cityoflfp.gov

CITY OF LAKE FOREST PARK
CITY COUNCIL SPECIAL WORK SESSION

Thursday, July 13, 2023 at 5:30 PM

Meeting Location: In Person and Virtual / Zoom

17425 Ballinger Way NE Lake Forest Park, WA 98155

INSTRUCTIONS FOR PARTICIPATING IN THIS MEETING VIRTUALLY:

Please note, this link works for both the Work Session (5:30 p.m.) and Regular Meeting (7:00 p.m.).

Join Zoom Webinar: https://us06web.zoom.us/j/81208922305
Call into Webinar: 253-215-8782 | Webinar ID: 812 0892 2305

Public Comment is not taken during the Work Session.

As allowed by law, the Council may add items not listed on the agenda.
For up-to-date information on agendas, please visit the City's website at www.cityoflfp.gov

Meetings are shown on the city's website and on Comcast channel 21 for subscribers within the Lake Forest Park city limits.

AGENDA

1. **CALL TO ORDER: 5:30 PM**
2. **ADOPTION OF AGENDA**
3. **COUNCIL DISCUSSION TOPICS**
   - **A.** Possible purchase of rifles for the Police Department
   - **B.** Review of Capital Improvement Plan Pavement Resurfacing Plan
   - **C.** Ordinance 23-1272/Adopting Interim Development Regulations As Authorized By The Growth Management Act Relating To Retaining Walls
4. **ADJOURN**

FUTURE SCHEDULE

--Thursday, July 20, 2023 City Council Budget and Finance Committee Meeting 6 pm – *hybrid meeting (Zoom and City Hall)*
--Monday, July 24, 2023 City Council Committee of the Whole Meeting 6 pm – *hybrid meeting (Zoom and City Hall)*

--Thursday, July 27, 2023 City Council Regular Meeting 7 pm – *hybrid meeting (Zoom and City Hall)*

Any person requiring a disability accommodation should contact city hall at 206-368-5440 by 4:00 p.m. on the day of the meeting for more information.

City of Lake Forest Park

Memo

To: Mayor Johnson and Council Members

From: Jeffrey Perrigo, Director of Public Works

cc: Phillip Hill, City Administrator

Date: June 05, 2023

Re: Capital Improvement Plan - Paving and Pedestrian Access

A complete assessment of our roadway network was last completed in 2013 with a singular focus of the pavement condition. Our roadways are our largest capital asset and should be adequately funded and well maintained. However, since the last pavement assessment, we recognize that residents have modified their means of mobility. Today we have more active residents walking, biking, running, using scooters, and other non-traditional modes of transportation. To address those behavioral changes, our next pavement assessment needs to take a more holistic approach which includes not only the pavement condition, but also consideration for the proximity to priority facilities, traffic volume, equity, pedestrian access, and drainage concerns, among others.

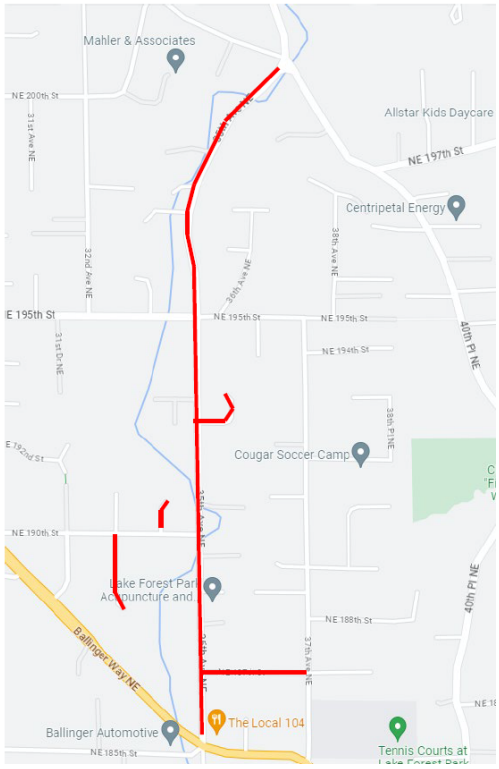
Performing the pavement assessment and subsequent analysis requires favorable weather conditions such as clean and dry pavement, staff time to develop the scoring protocol, analyze the data, and prioritize the pavement maintenance plan. Given the level of resources available and dedicated time required to perform this work, the full assessment is not yet complete.

The annual paving program is constructed through King County's regional bidding process where they aggregate paving requests from the region and request bids on the group's collection of streets. The County requests cities to provide a preliminary list of streets annually in January, a final list in March, with project bidding in May or June. This year's bid date is scheduled for June 15th. In the absence of having a new list of streets assessed prior to January's deadline, we submitted the list of streets that were on the original list of preliminary streets from 2022 that were unfunded.

Below is the list and map of the streets that were on the Original 2022 List:

ORIGINAL 2022 PAVING LIST

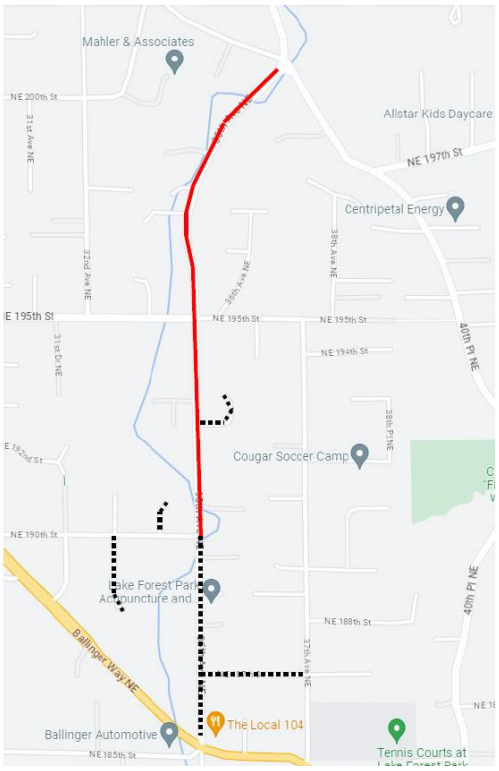
- 35th Ave NE – SR 104 to 40th PL NE
- NE 187th St - 35th Ave to 37th Ave
- 33rd Ave NE – NE 190th to Dead End
- 34th Ave NE – NE 190th to Dead End
- NE 192 PL / 35th PL NE – 35th Ave NE to Dead End



Below is the list and map of the streets that were <u>completed</u> from the Original 2022 List:

COMPLETED 2022 PAVING LIST

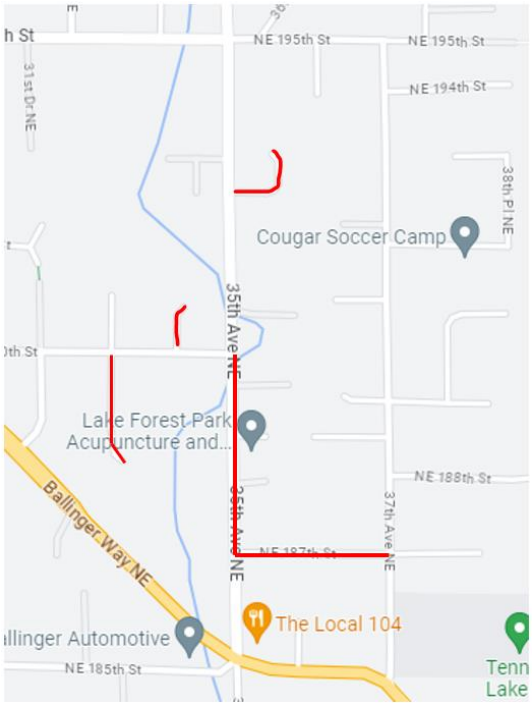
- 35th Ave NE – ~~SR 104~~ to 40th PL NE
  190th ST
- ~~NE 187th St - 35th Ave to 37th Ave~~
- ~~33rd Ave NE – NE 190th to Dead End~~
- ~~34th Ave NE – NE 190th to Dead End~~
- ~~NE 192 PL / 35th PL NE – 35th Ave NE to Dead End~~



Below is the list and map of the streets that were submitted to the County from the Original 2022 List for consideration in 2023:

SUBMITTED 2023 PAVING LIST

- 35th Ave NE – 190th S to NE 187th St
- NE 187th St - 35th Ave to 37th Ave
- 33rd Ave NE – NE 190th to Dead End
- 34th Ave NE – NE 190th to Dead End
- NE 192 PL / 35th PL NE – 35th Ave NE to Dead End



During our budget discussions last fall, Council requested that an assessment of the city's roadway network be complete and presented before additional resurfacing work could proceed. We are working with the County to continue our paving plan for the remaining streets from the 2022 list prior to a new pavement assessment. The streets were vetted and estimated by the County. Given the timing constraints, ongoing staffing shortage, and other priority projects facing the department, this approach appears to be the most responsible and effective. We are seeking concurrence with this approach to move forward with the remaining list of streets from 2022 and provide an updated prioritized street inventory measured against parameters such as proximity to priority facilities, traffic volume, equity, pedestrian access, and drainage concerns, to Council this fall after the pavement assessment is completed and in advance of the 2024 paving season.

CAPITAL IMPROVEMENT PLAN UPDATE

(Part 2)

2023 Pavement Plan

07.13.23

CIP PAVING OVERVIEW

Lake Forest Park's Pavement Statistics:

