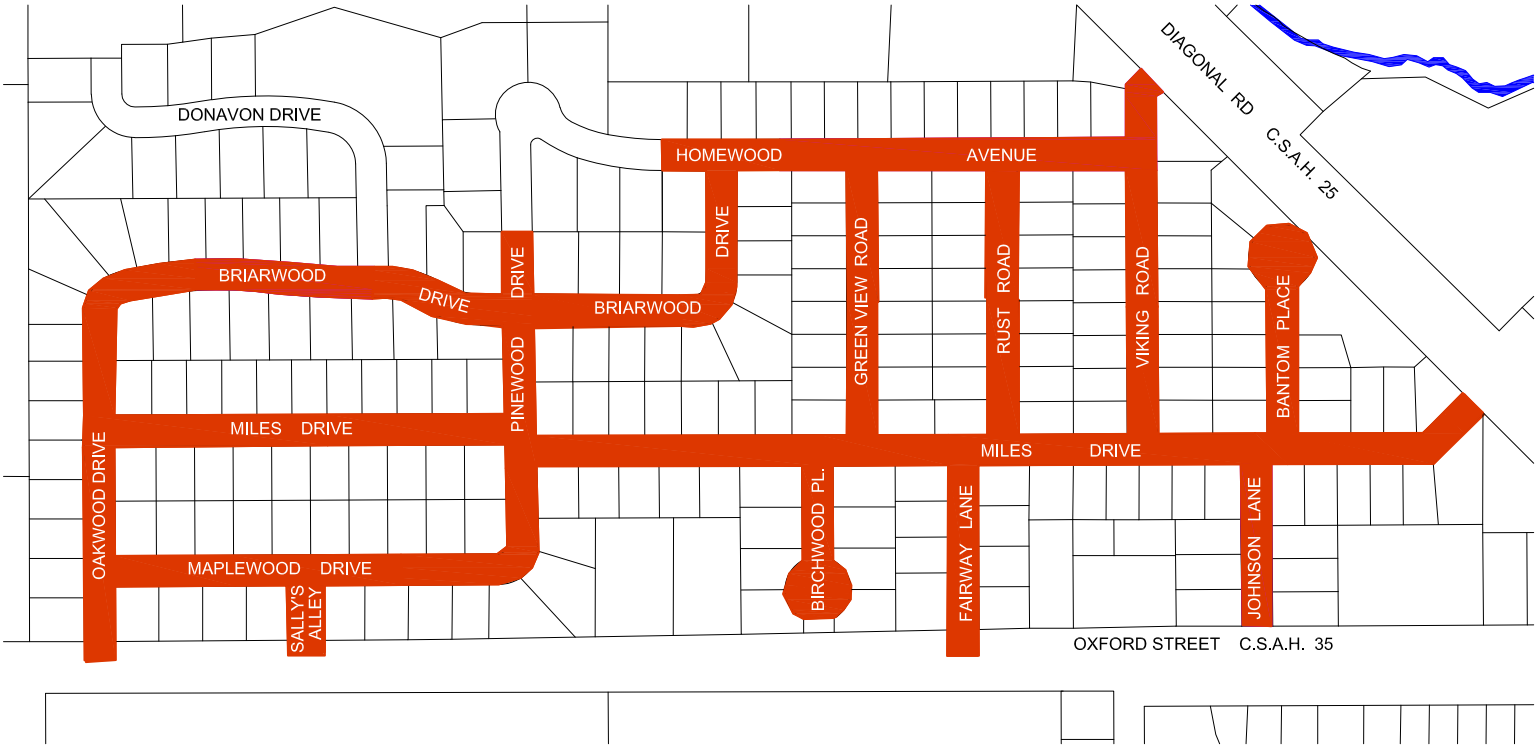
In addition to completion of the related work previously identified, it is recommended that this project be combined with any other compatible 2019 bituminous work, for bidding purposes only, should the bituminous option be selected. Should the concrete option be selected, it may be advantageous for this project to be bid separate from other projects to maximize the potential for a wider range of construction firms to be interested in under taking the project. It is also recommended that concrete include a schedule that allows for the project to be completed in 2020.

CONCLUSION

The proposed reconstruction of the subject streets, using either pavement option, is a feasible way and cost effective means of re-establishing the necessary integrity of the streets with an all season hard surfaced pavement.

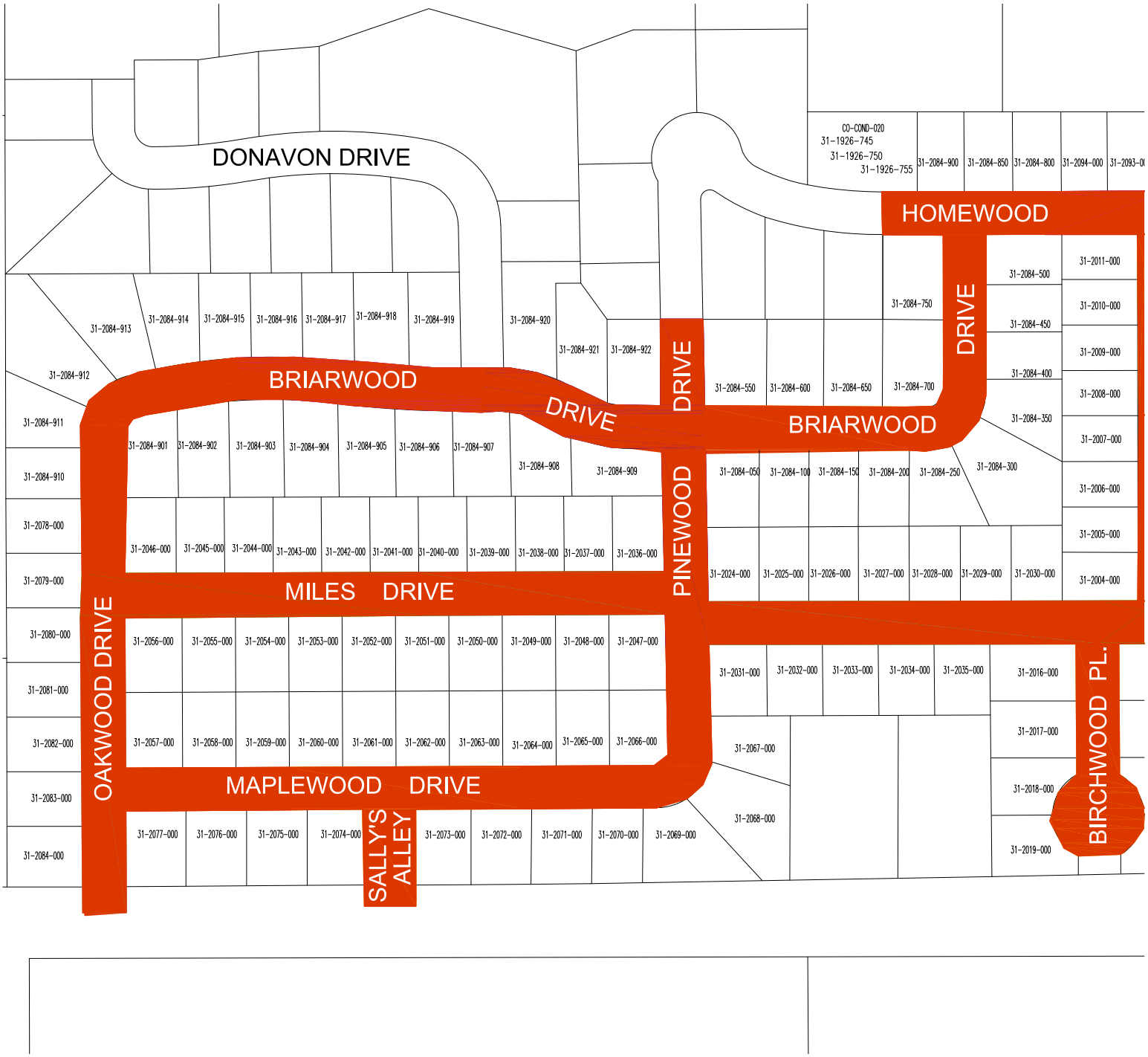
It is recommended that the choice of pavement type be determined at the improvement hearing based on consideration of life cycle value, construction duration, and the projected disadvantages in utilizing concrete pavement in the reconstruction of the subject streets.