55 – Number of miles of City pavement

20 years – Expected time between resurfacing cycles

$1M - Actual (2023) cost to **resurface** 1 mile of pavement

$5M to $7M – Estimated cost to **reconstruct** 1 mile of roadway

+/- $500,000 – Current annual budget for pavement resurfacing

CIP PAVING OVERVIEW

King County - Administrator

Engineering

Project Bidding

Contract Execution

Project Management

Lakeside Industries

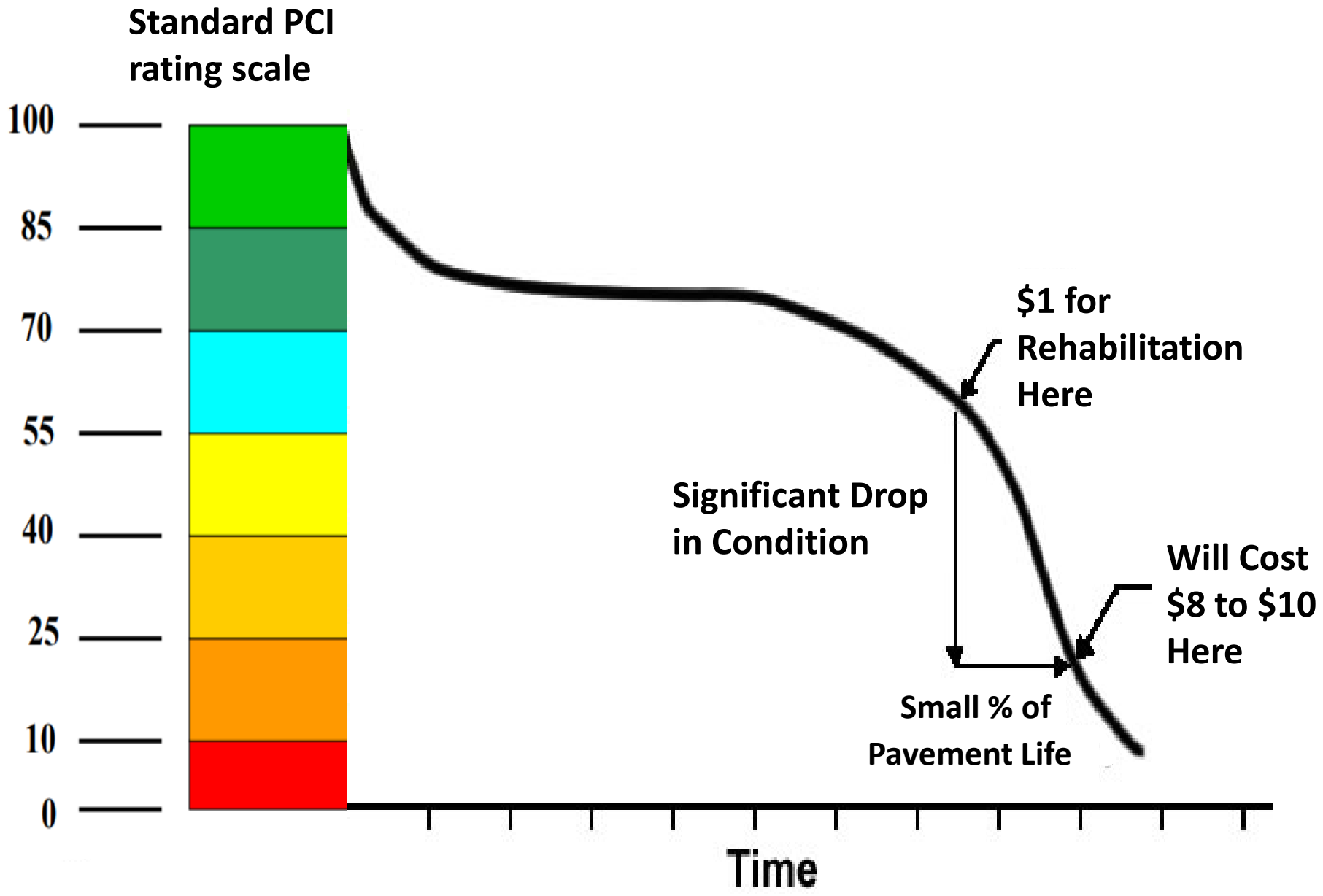
$3,461,949

Lake Forest Park

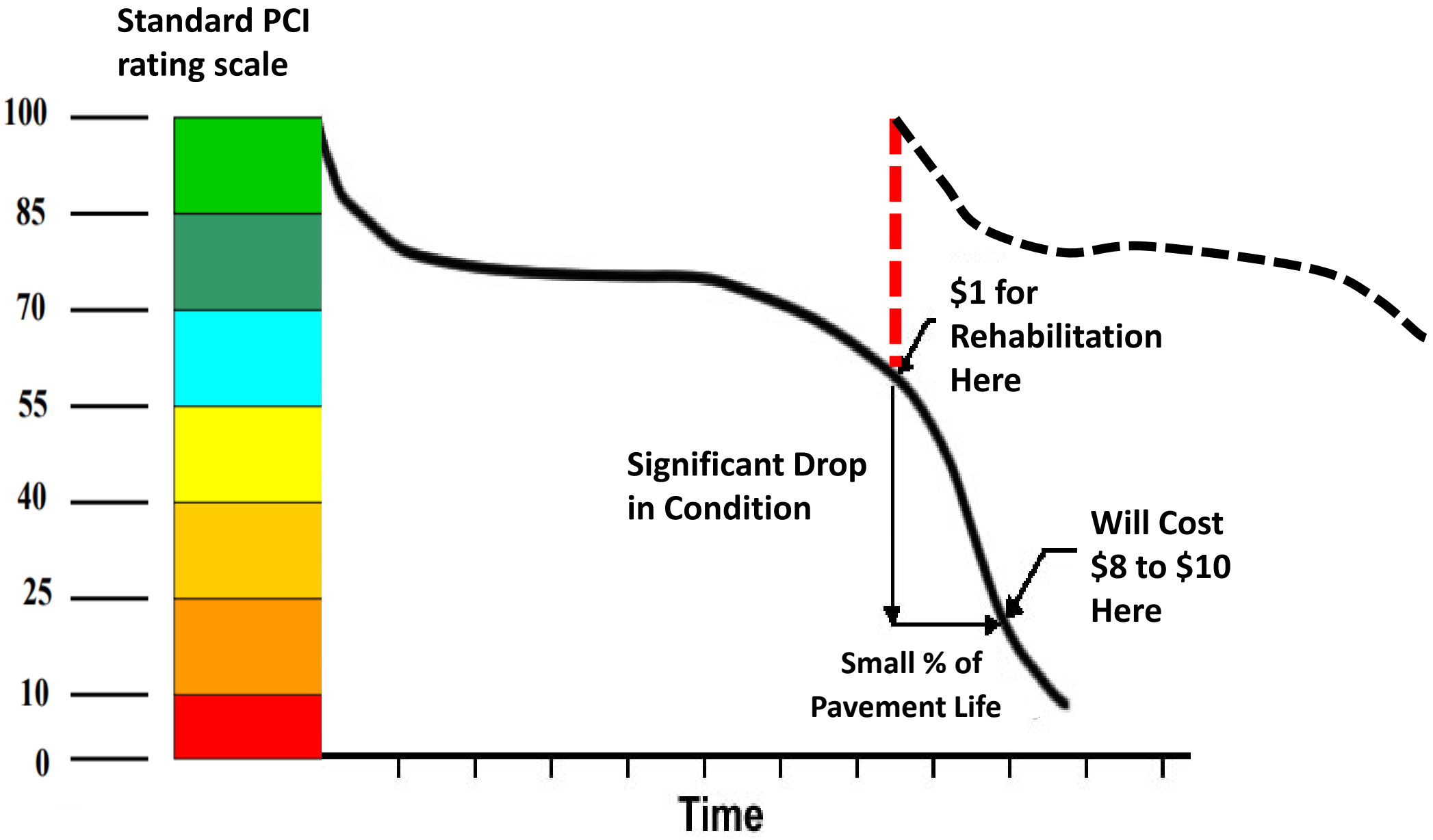
$459,449

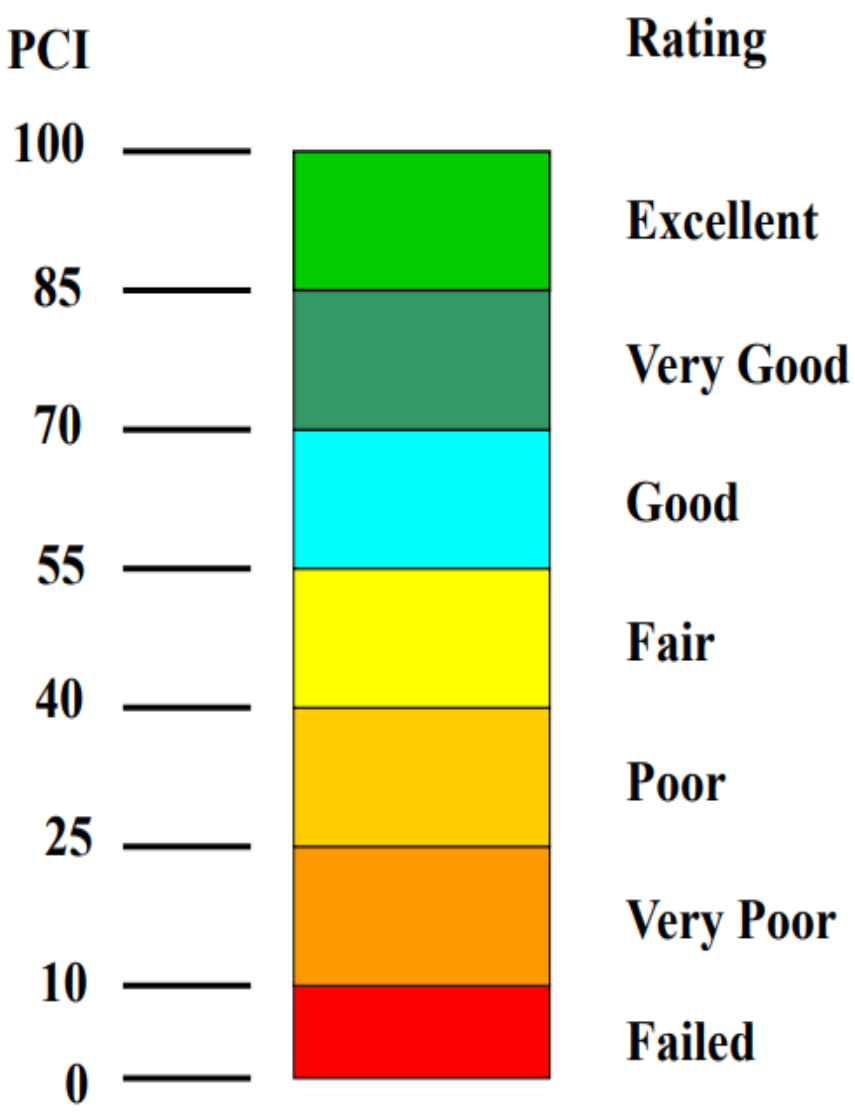
- Carnation
- Hunts Point
- Lake Forest Park
- Normandy Park
- Maple Valley
- Medina
- North Bend
- Yarrow Point

PAVEMENT DEGRADATION CU



PAVEMENT DEGRADATION CU

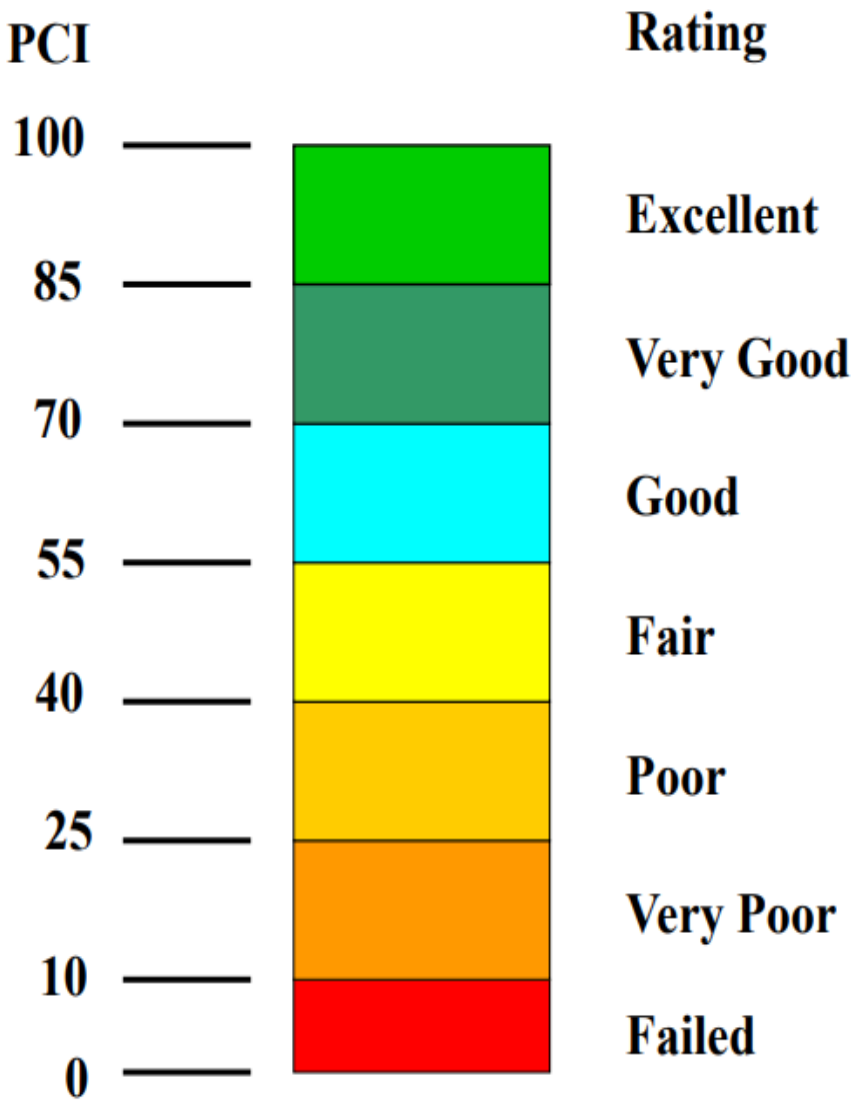




PAVEMENT CONDITION INDEX SCORES

CONDITION	RATING INDEX	DEFINITION
Excellent	86-100	Stable, no cracking, no patching, and no deformation. Very good riding qualities.
Very Good	71-85	Stable, minor cracking, generally hairline and hard to detect. Minor patching and possibly some minor deformation evident. Dry or light-colored appearance. Good riding qualities. Rutting less than ½".
Good	56-70	Generally stable, minor areas of structural weakness evident. Cracking is easier to detect, patches evident, patched but not excessively. Deformation more pronounced and easily noticed. Ride qualities are good to acceptable.
Fair	41-55	Areas of instability marked evidence of structural deficiency, large crack patterns (alligatoring) heavy and numerous patches, deformation very noticeable. Riding qualities range from acceptable to poor.
Poor	26-40	Pavement in extremely deteriorated condition. Numerous areas of instability. Majority of section showing structural deficiency. Ride quality is poor.
Very Poor	11-25	Pavement in extremely deteriorated condition. Extensive potholes. Numerous areas of instability. All of section showing structural deficiency. Ride quality is very poor.
Failed	0-10	Pavement structure failed. All of section showing severe structural deficiency.

PAVEMENT CONDITION INDEX SCORES



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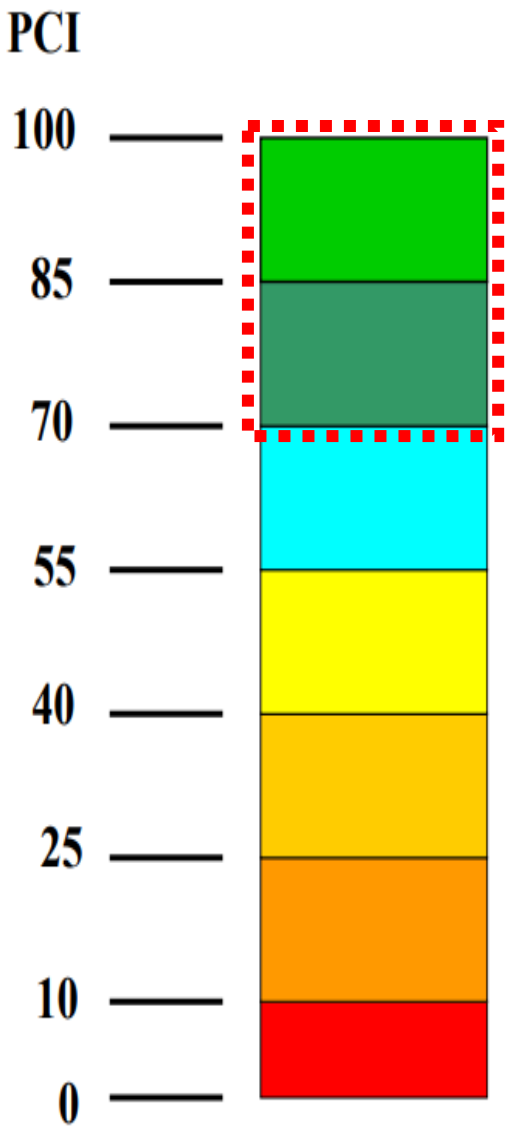
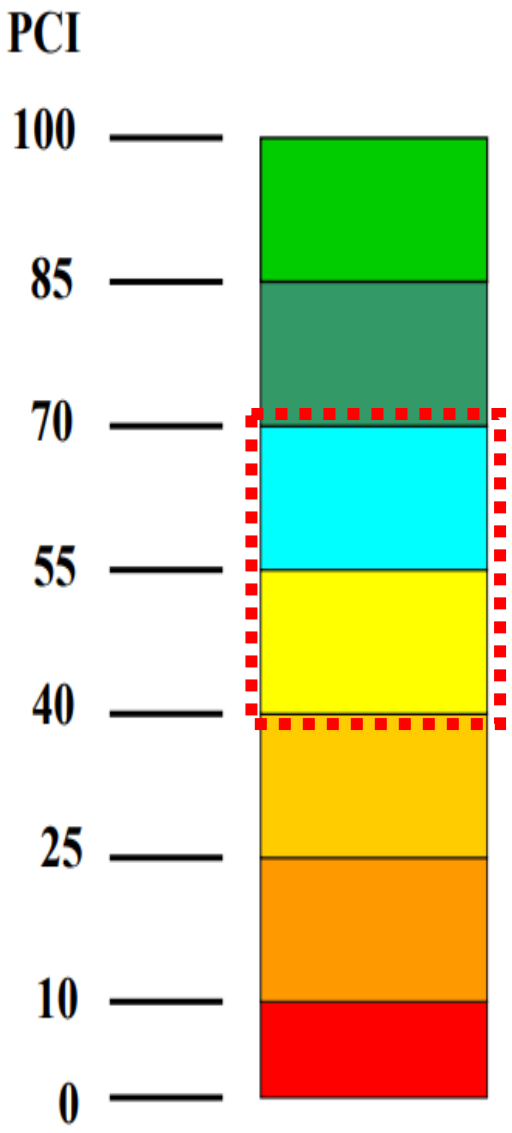
PAVEMENT CONDITION INDEX EXAMPLES



Pavement Condition
86 – 100 (Excellent)

Pavement Condition
71 – 85 (Very Good)

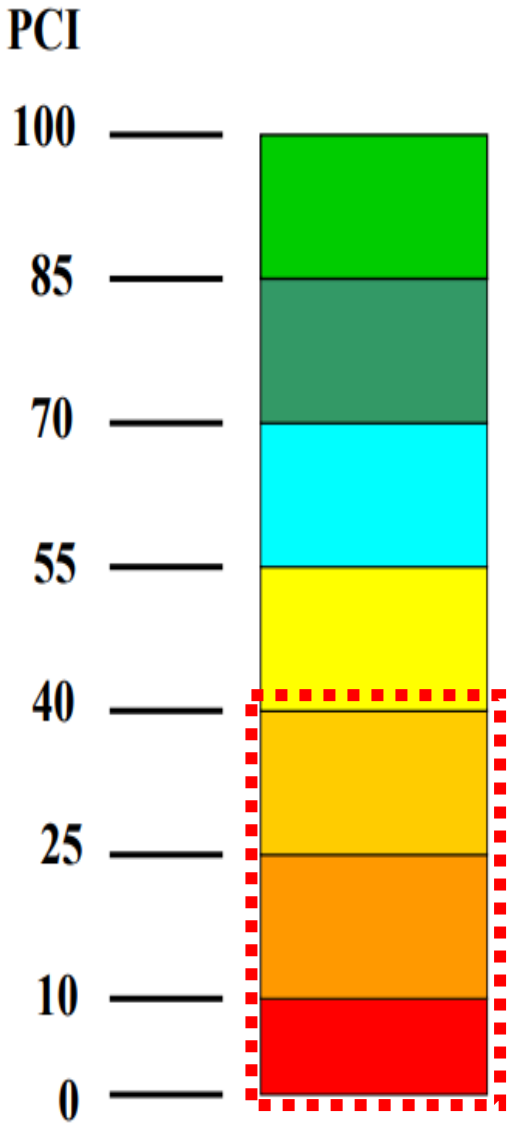
PAVEMENT CONDITION INDEX EXAMPLES



Pavement Condition
56 – 70 (Good)

Pavement Condition
41 – 55 (Fair)

PAVEMENT CONDITION INDEX EXAMPLES



Pavement Condition
11 – 40 (Poor/Very Poor)

Pavement Condition
0 – 10 (Failed)

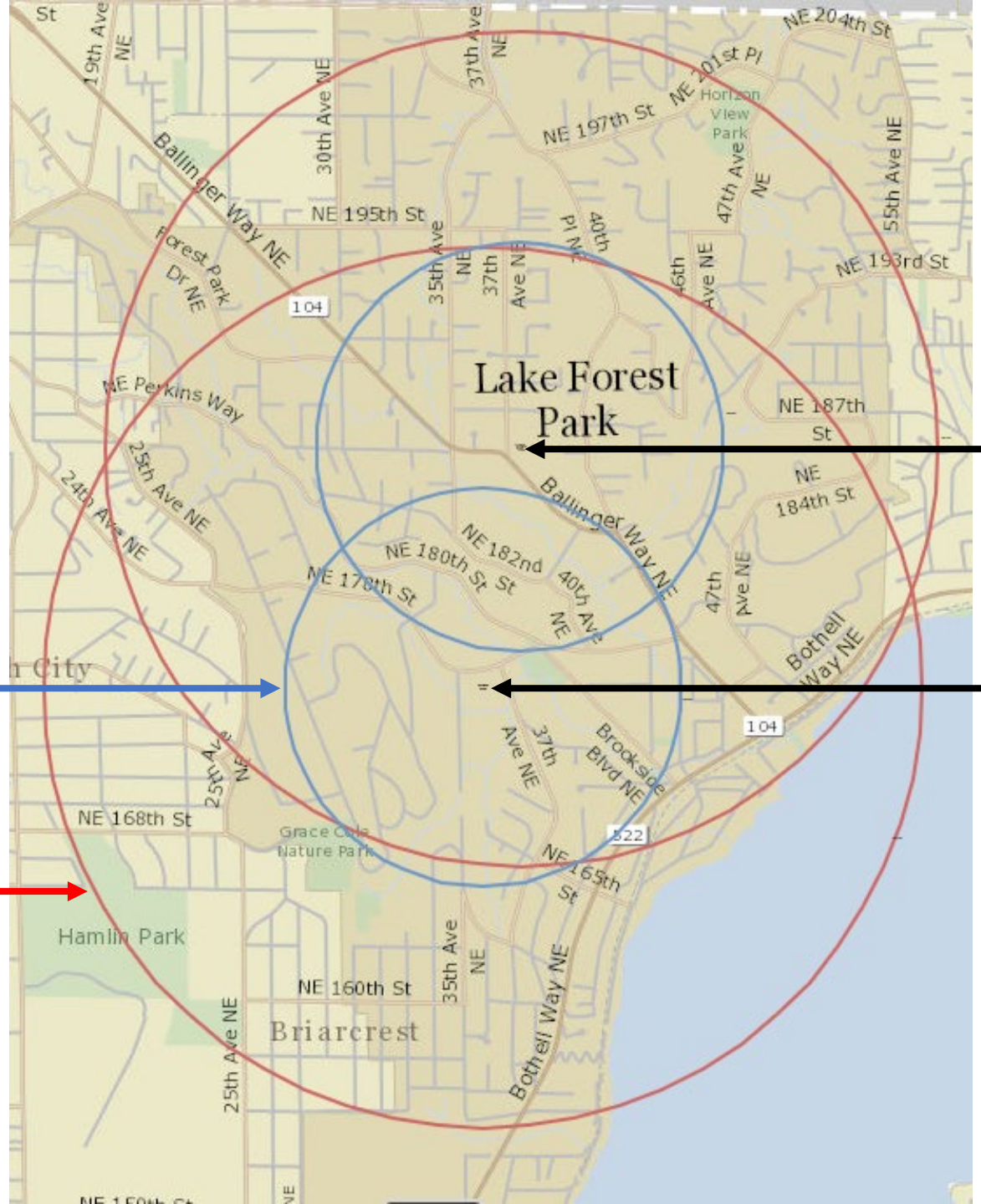
CIP PAVING OVERVIEW

Contra Costa County Public Works Department

Recently, the pavement management goal is to schedule areas for paving based on geographic areas to focus in on entire communities to minimize future construction impacts and to minimize transportation costs by the contractor. This will increase the efficiency and cost effectiveness of the program.