PROPOSED IMPROVEMENT

MAP A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MAP A1


DIAGONAL RD
C.S.A.H. 25
WOOD AVENUE
GREEN VIEW ROAD
RUST ROAD
VIKING ROAD
BANTOM PLACE
MILES DRIVE
BIRCHWOOD PL.
FAIRWAY LANE
JOHNSON LANE
OXFORD STREET C.S.A.H. 35
31-2084-850
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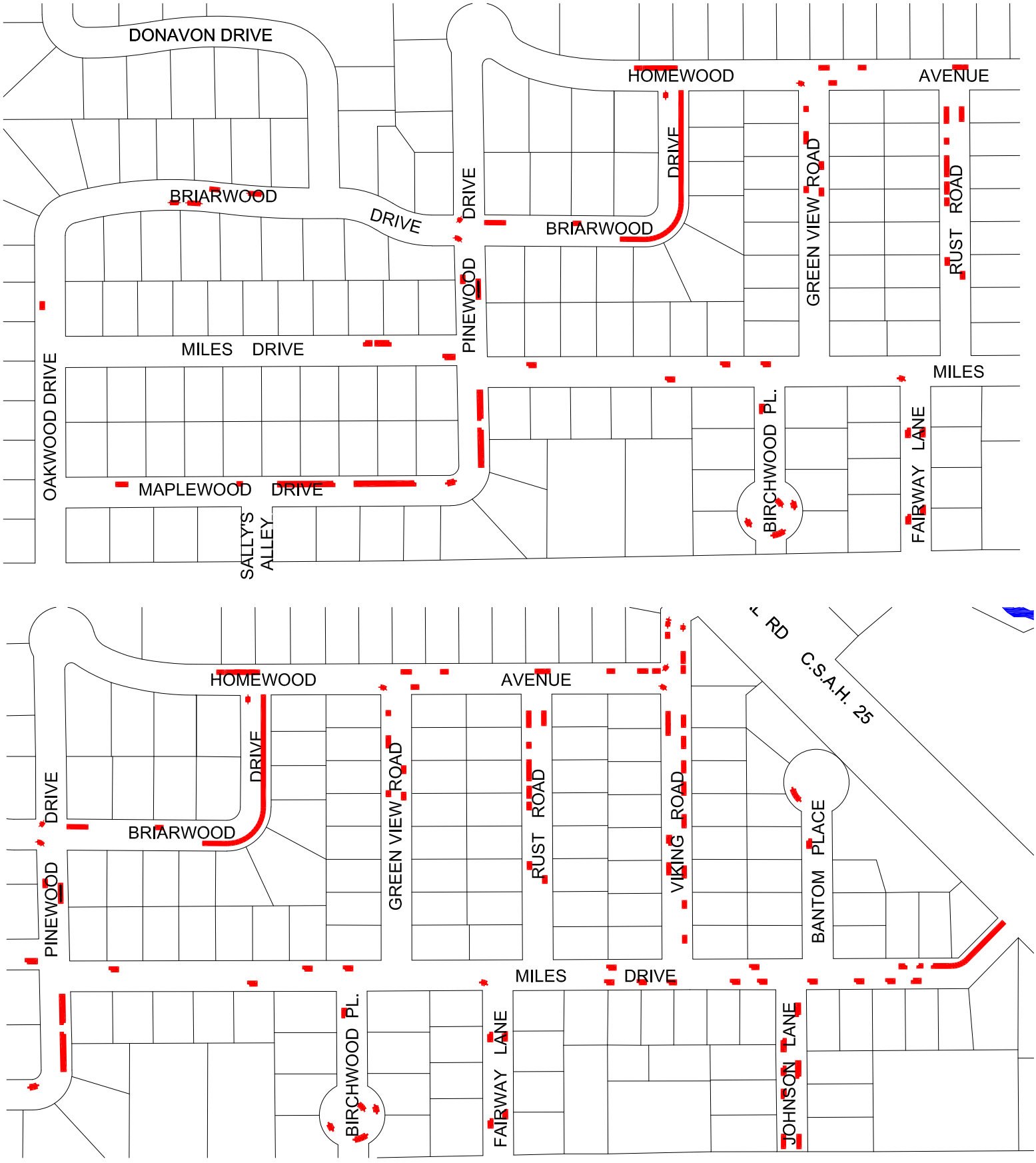
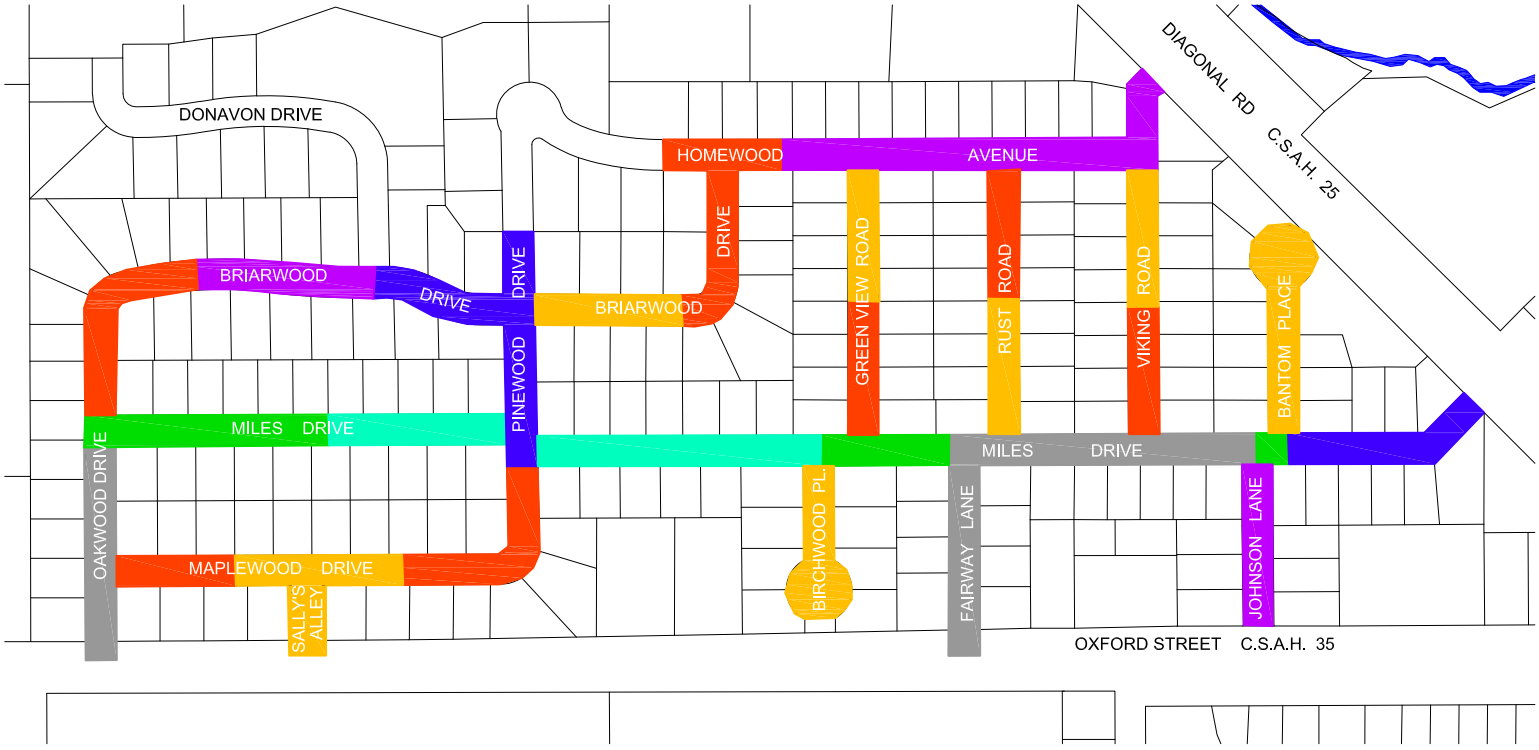
MAP A2



CURB PLANNED TO BE REMOVED AND REPLACED

MAP B



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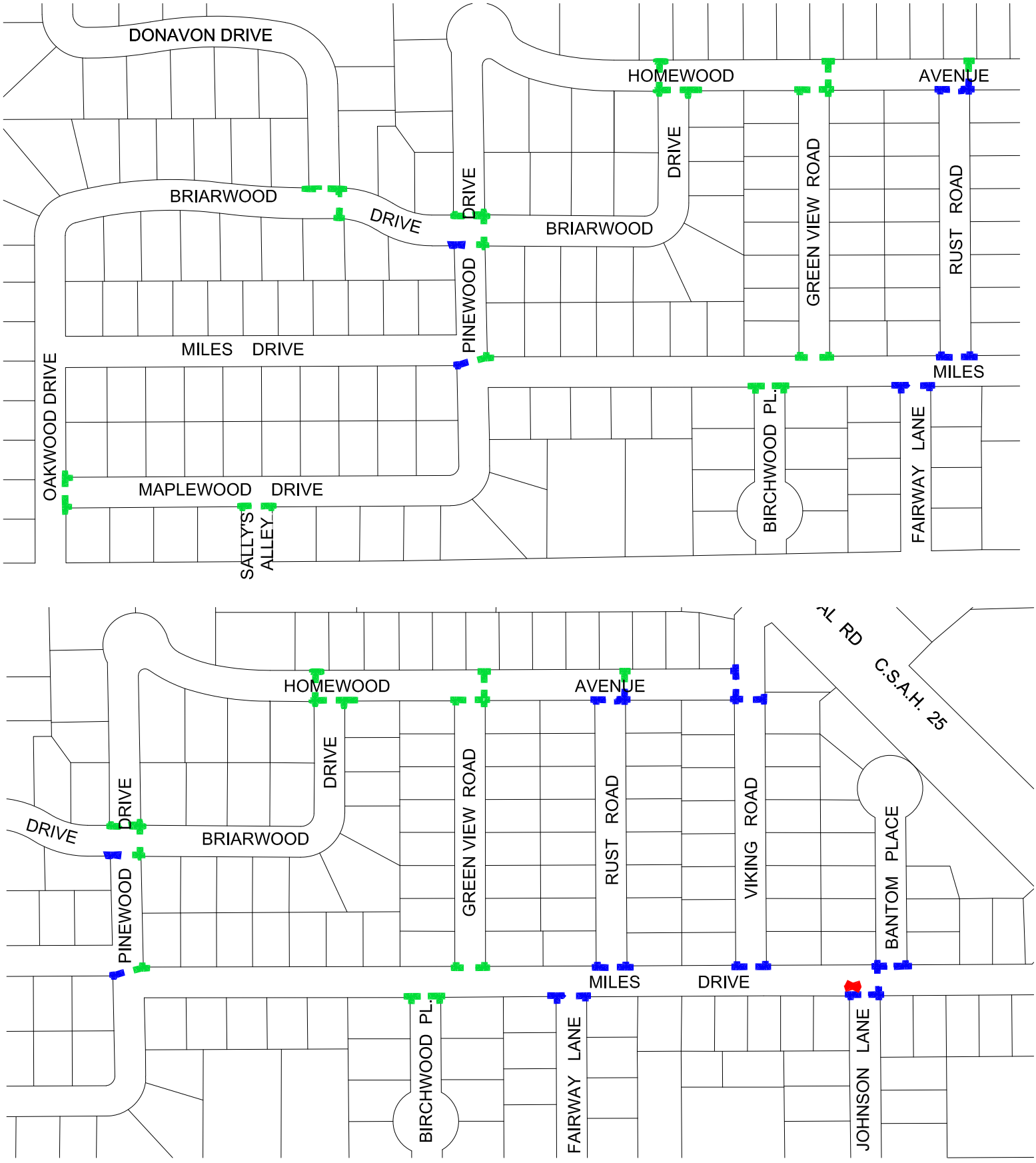
CONSTRUCTION PHASES (PRELIMINARY)