An annual paving program has multiple benefits for all street users. Maintained roadways are safer, with fewer potholes, updated striping, and often provide an opportunity for pedestrians and bicyclists improvements, as exemplified by new curb ramp installation and pavement striping for new bikeways. Every time a roadway receives a new surface, staff evaluates opportunities to install bicycle lanes or identify a street as a bike route. In addition, preventative maintenance of streets is similar to regular oil changes for a vehicle. Studies show that taken over the life cycle of the pavement, it is over twice as expensive to completely rebuild a street than to properly maintain them with a surface treatment program.

Proximity Map for Lake Forest Park's Elementary Schools



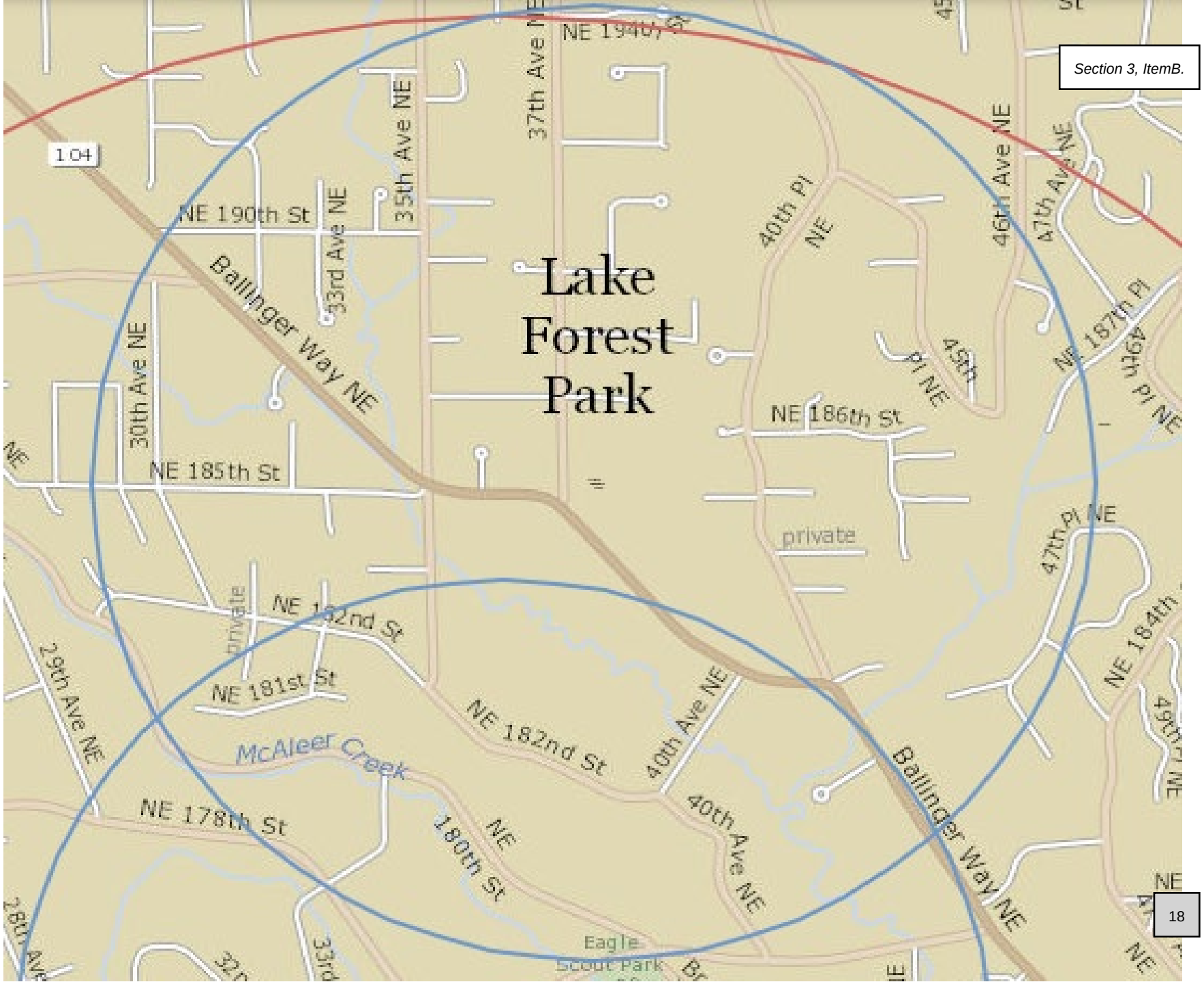
LFP Elementary

Brookside Elementary

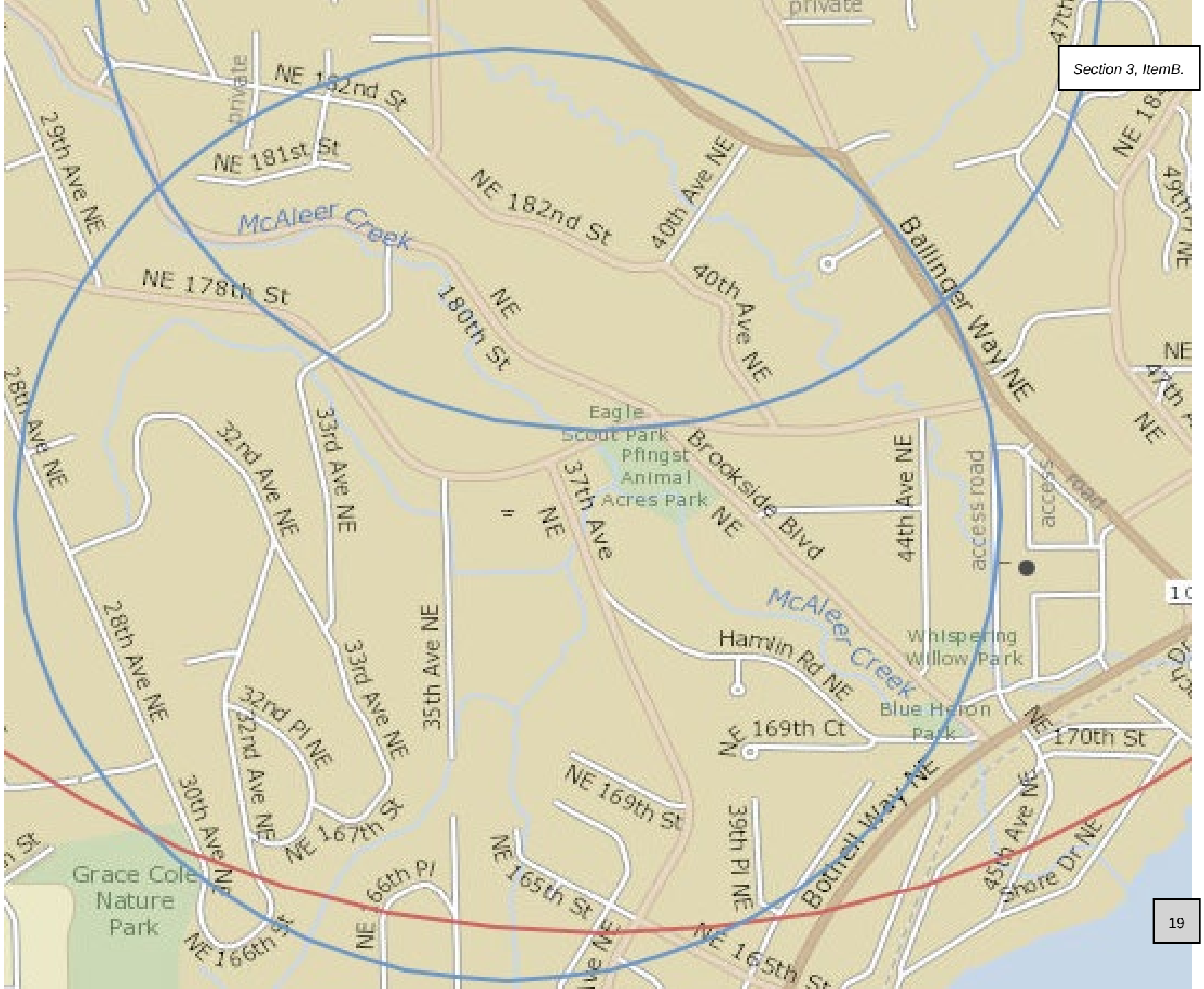
½ Mile Radius

1 Mile Radius

Proximity Map for Lake Forest Park Elementary School (1/2 mile)



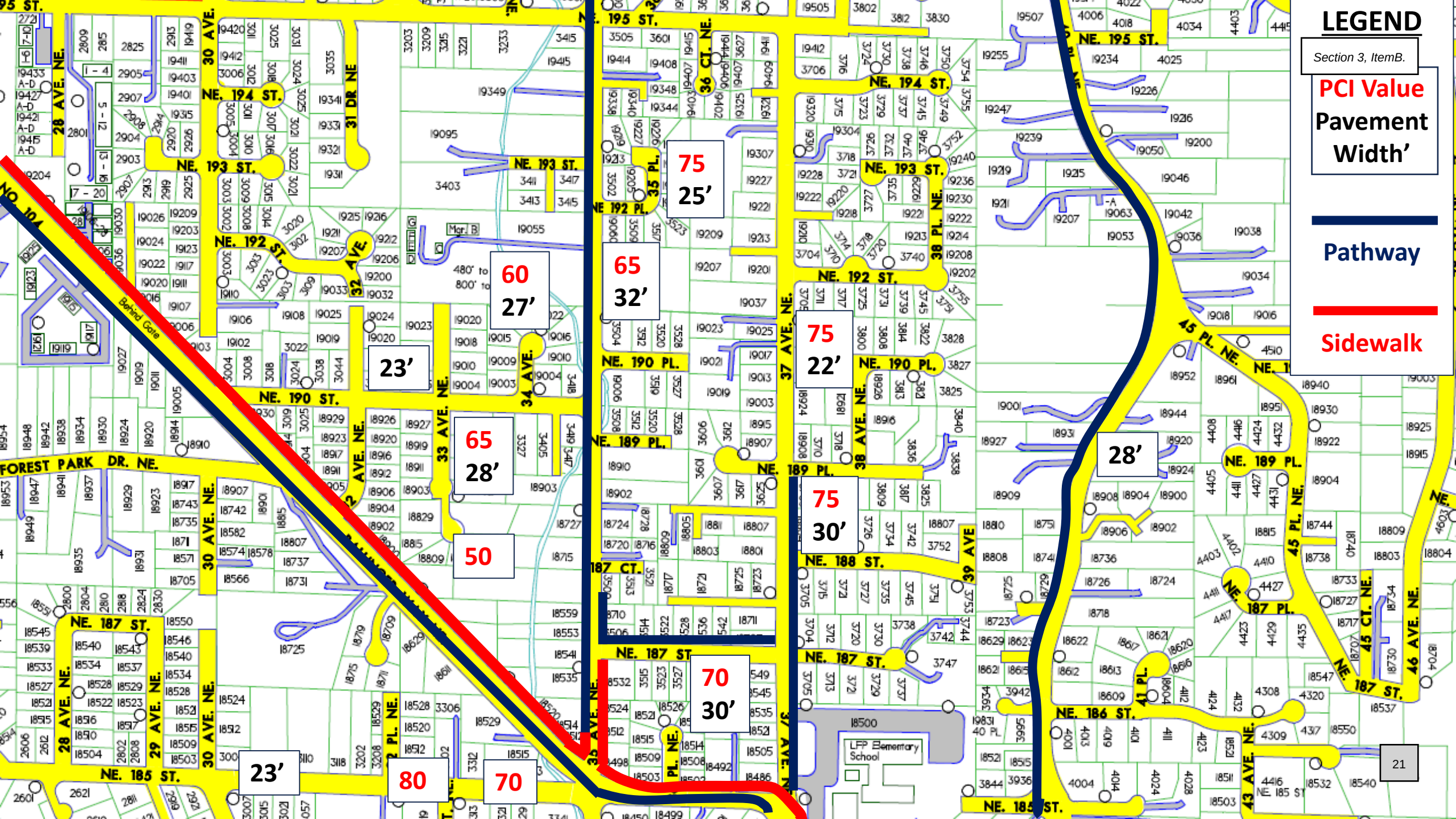
Proximity Map for Brookside Elementary School (1/2 mile)

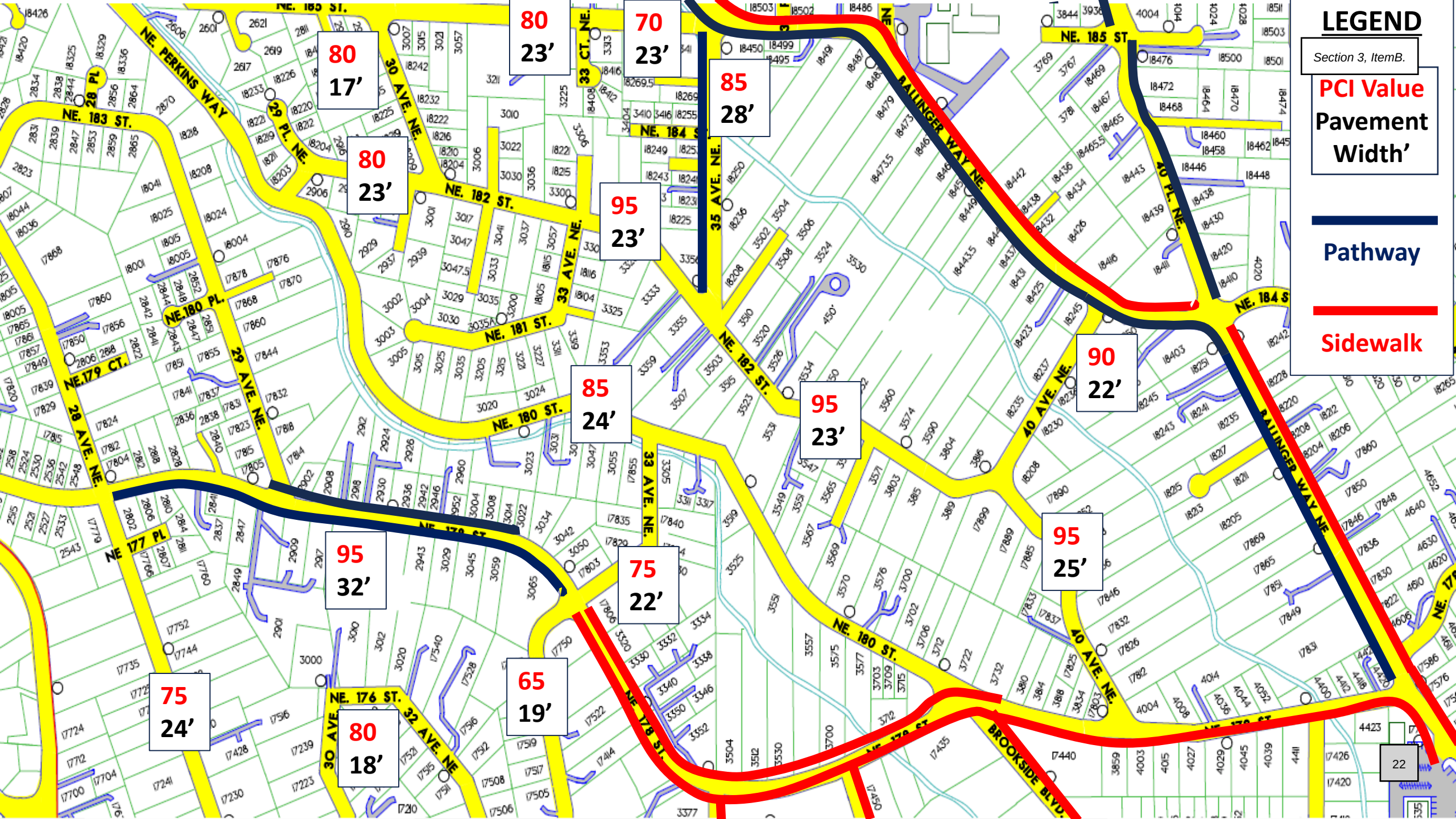


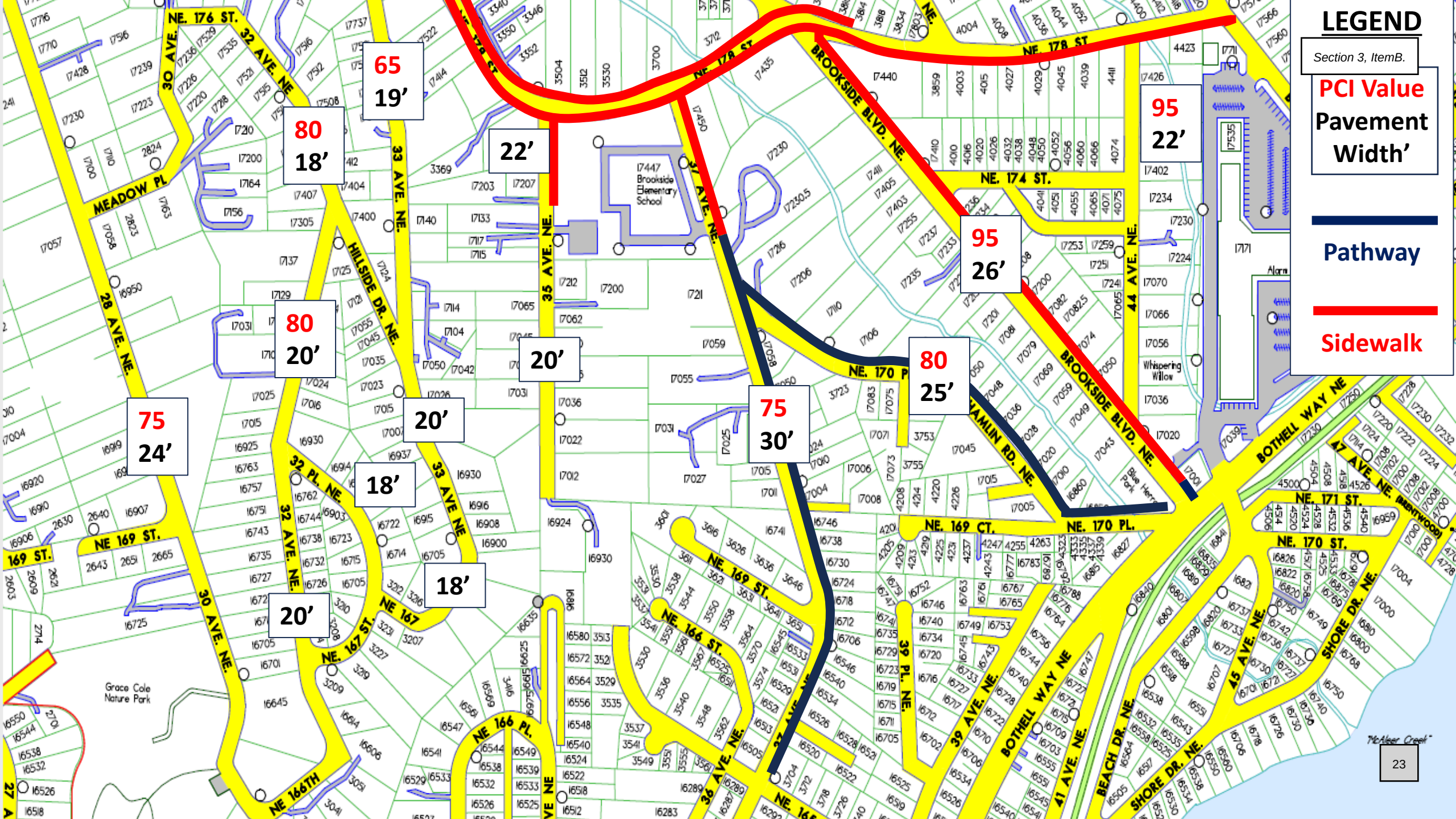
2.03(B) Urban Local Access Streets - (Curb Roadway Section)

Classification	Neighborhood Collectors	Subcollectors	Subaccess	Minor Access
Access	Restricted, Lots front on local access street where feasible.	As needed with some restrictions.[1]	Subaccess streets are not supportive of through traffic. Generally permanent cul-de-sacs or short loop[2] streets that connect to subcollectors.	Permanent cul-de-sacs or short loops with low traffic volumes that provide circulation and access to off-street parking within residential development limits.
Public or Private	Public	Public	Public or Private	Public or Private (See Section 2.06)
Serving Potential Number of Lots or Dwelling Units	Over 100[3]	100 Maximum[4]	50 Maximum	16 Maximum
Design Speed[5]	35 mph	30 mph	Low Speed Curve (See Section 2.10)	Low Speed Curve (See Section 2.10)
Max Superelevation	See Section 2.04B	See Section 2.04B	See Section 2.04B	See Section 2.04B
Horizontal Curvature	See Table 2.2	See Table 2.2	Low Speed Curve (See Section 2.10)	Low Speed Curve (See Section 2.10)
Maximum Grade[6]	11%	12%	12%	12%
Minimum Stopping Sight Distance	See Table 2.2	See Table 2.2	150 feet	150feet
Minimum Entering Sight Distance	See Table 2.2	-	-	-
Typical Traveled Way[9]	22 feet[17]	22 feet	22 feet	22 feet
Typical Roadway Width[8]	32 feet[7]	28 feet	24 feet	22 feet
Minimum Right-of-Way Width[8]	56 feet	48 feet	40 feet	40 feet
Minimum Half Street Width	20 feet	20 feet	20 feet	20 feet
Minimum One Way Paved Width	20 feet	20 feet	20 feet	20 feet
Minimum Sidewalk Width	See Section 3.02	See Section 3.02	See Section 3.02	See Section 3.02
Curb Type	Vertical	Vertical[11]/Rolled	Vertical/Rolled	Vertical/Rolled

6. Sidewalks shall be constructed next to the curb except in those situations where the County Road Engineer approves the construction of a planting strip adjacent to the curb.
7. Sidewalks shall be a minimum width of five feet on residential access streets and arterials. Minimum sidewalk width shall be six and one-half feet on arterials if curb is next to traveled lane. Sidewalks shall be a minimum width of eight feet on commercial access streets.
8. At least eight feet wide:
   a. Where the street frontage has the characteristics of a business/commercial district and where the building frontage is within 80 feet of the street right-of-way.
   b. Within the curb radius returns of all arterial intersections where curb ramps are required.
   c. Within designated bus zones to provide a landing area for wheelchair access to transit services.
9. With specified width greater than eight feet where the County Road Engineer or Development Engineer determines this is warranted by expected pedestrian traffic volume.
10. With Portland cement concrete surfacing as provided in Sections 3.03 and 4.01. See specifications for joints in Section 3.04 and figure 3-001.
11. A minimum of one foot of gravel or native material shall be provided back of and immediately adjacent to the sidewalk. The material shall be flushed with the top of sidewalk.


LEGEND
Section 3, ItemB.
PCI Value
Pavement
Width'
Pathway
Sidewalk
NE. 195 ST.
NE. 194 ST.
NE. 193 ST.
NE. 192 ST.
NE. 190 PL.
NE. 189 PL.
NE. 188 ST.
NE. 187 ST.
NE. 185 ST.
NE. 186 ST.
30 AVE. NE.
28 AVE. NE.
31 DR NE
32 AVE.
33 AVE. NE.
34 AVE.
35 PL. NE.
36 CT. NE.
37 AVE. NE.
38 AVE. NE.
38 PL. NE.
39 AVE
45 PL. NE.
45 PL. NE.
45 CT. NE.
46 AVE. NE.
43 AVE. NE.
41 PL.
187 CT.
192 PL.
FOREST PARK DR. NE.
NO. 104
Behind Gate
Mgr. B
480' to
800' to
75
25'
65
32'
60
27'
23'
75
22'
65
28'
75
30'
50
70
30'
80
70
23'
28'
LFP Elementary School
18500
21


LEGEND
Section 3, ItemB.
PCI Value
Pavement
Width'
Pathway
Sidewalk
80
17'
80
23'
80
23'
70
23'
85
28'
95
23'
85
24'
95
23'
90
22'
95
25'
95
32'
75
22'
75
24'
65
19'
80
18'
NE. 185 ST.
NE. 183 ST.
NE. 182 ST.
NE. 181 ST.
NE. 180 ST.
NE. 177 PL
NE. 176 ST.
NE. 184 S
NE.180 PL.
NE.179 CT.
30 AVE. NE.
33 CT. NE.
35 AVE. NE.
33 AVE. NE.
29 AVE. NE.
28 AVE. NE.
28 PL
29 PL. NE.
32 AVE. NE
40 AVE. NE.
40 PL. NE.
PERKINS WAY
BALLINGER WAY NE.
BROOKSIDE BLVD.
22


LEGEND
Section 3, ItemB.
PCI Value
Pavement
Width'
Pathway
Sidewalk
65
19'
80
18'
22'
80
20'
20'
20'
75
24'
18'
20'
18'
75
30'
80
25'
95
26'
95
22'
NE. 176 ST.
32 AVE. NE.
30 AVE. NE.
MEADOW PL
33 AVE. NE.
HILLSIDE DR. NE.
28 AVE. NE.
35 AVE. NE.
37 AVE. NE.
NE. 178 ST.
BROOKSIDE BLVD. NE.
NE. 174 ST.
44 AVE. NE.
NE. 170 PL
HAMLIN RD. NE.
BROOKSIDE BLVD. NE.
BOTHELL WAY NE
47 AVE. NE.
NE. 171 ST.
NE. 169 CT.
NE. 170 PL.
NE. 170 ST.
SHORE DR. NE.
45 AVE. NE.
NE 169 ST.
169 ST.
30 AVE. NE.
32 PL. NE.
32 AVE. NE.
33 AVE NE
NE 167 ST.
NE. 169 ST.
NE. 166 ST.
NE. 166 PL.
36 AVE. NE.
39 PL. NE.
39 AVE. NE.
BOTHELL WAY NE
41 AVE. NE.
BEACH DR. NE.
SHORE DR. NE.
NE 166TH
17447 Brookside Elementary School
Grace Cole Nature Park
Whispering Willow
Blue Heron Park
McAleer Creek
23

Good - PCI = 65

Generally stable, **minor areas of structural weakness evident**. **Cracking is easier to detect**, patches evident, patched but not excessively. Deformation more pronounced and easily noticed. **Ride qualities are good to acceptable.**

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Fair - PCI = 50

Areas of instability marked evidence of structural deficiency, **large crack patterns (alligatoring) heavy and numerous patche** deformation very noticeable. **Riding qualities range from acceptable to poor**.

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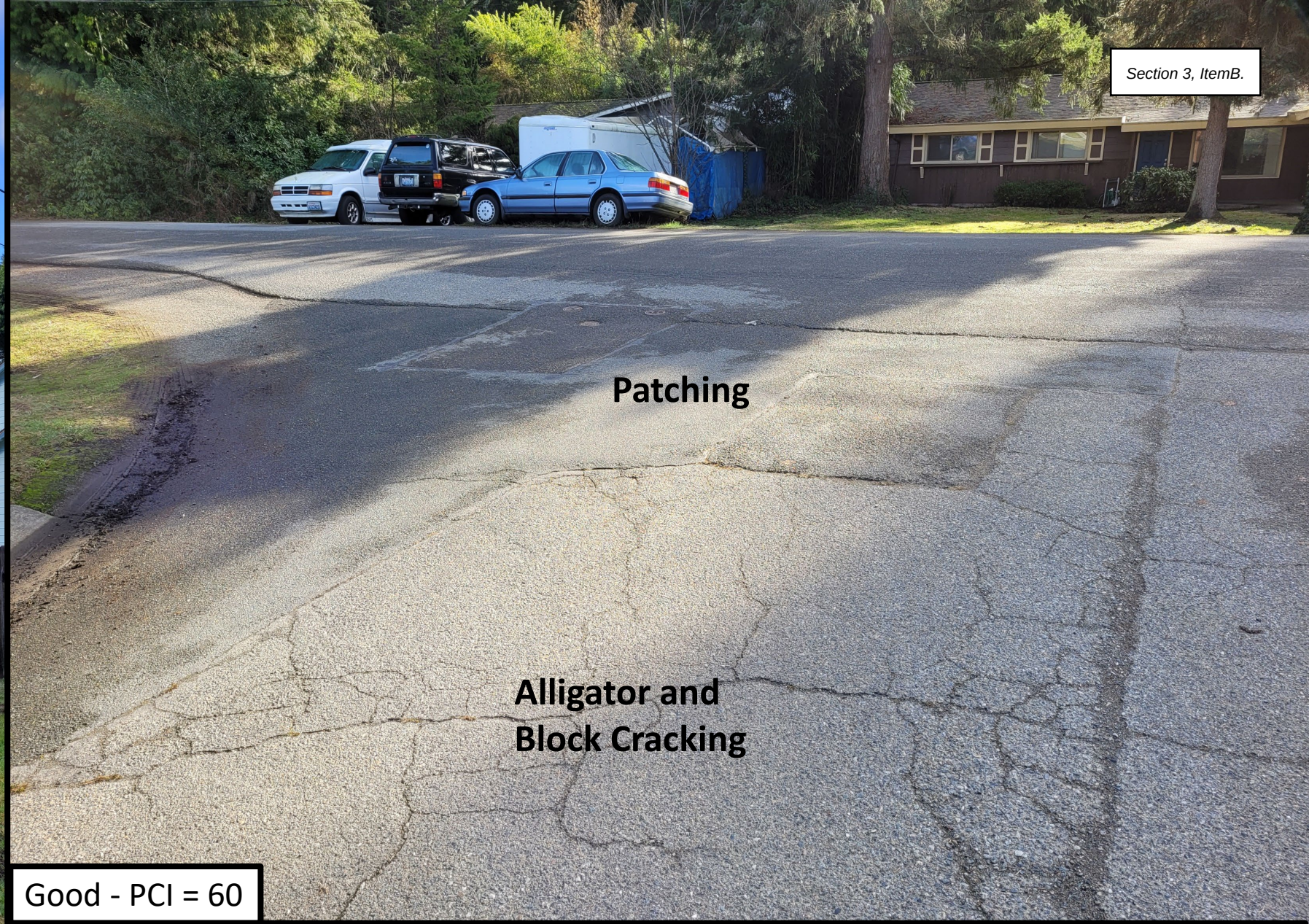

Good - PCI = 60

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Base under the pavement settled around utility structure leading to poor ride quality