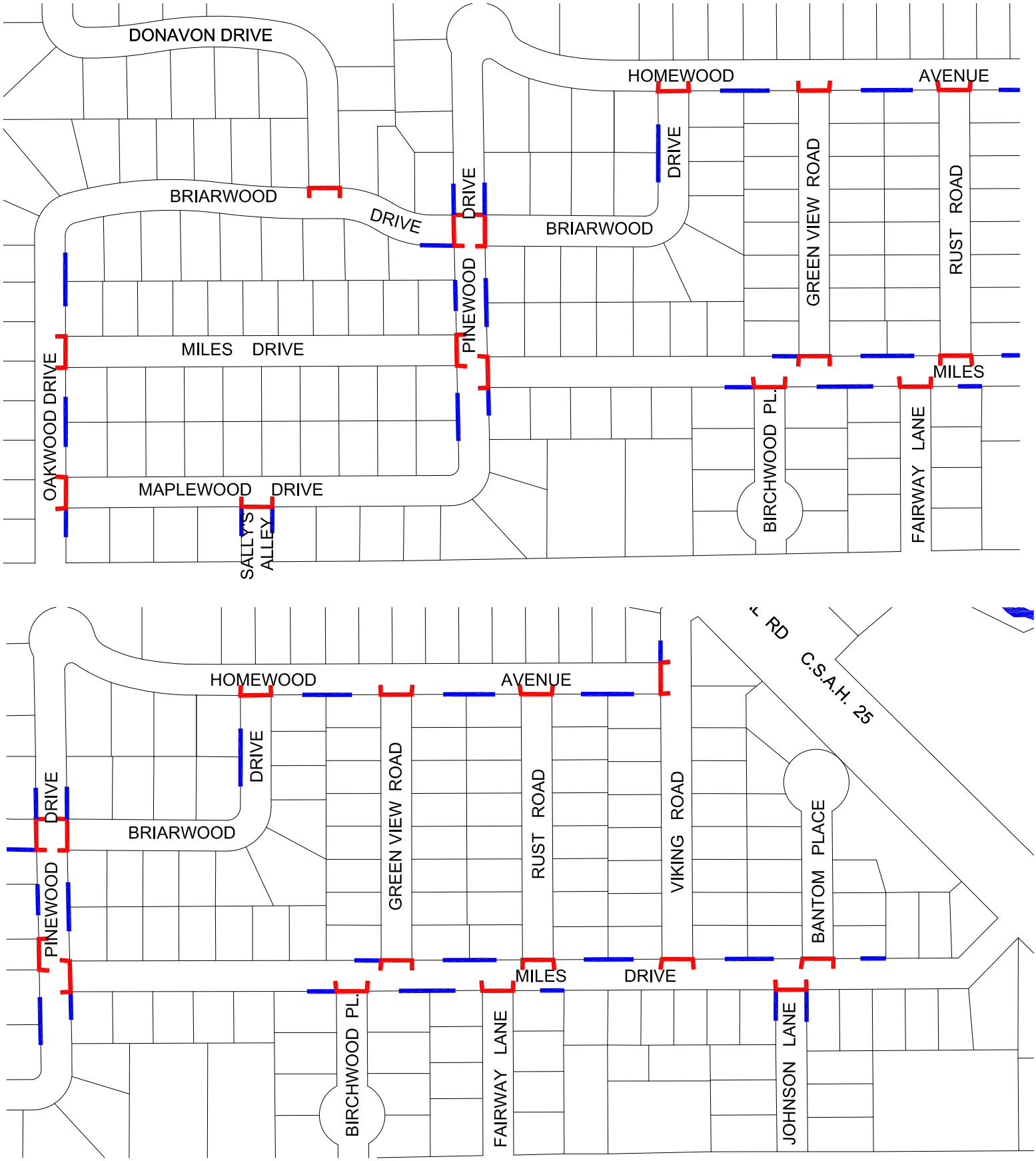
MAP C



PROPOSED WALK AND CURB RAMP WORK

NEW **RECONSTRUCT** **REMOVE**

MAP D



SIDEYARD ALLOWANCES **INTERSECTION FRONTAGES**

MAP E