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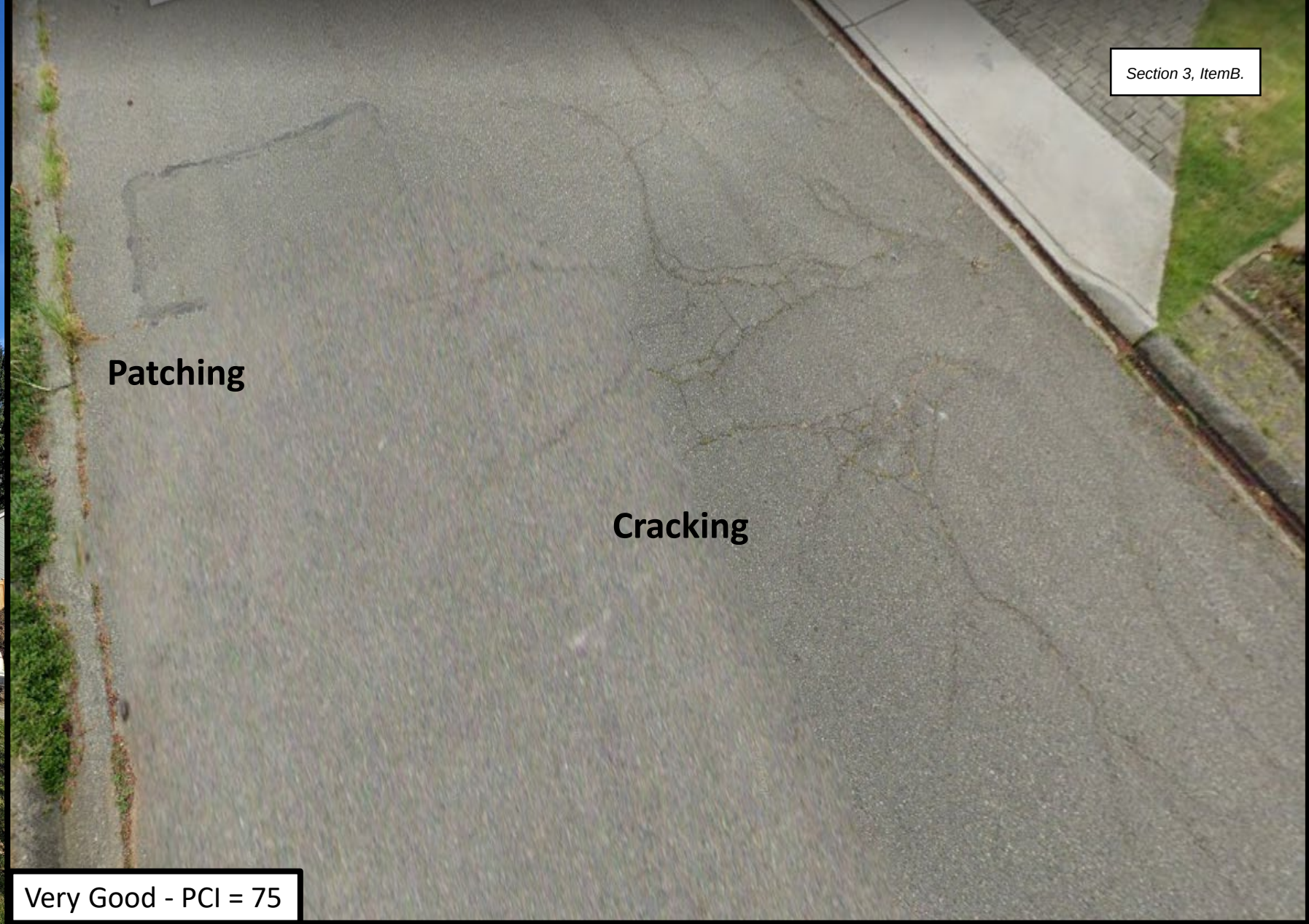

Very Good - PCI = 75

Stable, minor cracking, **generally hairline and hard to detect**. **Minor patching** and possibly some minor deformation evident. Dry or light-colored appearance. **Good riding qualities**. Rutting less than ½".

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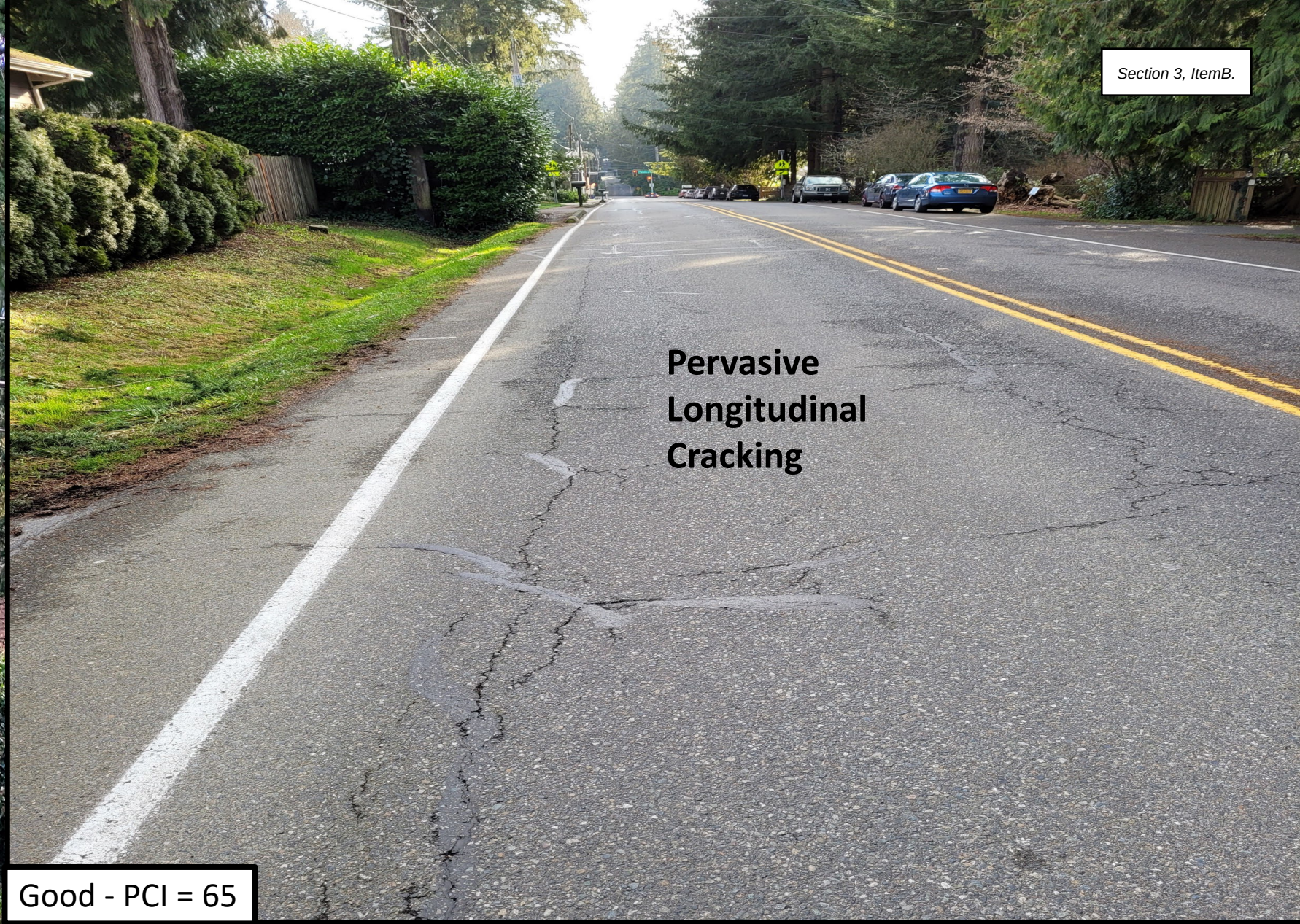

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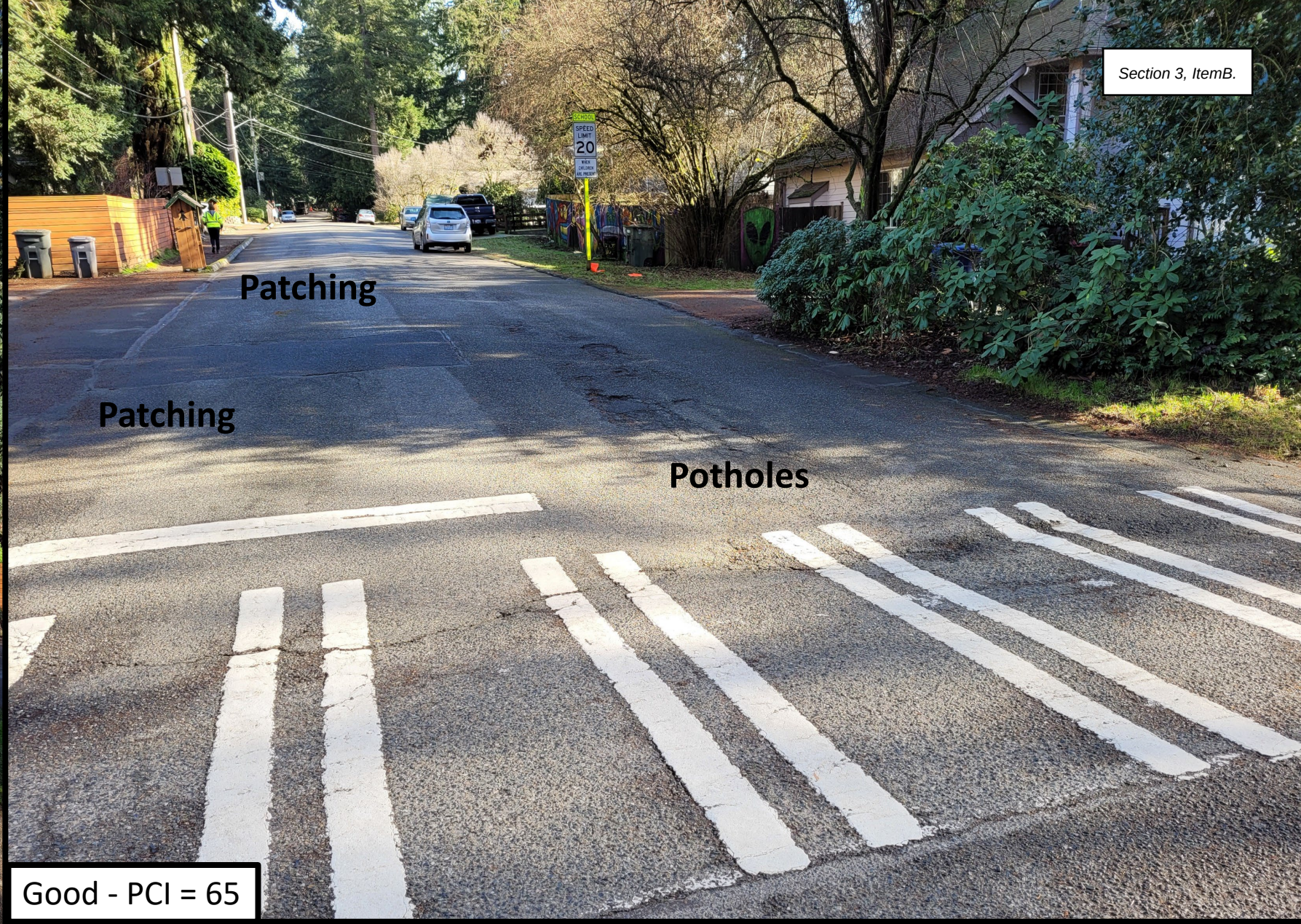

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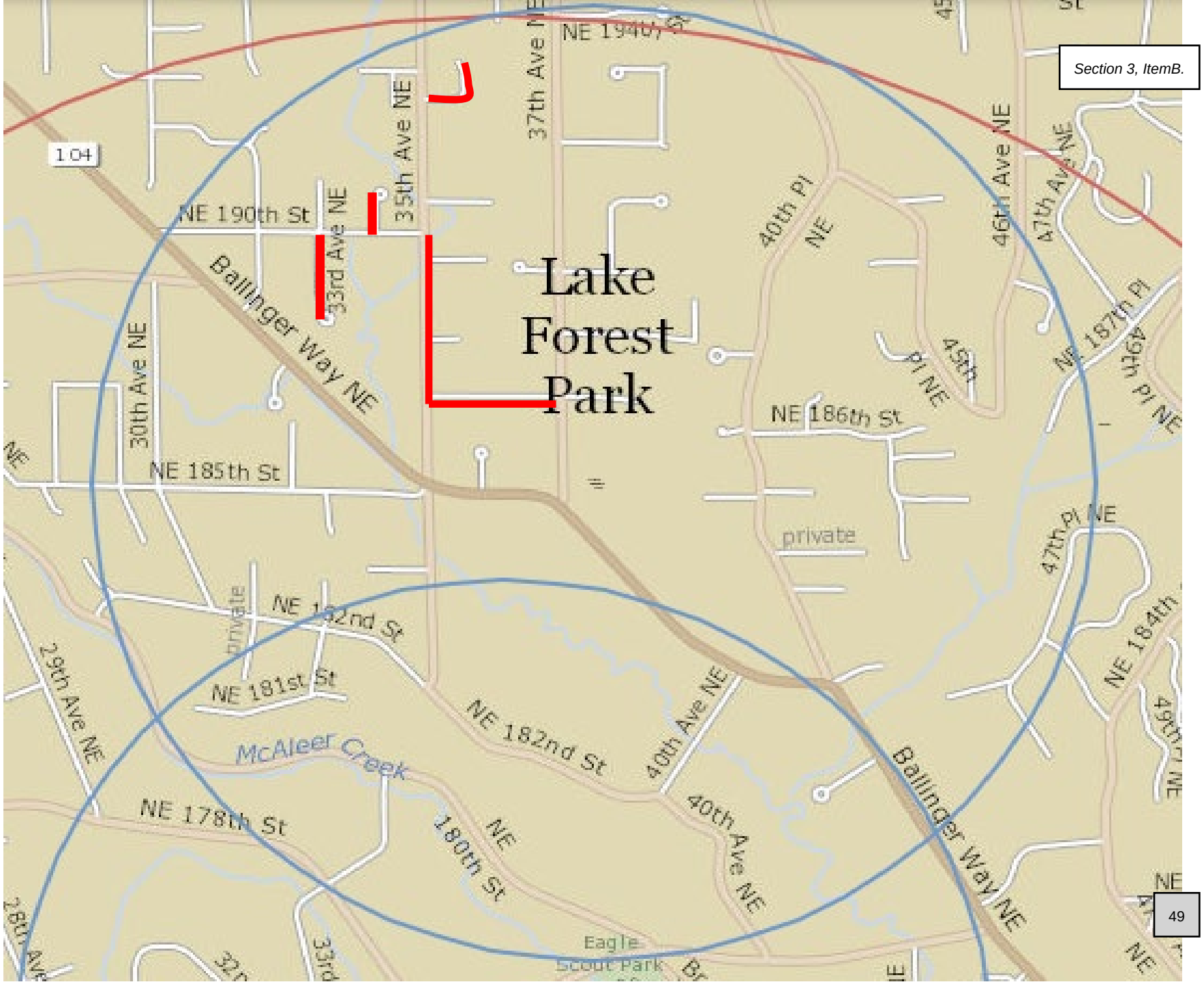
Proximity Map for Lake Forest Park Elementary School (1/2 mile)



Location	Estimated Cost/Location
33rd Ave Ne: NE 190th St to End of Road	$74,092
34rd Ave Ne: NE 190th St to End of Road	$50,233
NE 192nd St: NE 192nd St to End of Road	$66,938
35th Ave Ne: NE 190th St to NE 187th St	$137,340
NE 187th St: 35th Ave NE to 37th Ave NE	$130,846
Estimated Total Cost:	**$459,449**

CITY OF LAKE FOREST PARK
CITY COUNCIL
AGENDA COVER SHEET

Meeting Date	July 13, 2023
Originating Department	Planning
Contact Person	Steve Bennett, Planning Director and Kim Adams Pratt, City Attorney
Title	Ordinance 23-1272/Adopting Interim Development Regulations As Authorized By The Growth Management Act Relating To Retaining Walls

Legislative History

- First Presentation - January 26, 2023, regular City Council meeting
- Second Presentation – February 6, 2023, City Council special Committee of the Whole meeting
- Third Presentation – February 23, 2023, regular City Council meeting
- Fourth Presentation – April 13, 2023, regular City Council meeting
- Fifth Presentation – May 11, 2023, regular City Council meeting
- Sixth Presentation – May 18, 2023, special City Council meeting
- Seventh Presentation – June 5, 2023, special City Council meeting
- Eighth Presentation – June 8, 2023, regular City Council meeting
- Ninth Presentation – June 22, 2023, regular City Council meeting
- Tenth Presentation – July 13, 2023, City Council work session

Attachments:

1. Ordinance 23-1272/Adopting Interim Development Regulations as authorized by the Growth Management Act relating to retaining walls (including Retaining Wall Design Standards)
2. PACE Engineers, Inc. Memorandum dated July 7, 2023
3. WSDOT Noise Modeling requiring the use of FHWA traffic noise modeling
4. Federal Regulations: 23 CFR Part 772 Procedures for abatement of highway traffic noise

Executive Summary

On June 8, the City Council adopted Ordinance No. 23-1270, interim development regulations for retaining walls. After a public hearing on June 22, 2023, the City Council amended the interim regulations under Ordinance No. 23-1272. Section 7 of both ordinances direct City staff to investigate and obtain outside consulting services if necessary to research the WSDOT traffic noise policy and procedures and provide such information with a recommendation to the City Council for its adoption of permanent retaining wall regulations. This work session is scheduled for discussion of the PACE Memorandum and Ordinance No. 23-1272.

Under the Growth Management Act (GMA), interim regulations may be in effect for six months and may be renewed for one or more six-month periods. Ordinance No. 23-1272 expires December 8, 2023, unless extended or terminated sooner by the City Council.

Fiscal & Policy Implications

There are no known fiscal implications at this time.

Staff Recommendation

Discuss Ordinance No. 23-1272 and the PACE Memorandum; provide direction to City staff; and set a public hearing date.

ORDINANCE NO. 23-1272

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF LAKE FOREST PARK, WASHINGTON, AMENDING ADOPTED INTERIM DEVELOPMENT REGULATIONS AS AUTHORIZED BY THE GROWTH MANAGEMENT ACT RELATING TO RETAINING WALLS; DECLARING AN EMERGENCY; PROVIDING FOR SEVERABILITY, AND ESTABLISHING AN EFFECTIVE DATE

WHEREAS, the adoption of land use and zoning regulations is a valid exercise of the City's police power and is specifically authorized by RCW 35A.63.100 and RCW 36.70A.040; and

WHEREAS, within the express terms of the Growth Management Act, the Washington State Legislature has specifically conferred upon the governing bodies of Washington cities the right to establish and adopt interim development regulations; and

WHEREAS, large scale retaining walls in or adjacent to publicly owned rights-of-way can result in visual and physical blight, tree and vegetation removal, and become de facto landmarks identifying the City of Lake Forest Park (the "City")

WHEREAS, it is imperative that negative impacts of these retaining walls be mitigated with structural and aesthetic design, planting, and other mitigation measures; and

WHEREAS, it is imperative that these retaining walls that become significant, recognizable features in the City be integrated with and support the community identity; and

WHEREAS, chapter 12.50 of the Lake Forest Park Municipal Code ("LFPMC") would establish regulations for retaining walls in or adjacent to publicly owned right-of-way;

WHEREAS, an Environmental Checklist for a non-project action was prepared under the State Environmental Policy Act, Chapter 43.21C RCW, pursuant to Chapter 197-11 WAC, and a Determination of Non-Significance ("DNS") was issued on April 12, 2023; and

WHEREAS, in accordance with the requirements set forth in RCW 36.70A.106, the City provided the Washington State Department of Commerce notice of the City's

intent to adopt the proposed amendments on April 6, 2023, and received notice that the Department had granted expedited review on April 20, 2023; and

WHEREAS, the City Council held public meetings to review the proposed regulations during meetings on January 26, 2023; February 6, 2023, February 23, 2023, April 13, 2023, May 11, 2023, June 5, 2023, June 8, 2023, and June 22, 2023; and

WHEREAS, the City Council held a public hearing on May 11, 2023, and June 22, 2022 regarding the proposed regulations; and

WHEREAS, the City Council adopted interim retaining wall regulations in Ordinance No. 23-1270 on June 8, 2023, and after the public hearing on June 22, 2023, adopted an amendment to Ordinance No. 23-1270, Section 2, LFPMC 12.50.020(C)(6).

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF LAKE FOREST PARK, WASHINGTON, DO ORDAIN AS FOLLOWS:

Section 1. PRELIMINARY FINDINGS. The recitals and findings set forth above are hereby adopted as the City Council's preliminary findings in support of the interim development regulations imposed by this ordinance.

Section 2. ADOPTION OF INTERIM DEVELOMENT REGULATIONS. Pursuant to the provisions of RCW 35A.63.220 and RCW 36.70A.390, interim development regulations are hereby enacted creating Chapter 12.50 of the Lake Forest Park Municipal Code (LFPMC) as follows:

12.50.010 Purpose and intent.
The purpose and intent of this chapter is to:

A. Recognize that while at the basic level, a retaining wall is a structure that holds or retains soil behind it, retaining walls can also result in visual and physical blight, tree and vegetation removal, impairment of gateway areas, and other impacts that require visual design, planting, and topographic, and aesthetic mitigation.

B. Recognize that retaining walls can be built from different materials to achieve the strength required and achieve aesthetic goals;

C. Require aesthetic design features that reflect the character of the community as adopted in Retaining Wall Design Standards;

D. Recognize that retaining walls are frequently adjacent to noise sensitive areas such as residential dwelling units and other land uses that are noise sensitive and subject to inequitable noise impacts, which can be intensified by removal of vegetation and trees and/or by the reflected noise from retaining wall surfaces;

E. Require proof of compliance with state regulations for noise attenuation, absorption, and transmission; recognize that compliance may be achieved through a variety of

techniques and materials such as the use of tilted retaining walls to direct noise upward, large and small variations of façade to break up low to high frequencies, and sound reflection mitigation;

F. Require landscaping to avoid visual dominance of the retaining wall, potentially discourage graffiti, and add visual quality;

G. Encourage building material choices that ensure aesthetics, durability, maintenance, and cost; and

H. Promote cooperation between the State of Washington Department of Transportation ("WSDOT"), the City, and the project proponent.

12.50.020 Retaining wall construction and design.

A. Public benefit. Retaining walls located within the right-of-way shall be installed to benefit the general public by supporting or protecting public transportation infrastructure and shall not be for private development gain.

B. Application type.

1. An application for retaining wall construction and design approval shall be processed pursuant to the requirements in chapter 16.26 LFPMC for a Type III permit, administrative decision made by the code administrator. The Public Works director shall be the "code administrator" for the Type III permit decision.

2. For proposed retaining walls 25 feet or more in length and that propose removal of 10 or more trees that are either exceptional, landmark, or significant trees as defined in Chapter 16.14 LFPMC, a Neighborhood meeting shall be held pursuant to the requirements in LFPMC 16.26.050, prov-ided however, that the Neighborhood meeting is not required to be held prior submittal of the application for the retaining wall.

3. For purposes of sending notice of the Neighborhood meeting under LFPMC 16.26.050(B), notice shall be mailed to owners of real property within 500 feet of either side of the right-of-way for the entire length of the retaining wall project. For purposes of sending the notice of application under LFPMC 16.26.040(D)(1)(b), notice shall be mailed to owners of real property within 500 feet of either side of the right-of-way for the entire length of the retaining wall project.

C. Transportation design manuals and regulations. Retaining walls located on private property or right-of-way that support or protect public transportation infrastructure shall, at a minimum, meet the requirements set forth in the latest edition of the Washington State Department of Transportation (WSDOT) Design Manual, Bridge Design Manual, and the International Building Code. These manuals and codes provide policies, procedures, and methods for developing and documenting design improvements to the transportation network.

1. The retaining wall construction type shall be the same from the highest to the lowest portion of each independent wall segment. Where walls are terraced or tiered, all tiers/terraces shall consist of the same wall construction type for the length of each independent segment.

2. Concrete retaining walls shall be coated with a moisture barrier and anti-graffiti paint.

3. Total structural isolation is required for public and private retaining walls adjacent to each other.

4. The Public Works director may take into account long term maintenance requirements, constructability, and recommendations on same from the applicant's engineers and independent third-party engineers.

5. Easements may be required for the maintenance, operation, and replacement of the wall.

6. The applicant shall provide documentation of how the retaining wall design satisfies, or exceeds, applicable WSDOT traffic noise policy and procedures. The documentation should include an assessment of noise impacts from the proposed design, including consideration of tree and vegetation removal, reflected noise, and proximity to residences, as well as proposed reflection and absorption techniques such as the use of tilted retaining walls to direct noise upward and variations in the facade to break up low to high frequencies.

7. Prior to issuing a decision on the retaining wall, the Public Works Director shall obtain, at the applicant's expense, a written structural review and recommendation from an independent third party with professional expertise and no affiliation with the applicant.

D. Aesthetic design.

1. An architectural finish or engineered block shall be used that integrates with and supports the community identity of the City showing a strong relationship to the surrounding natural environment including native trees, flora, and fauna of the region. The architectural finishes included in Provision 1 of the Retaining Wall Design Standards dated June 8, 2023, are examples that satisfy this requirement. The Public Works Director will review and issue a decision on the architectural finish and engineered block consistent with this section after obtaining, at the applicant's expense, a written review and recommendation from an independent third party with professional expertise and no affiliation with the applicant.

2. Landscaping treatments shall be used on retaining walls that reduce the harshness of these walls. The landscaping standards included in Provision 2 of the Retaining Wall Design Standards dated June 8, 2023, are examples that satisfy this

requirement. The Public Works Director will review and issue a decision on landscaping treatments consistent with this section after obtaining, at the applicant's expense, a written review and recommendation from an independent third party with professional expertise and no affiliation with the applicant.

3. As a condition of permit approval, the Public Works Director shall require as needed, based on the impacts and circumstances related to a particular retaining wall, installation of a temporary irrigation systems, and the funding for or implementation of a 3-year tree and plant monitoring and maintenance plan, including the replacement of failed trees and plants.

Section 3. ADOPTION OF INTERIM DEVELOPMENT REGULATIONS. Pursuant to the provisions of RCW 35A.63.220 and RCW 36.70A.390, interim development regulations are hereby enacted to amend LFPMC 16.26.010, as follows:

16.26.010 Purpose and application.

A. This chapter establishes standard procedures for land use and related decisions made by the city of Lake Forest Park. They provide for an integrated and consolidated permit review process to promote timely and informed public participation and to eliminate redundancy and thereby minimize delay and expense.

B. This chapter applies to all applications for land use and related decisions made under chapter 12.50 LFPMC, and ~~LFPMC~~ Titles 15, 16, 17 and 18 LFPMC.

Section 4. ADOPTION OF INTERIM DEVELOPMENT REGULATIONS. Pursuant to the provisions of RCW 35A.63.220 and RCW 36.70A.390, interim development regulations are hereby enacted to amend LFPMC 16.26.030, as follows:

16.26.030 Classification of decisions.

. . .

C. Type III – Administrative Decisions Made by a Code Administrator.

1. Threshold determinations under the State Environmental Policy Act (SEPA);

2. Administrative variances;

3. Shoreline exemption permits;

4. Sensitive area permits issued pursuant to Chapter 16.16 LFPMC, with the exception of requests for exemption under LFPMC 16.16.250 and the exception of minor sensitive area permits as described under LFPMC 16.16.080(A)(2); ~~and~~

5. Short subdivisions; and

6. Retaining wall permits pursuant to chapter 12.50 LFPMC.

. . .

Section 5. EFFECTIVE DURATION OF INTERIM DEVELOPMENT REGULATIONS. These interim development regulations set forth in this ordinance shall be in effect for a period of six (6) months from the date of Ordinance No. 23-1270 and shall automatically expire on December 8, 2023, unless the same is extended as provided in RCW 35A.63.220 and RCW 36.70A.390, or unless terminated sooner by the City Council.

Section 6. SET A PUBLIC HEARING. A public hearing shall be held by the City Council regarding interim development regulations for retaining walls within sixty days of passage as required by RCW 36.70A.390.

Section 7. REFERRAL TO STAFF. The Planning Director, or designees (the "Director") is hereby authorized and directed to investigate and obtain outside consulting services if necessary to research the WSDOT traffic noise policy and procedures, provide such information to the City Council, and make a recommendation regarding permanent retaining wall development regulations.

Section 8. SEVERABILITY. Should any portion of this ordinance, or its application to any person or circumstance, be declared unconstitutional or otherwise invalid for any reason, such decision shall not affect the validity of the remaining portions of this ordinance or its application to other persons or circumstances.

Section 9. CORRECTIONS. The City Clerk is authorized to make necessary corrections to this ordinance including, but not limited to, the correction of scrivener's/clerical errors, references, ordinance numbering, section/subsection numbers and any references thereto.

Section 10. EFFECTIVE DATE. The City Council hereby finds and declares that pending retaining wall projects and their potential negative impacts in the City cause an emergency which necessitates that this ordinance become effective immediately in order to preserve the public health, safety and welfare. Pursuant to *Matson v. Clark County Board of Commissioners*, 79 Wn. App. 641, 904 P.2d 317 (1995), non-exhaustive underlying facts necessary to support this emergency declaration are included in the "WHEREAS" clauses above, all of which are adopted by reference as findings of fact as if fully set forth herein. This ordinance shall become effective immediately upon passage. The City Clerk is directed to publish a summary of this ordinance at the earliest possible publication date.

APPROVED BY A MAJORITY PLUS ONE of the Lake Forest Park City Council this 22nd day of June, 2023.

APPROVED:

Jeff Johnson
Mayor

ATTEST/AUTHENTICATED:

Matthew McLean
City Clerk

APPROVED AS TO FORM:

Kim Adams Pratt
City Attorney

Introduced:	June 22, 2023
Adopted:	June 22, 2023
Posted:	June 27, 2023
Published:	June 27, 2023
Effective:	June 22, 2023

Retaining Wall Design Standards

June 8, 2023

INTENT

These provisions are intended to mitigate the impact of large, monotonous retaining walls in the right-of-way by requiring architectural and landscaping treatments that reduce the harshness of such walls and reflect the community identity.

INTERPRETATION

The terms used in these standards indicate whether provisions are required or whether they are discretionary, but highly recommended and desirable.

SHALL—The use of the term “shall” (or “shall not” in the negative) represents a requirement of the design to meet the intent of the guideline. This provision must be followed as part of planning, design, and implementation of the project.

SHOULD—The use of the term “should” (or “should not” in the negative) indicates a provision that is strongly encouraged, but that is not an absolute requirement. Compliance with this provision is voluntary, but highly desirable to the community.

PROVISIONS

1. The architectural finish of retaining walls shall depict artistic images having a strong relationship to the Pacific Northwest and the surrounding natural environment including native trees, flora, and fauna of the region. (see examples in Figures A and B)

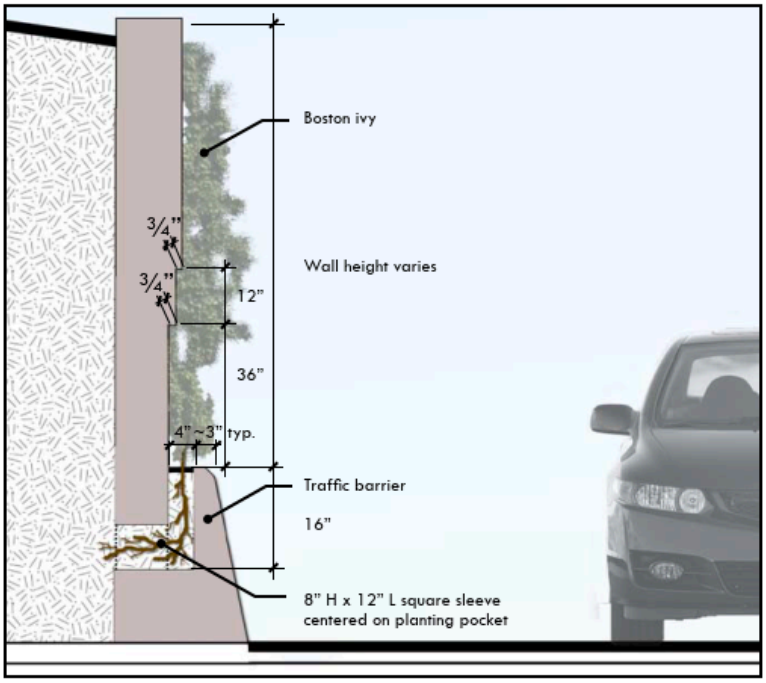
   FIGURE A

FIGURE B

2. In addition to the architectural finish requirements of Provision 1, landscaping and vegetation such as that found in Figures C and D below shall be installed. Trees, shrubs and ground cover planted adjacent to a wall should incorporate plant species native the pacific northwest where possible.
    a. In situations where the retaining wall is behind a sidewalk, the plantings shall be drought tolerant species that do not require permanent irrigation and shall be spaced in a manner similar to the spacing of the plantings shown in Figure C below.
    b. In situations where the retaining wall is directly adjacent to a vehicular travel land or shoulder, wall vegetation shall be installed in a manner similar to Figure D (vine pocket) below. The City's preference is that a permanent irrigation system be installed for the vine pockets. When vine pockets are supported by an irrigation system, they can be spaced up to 10 feet apart on average for the length of the wall segment. If no permanent irrigation system is installed, vine pockets shall be spaced no farther than 6 feet apart on average for the length of the wall segment. Vine pockets should be spaced so that the vines do not substantially obscure the artistic images depicted on the walls.

FIGURE C

FIGURE D



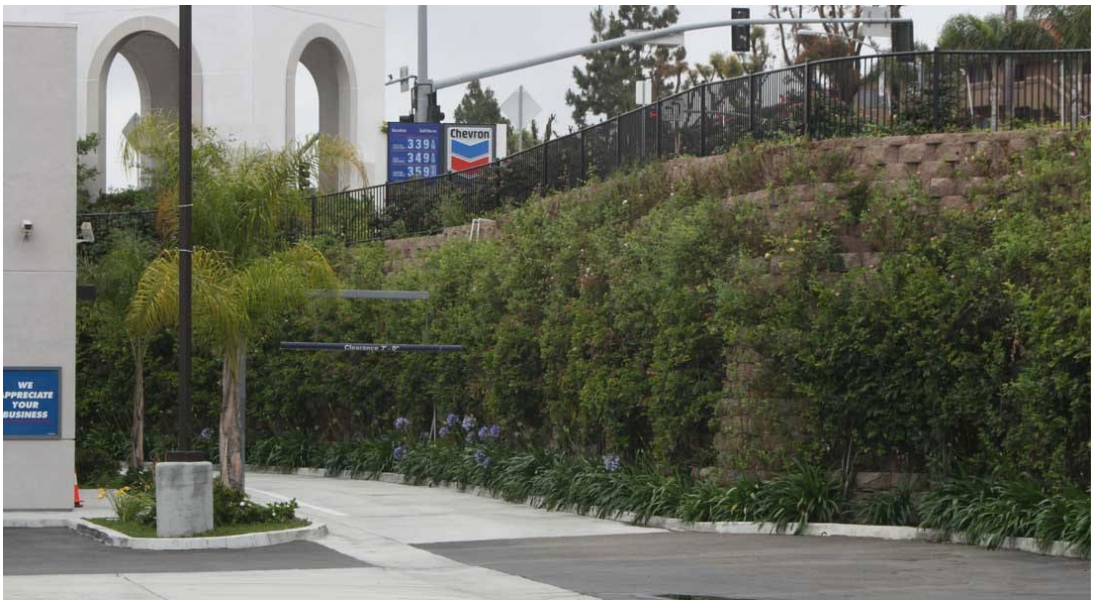
Vine Pocket – Example Section

3. The wall construction type for an independent wall segment may deviate from the requirements of Provisions 1 and 2 if it can be demonstrated to the Public Works Director's satisfaction that vegetation will grow directly from the wall face as shown in Figures E and F and will reach a

coverage of 80% of the wall front surface within 36 months. The plantings should be native and a permanent irrigation system shall be incorporated.

FIGURE E

FIGURE F



MEMORANDUM

DATE: July 7, 2023

TO: Jeffrey Perrigo, PE

FROM: Christian Nichols, PE

SUBJECT: SR 522 BRT – Noise Impact Regulations

The intent of this memo is to provide context regarding the WSDOT Noise Policy and its implementation in the Sound Transit 522 project through Lake Forest Park.

Regulations and Standards

The following sections identify the regulations and standards applicable for this type of project from the SR 522 Bus Rapid Transit (BRT) SEPA Environmental Checklist – Appendix E Noise and Vibration Technical Memo:

Section 4

The assessment of potential noise and vibration impacts from the project was based on the current Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment (September 2018), which this report refers to as the FTA Manual (2018). Other regulatory information and ordinances reviewed and applicable to the project include the Washington Administrative Code (WAC) and codes and ordinances from the cities of Seattle, Shoreline, Lake Forest Park, Kenmore and Bothell.

The FTA criteria recommend the use of the Federal Highway Administration (FHWA) regulations for traffic noise analysis on roadways directly affected by the project. In Washington state this would be the WSDOT regulations. However, traffic noise is only considered if the project includes certain specific elements. Section 4.1.5 discusses in more detail the FHWA and WSDOT regulations and criteria with respect to traffic noise.

Section 4.1

Based on FTA's guidance and a review of the design specifics of the project, the project study team followed the General Assessment as defined in the FTA Manual (2018) for the noise analysis.

Section 4.1.5

WSDOT is responsible for implementing the FHWA regulations in Washington state. Under FHQA and WSDOT regulations, traffic noise studies are performed only for projects meeting one or more of the following criteria, [1]as noted in the 2020 WSDOT Noise Policy below.

2020 WSDOT Noise Policy

Below is the introduction from the WSDOT Noise Policy document further explaining the requirements of the FHWA and how the WSDOT Noise Policy and its implementation complies with those requirements:

The Federal Highway Administration (FHWA) requires state departments of transportation to develop noise policies that will apply to projects within that state. FHWA considers the procedures outlined in the WSDOT Environmental Procedures Manual (EPM) and on the WSDOT Air Quality, Noise, and Energy Program webpage to be an extension and refinement of the requirements set out in 23 CFR 772 for roadway related traffic noise when applied to projects that require FHWA approval in Washington State, including projects administered by local agencies. Fulfillment of the procedures set out in the document assures that the federal noise standard for roadway traffic noise is met.

Project traffic noise is assessed for the criterion below:

Type 1 Project – Qualifying Highway Projects

Type 1 activity criteria apply equally to roadways, bus lanes, re-striping for new lanes…and auxiliary lanes.

A traffic noise analysis is required by law for federally funded projects and required by state policy and procedures for roadway project that incorporate any one of the following elements:

1. Construction of a highway in a new location
2. Physical changes to the horizontal or vertical alignment of an existing highway where there is either:
    a. Moving the existing highway horizontally which halves the distance between the nearest edge of the travelled lane and the closest receptor's outdoor use area, or
    b. Significantly altering the vertical alignment of an existing highway that exposes a new line-of-sight between the receptor and the traffic noise source.
3. Increases the number of through traffic lanes on an existing highway which can include High-Occupancy Vehicle (HOV) lane, High Occupancy Toll (HOT) lane, bus lane, truck

[1] SR 522 (BRT) SEPA Environmental Checklist – App E Noise and Vibration Technical Report

climbing lane or addition of an auxiliary lane of 2,500 feet in length or more except when the auxiliary lane is a turn lane.

4. The addition of a new or substantial alteration of an existing weigh station, rest stop, ride-share lot or toll plaza.

The following discussion from SR 522 Bus Rapid Transit (BRT) SEPA Environmental Checklist – Appendix E Noise and Vibration Technical Report summarizes the determination for the portion of the project within Lake Forest Park based on the criterion identified above.

SEPA – App E Noise and Vibration Technical Report

Within the Noise and Vibration Technical Report, the Lake Forest Park portion of the project was delineated as Segment 2 of the four project segments.

In Segment 2, the proposed widening of SR 522 near NE 165th Street was evaluated to determine whether it would meet FHWA Type 1 requirements for a detailed noise analysis (as described in Section 4.1.4). Five analysis locations were evaluated to determine whether the project's roadway realignment would move the nearest travel lane at least half the distance closer to the exterior use at each of the properties and, therefore, would meet the FHWA and WSDOT criterion requiring a Type 1 noise analysis. As shown in Table 7-6, the proposed widening would not reduce the distance between any noise-sensitive properties and the proposed roadway by at least half the distance between the existing properties and the existing roadway, and the resulting changes in traffic noise would not result in a perceptible change in traffic noise levels. Therefore, because the project fails to meet the Type 1 criterion for modifications to the horizontal alignment in Segment 2, a detailed noise analysis is not required.[2]

Table 7-6 Segment 2: FHWA Type 1 traffic noise analysis

Receiver[1]	Current Distance[2] (ft)	Distance with Project[3] (ft)	Change in Distance[4] (ft)	dB Change	Half Current Distance[5] (ft)	Current Distance Reduced by Half or More
M-1	59	57	2	0.1	29.5	No
M-2	59	55	4	0.3	29.5	No
M-3	55	52	3	0.2	27.5	No
M-4	71	66	5	0.3	35.5	No
M-5	66	62	4	0.3	33	No

[1]Analysis sites are shown in **Figure 7-1**.
[2]Current Distance = Distance between the noise-sensitive property and the existing nearest travel lane.
[3]Distance with Project = Distance between the noise-sensitive property and the proposed nearest travel lane.
[4]Change in Distance = Difference (in feet) between the current distance and the proposed distance with the project.
[5]Half Current Distance = The minimum distance that the proposed nearest travel lane would have to be realigned to meet the FHWA criteria requiring a Type 1 noise analysis.

[2] SR 522 (BRT) SEPA Environmental Checklist – App E Noise and Vibration Technical Report

As the project was determined not to meet the Type 1 criterion and not requiring a noise analysis, there is no additional documentation regarding the noise impacts other than what was included in the SEPA Environmental Checklist. As such no study was conducted regarding the sound reflections from proposed barriers or walls along the project corridor.

Federal Transit Administration (FTA) Evaluation of Reflected Noise from a Single Noise Barrier

The following is from the FTA Field Evaluation of Reflected Noise from a Single Noise Barrier. These sections are intended to offer some context for the change in noise after barrier construction.

Conventional thinking is that an increase less than 3 dB should be just barely perceptible… One hypothesis tested in this research is that the noticeability and annoyance caused by the reflections might be due to other factors… In particular, the higher frequencies are more likely to be reflected (as opposed to diffusely reflected) back across the road. These higher frequencies may stand out more in the total received sound, changing the character of the sound. Given possible existing negative feelings about the highway among residents who did not qualify for a sound wall, a change in the sound character could be sufficient for those residents to experience increased annoyance from the traffic noise.

Another aspect of this phenomenon may be a factor that was noted in a study of a Caltrans project where sound absorption was added to a previously reflective far-side noise barrier along U.S. 101 in San Rafael, California (Menge and Barrett 2011). A resident observed, "It's a significant change. . . . The white noise that you hear is gone. What's missing is the 'shhhhh.'" This comment supports the concept that higher frequency spectral content is enhanced by the barrier reflections, or at least is attenuated less than low-frequency content. The comment also suggests the potential effect of the reflected sound on the overall time history or time signature of the total received sound. When a single vehicle passes by in the absence of a far-wall barrier, the sound that is perceived originates from the vehicle's location. When a reflective far wall is introduced, however, a receptor perceives not only the sound coming directly from the vehicle, but also the sound reflected off the far wall, which comes from a different point along the road. The relationship between the actual (direct) source and the reflected source changes as the vehicle proceeds through the area in front of the barrier. As a result, the time signature of the pass-by is lengthened. When multiple vehicles are present, the character of the normal rise and fall of the sound level of the vehicle pass-by also changes, affecting receptors' ability to pinpoint the direction of the sound. For curved barriers this effect can be further heightened due to multiple reflections.

City of Lake Forest Park Municipal Code

The following language was recently adopted by City Council on June 20, 2023:

> The applicant shall provide documentation of how the retaining wall design satisfies, or exceeds, applicable WSDOT traffic noise policy and procedures. The documentation should include an assessment of noise impacts from the proposed design, including consideration of tree and vegetation removal, reflected noise, and proximity to residences, as well as proposed reflection and absorption techniques such as the use of tilted retaining walls to direct noise upward and variations in the facade to break up low to high frequencies.

Summary

As shown in Appendix E Noise and Vibration Technical Report of the SEPA Environmental Checklist for this SR 522 BRT project a noise analysis was not required because the project did not meet the Type 1 project criterion.

Given a noise analysis was not conducted, there was no analysis or discussion regarding reflective noise for the proposed installation of a retaining wall along SR 522 within Lake Forest Park. The information and assessment included in the SEPA Environmental Checklist appears to comply with the regulations and standards for this project, though there is no discussion of reflective noise impacts.

Guidance for Noise Modeling Using FHWA's Traffic Noise Model (TNM) 2.5 For Projects in Washington State

September 1, 2020

Available online: Traffic Noise Model (TNM) Guidance

Contents

1.0 Introduction

1.1 Background

The Washington State Department of Transportation (WSDOT*) Traffic Noise Policies and Procedures* require use of the most current Federal Highway Administration (FHWA) Traffic Noise Model (TNM) for traffic noise analysis. TNM modeling requires numerous inputs and modeling assumptions so WSDOT developed *"TNM Modeling Guidance"* to promote consistency and facilitate comparisons of modeling results between projects and project alternatives. WSDOT guidance is based on TNM modeling guidelines developed for the Tennessee Department of Transportation and modified to address WSDOT's TNM noise modeling experiences for projects in Washington State as well as the NCHRP 25-34 Supplemental Guidance (2014) and FHWA Best Practices (2015).

The WSDOT guidance shall apply to all projects that must comply with the 2020 WSDOT Noise Policies and Procedures. Deviation from the guidance may be appropriate in some situations. Deviations must be approved by the WSDOT Noise Program and documented by the noise analyst in the noise study report or through supplemental information.

1.2 Audience

The guidance provides supplementary information to analysts with existing TNM modeling experience. It is not intended to serve as a training tool or supersede analyst qualification requirements listed in the WSDOT *Traffic Noise Policies and Procedures*.

Guidance is not provided for all of the TNM input items. The document focuses on areas where WSDOT feels that additional guidance is needed to ensure modeling consistency for projects in Washington State.

1.3 Guidance Updates

WSDOT guidance will be updated periodically to address changes in best practices. Traffic noise modeling guidance provided by FHWA (2015) or NCHRP (2014) may supersede this guidance document. Consult with the WSDOT Noise Program on questions regarding the WSDOT guidance.

**Check WSDOT Noise webpage to confirm that you are using the most current version of the modeling guidance.*

1.4 Additional Resources

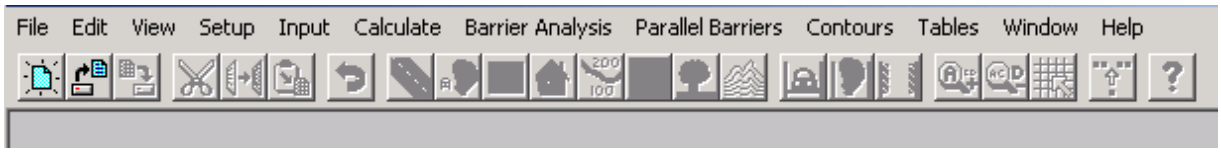
Analysts are encouraged to frequently check the TNM modeling guidelines developed by the United States Department of Transportation's Volpe Center that are provided online:

- Highway Traffic and Construction Noise - Regulation and Guidance

Additional noise modeling best practices are clarified in the National Cooperative Highway Research Program (NCHRP 25-34) report on *Supplemental Guidance on the Application of FHWA's Traffic Noise Model (TNM)* (2014).

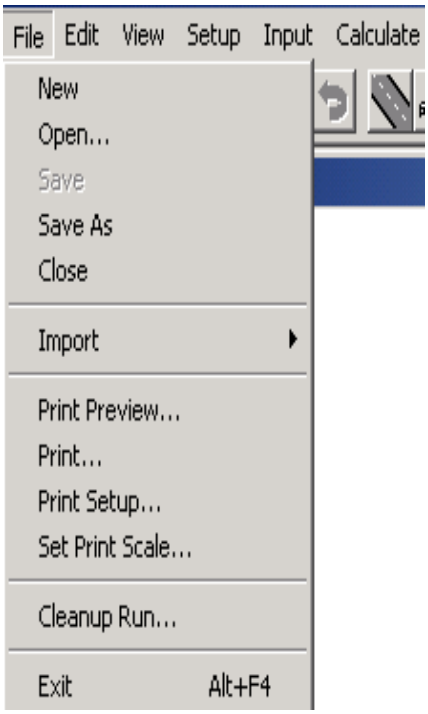
1.5 Organization

The guidance provided in this report follows the TNM 2.5 input toolbar (shown below) from left to right.



Information is provided by way of either "tips" in blue type or "guidance" In red type. Tips are intended to help analysts navigate TNM more efficiently. Guidance provides information regarding how WSDOT expects the TNM modeling to be conducted.

2.0 File



2.1 Open

Tip: TNM will not open a run if the combined path and run name exceed 87 characters in length.

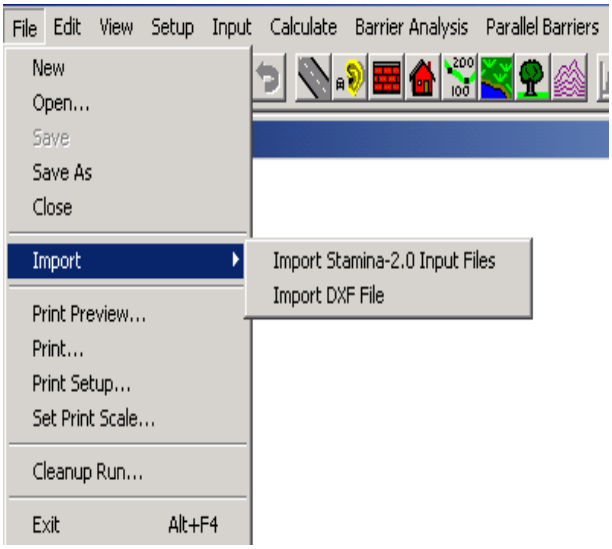
2.2 Import

2.2.1 Import DXF File

2.2.2 DXF Import as Background

TNM DXF Import has some limitations. TNM has an internal CAD package based on AutoCAD 2000. Arcs are brought into TNM as straight lines, sometimes with chords that are too long. TNM does not bring in DXF point objects, and TNM does not have any kind of raster display capability. TNM often has trouble with complex DXF files, newer DXF file formats or DXF files that are larger than about 6,000 KB in size.

Tip: Before importing a DXF file as a background, remove the following: all unneeded layers/levels, references. Separate contours and divide into separate DXF files. If necessary, divide DXF files into separate project quadrants or areas. Try to keep the DXF file size <6,000 KB. Also, DXF files should comply with AutoCAD 2000 or earlier. When using MicroStation to convert a .dgn file to a .dxf file format save the .dxf file as the oldest file format available.



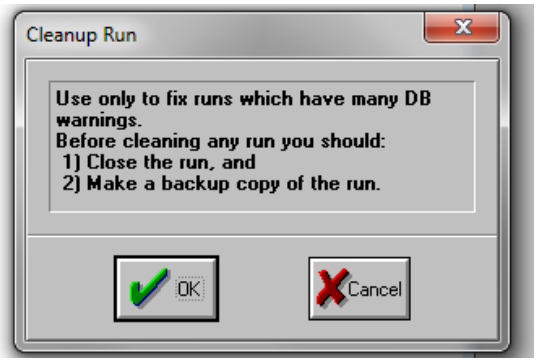
2.2.1.2 DXF Import as Objects

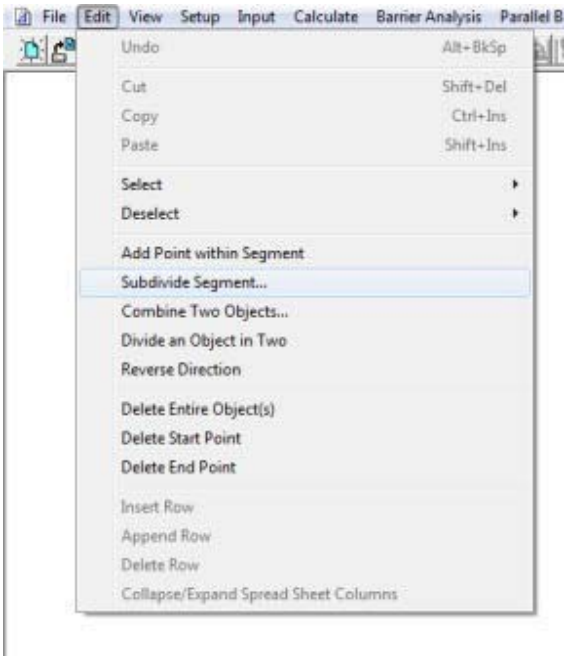
Tip: With the" Import as Objects" method, DXF lines are objects that can be selected, snapped to and converted into TNM objects, such as roadways. TNM may crash, leave out lines, or need the user to take action after every zoom or pan to redraw all of the imported objects. TNM functions more efficiently with smaller DXF files that only use the levels/layers needed.

2.3 Set Print Scale

Tip: "1 inch" (or "1 cm") is the distance between tick marks on the plot axes, not 1-inch (or 1-cm) on the paper. Also, note that Printer Margins do not affect the location of the axes, which are fixed, just the size of the plotted objects.

2.4 Cleanup Run





3.0 Edit

3.1 Subdivide Segment

Tip: TNM allows you to subdivide segments of TNM objects. This can be useful when you need to create smaller noise barrier segments which could allow for fine tuning the optimization of a noise barrier. This feature also shows you the exact length of a specific segment prior to subdivision which can be useful when reviewing final noise wall plan sheets to see how the modeled panels relate to the panels on the plan sheets.

3.2 Divide an Object in Two

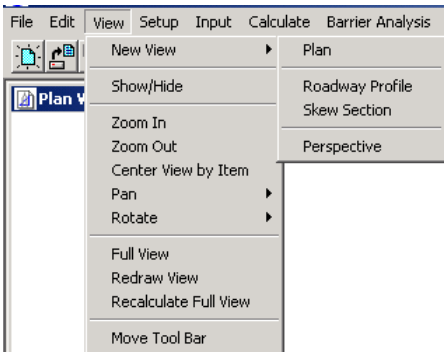
Tip: TNM allows you to divide a TNM object into two separate objects. This can be useful when you need to create a roadway object that has different traffic volumes on each roadway object or dividing a noise barrier into smaller panel segments that can help to optimize the noise wall height/length.

4.0 View

Guidance: Use the Skew and Perspective Views to check your model before calculating results or conducting a barrier analyses. Look for anomalous elevations, receiver/source relationships, etc.

4.1 New View, Roadway Profile

Tip: TNM 2.5 has a bug that draws the arrows as double-headed and shows the name of the last point, which the Plan View does not do.



4.2 New View, Skew Section

Tip: TNM 2.5 will not draw a Skew Section (cross section) or partial cross section if the Plan View is zoomed in too close to the project. Try zooming out from the Plan View and redrawing the cross section.

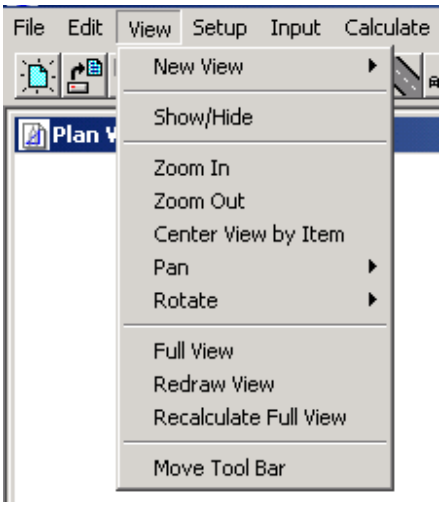
4.3 New View, Perspective

Tip: TNM 2.5 Perspective View will allow you to rotate and view the plan view from

different angles. This can be very helpful in reviewing TNM models to see if any TNM objects have missing or incorrect elevations or if elevations are inconsistent with other objects nearby.

4.4 View, Show/Hide

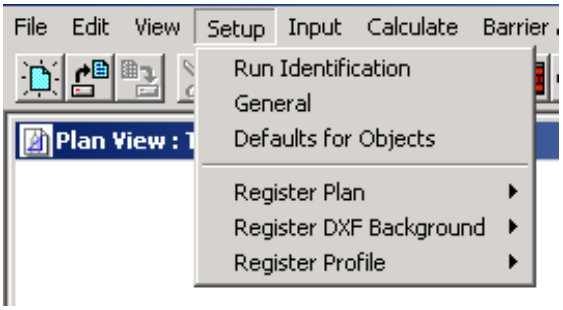
Tip: Uncheck the DXF background under "Show Objects" for quicker screen navigation. Re-check DXF background after locating the desired section of the model. Checking receivers under "Show Text" turns on receiver names in "Plan View," "Perspective," or "Barrier Analysis," which helps to identify specific receivers to troubleshoot issues or verify results.



5.0 Setup

5.1 Run Identification

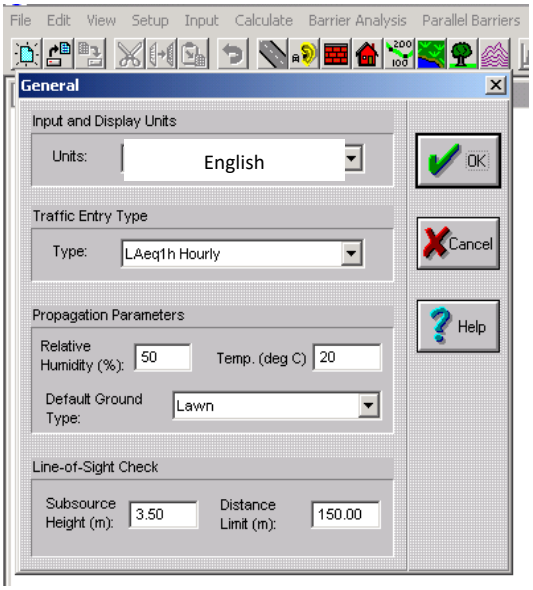
Guidance: Include the title, organization, project/contract and analysis for each run using terms that clearly indicate what the results represent.



5.2 General

Guidance:

- Make sure to make the following changes prior to creating any objects
- Use English modeling units
- Use $L_{Aeq}(1h)$ for traffic entry type
- Do not modify default values for Relative Humidity, Temperature or Line-of-Sight Check unless you feel your project will be challenged in court.
- Otherwise consult with WSDOT. These inputs have minimal effect on outputs.
- Consult WSDOT if using a default ground type other than lawn.
- Ground zones can be used to simulate site-specific conditions instead.



5.3 Defaults for Objects

TNM has built-in default values for every parameter of every input type. The user may set up custom defaults using the "Defaults for Objects" menu command.

For newly created TNM 2.5 runs, the defaults for receivers are 1 for Dwelling Units and 4.92 feet (1.5 meter) for Height Above Ground. The four Levels/Criteria parameters' defaults are 0 (existing sound level), 8 (noise reduction goal), 66 (noise impact criterion), and 10 dB (substantial impact criterion).

Guidance: Model receivers at a height of 4.92 feet above ground. Set the noise reduction goal to 7 dB for noise barrier analyses (reasonableness design goal).

5.4 Register Plan Sheet

Tip: While registering plan sheets, TNM computes the expected coordinates of the third point and shows them in the computed cells of the verification box. If you decide that computed and target coordinates are close enough, click "OK." You will then receive a registration accuracy warning if the computed coordinates are off by more than 0.05 % (5 feet in 10,000 feet). The warning is only a guide and you may feel that a larger difference is acceptable.

5.5 Register Profile

Tip: TNM was intended to allow Z coordinates to be digitized from paper highway profile sheets after using the "register profile" function. However, TNM profile registration currently requires a 1:1 horizontal to vertical scale for profiles. All highway profiles have exaggerated vertical scales and, thus cannot be used for digitizing Z coordinates by TNM.

6.0 Input

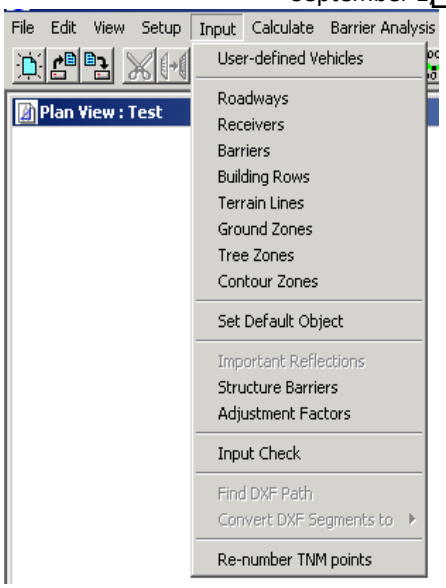
6.1 User-Defined Vehicles

Guidance: User-defined vehicles should not be modeled without consultation with and approval from WSDOT.

6.2 Roadways

6.2.1 Roadway Length

Guidance: Extend roadways beyond all first row receivers by a distance of at least four times the distance from the receiver to the roadway centerline. For example, the TNM roadway would extend 400 feet beyond the last first row receiver located 100 feet from the road centerline.



6.2.2 Number of TNM Roadways

Guidance: Model each direction of traffic for a roadway and model each roadway lane individually when:

- Eight lane or greater facilities, or
- Receptors are located below the elevation of the roadway, or
- There are intervening objects in the sound propagation path that block the line of sight between the roadway and the receiver, or
- It is necessary to consider the super-elevation of the highway,

Provide an overlap of 0.1 to 1.0 feet between travel lanes and between travel lanes and the shoulder. Use a "dummy lane" to model the shoulder of a roadway.

If the roadway is a 4 lane facility or less or if it is a minor arterial with low volumes and low speeds lanes can be grouped into a single road object for each direction of travel. Model additional roadways within the project area that affect noise levels or validation at receivers within the project, including interchange ramps and local roads.

Tip: Your model may not validate using minor roads without using significant terrain features, particularly for elevated receivers or elevated roadways.

6.2.3 Roadway Horizontal Coordinates

Guidance: Locate modeled roadways within ± 3 feet of the actual horizontal alignment of the road/lane.

Tip: Using X, Y and Z coordinates from the design profiles in the TNM roadway input provides a more accurate roadway alignment.

6.2.4 Roadway Elevations

Guidance: When modeling roadways on fill, always include a terrain line along the toe of slope of the roadway fill. When modeling roadways on structure, always include a terrain line at ground level just off the edge of structure. Failure to do this can result in a 2 to 5 dB under prediction by TNM with increased under prediction at receivers at increasing distances.

When available, use current roadway profiles and cross sections to determine roadway elevations. Elevations along the roadway should be less than ± 1-2 feet from the actual roadway elevation. See also section 6.6 for use of terrain lines with roadways.

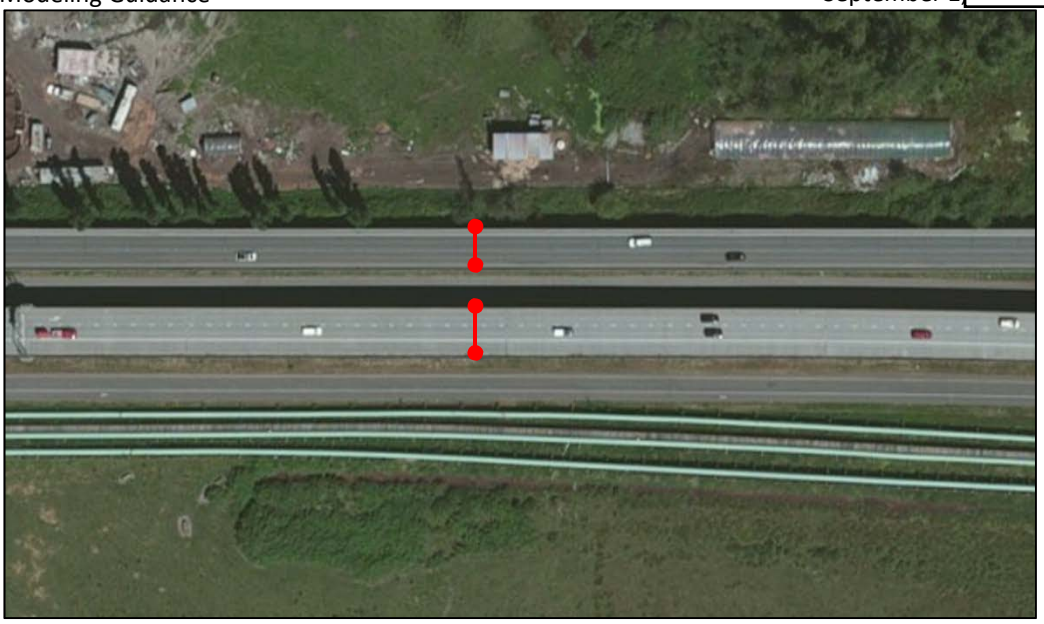
For projects on new alignment where roadway profiles and cross-sections are not available, use and document reasonable assumptions about the future roadway profile.

6.2.5 Roadway Width

Guidance: For highways that are greater than 4 lane facilities model each lane individually using the actual width of each lane and include the outside and inside shoulders in the outside and inside lane widths or use a "dummy lane" for the shoulders (Section 6.2.2). There should be 0.1 to 1.0 foot ofl overlap of the individual modeled roadway lanes.

For highway facilities with low speeds and /or facilities with 4 lanes or less or local arterials you can group two lanes together into one modeled lane in each direction but must include the total roadway widths including travel lanes and shoulders. There should be overlap of 0.1 to 1.0 feet of modeled roadway lanes unless there is an unpaved median.

For example, in the 4 lane divided highway shown below, the upper roadway has two 12-foot travel lanes and a 2-foot outside and 2-foot inside shoulder. The lower road has two 12-foot travel lanes, a 12-foot outside shoulder and a 2-foot inside shoulder for a total pavement width of 28 feet and 38 feet, respectively. Therefore, a minimum grouped pavement width of 28 ft. should be modeled for the upper roadway and 38 feet should be modeled for the lower. The median separation between the two roadways should also be modeled.



6.2.6 Pavement Type

FHWA Policy states:
"TNM defaults to "AVERAGE" for pavement type. The use of any other pavement type must be substantiated and approved by the FHWA...." It is very difficult to forecast pavement surface condition into the future. Therefore, unless definite knowledge is available on the pavement type and condition and its noise generating characteristics, no adjustments should be made for pavement type in the prediction of highway traffic noise levels.

Guidance: Use "Average" pavement type for all TNM runs, unless otherwise justified and approved by WSDOT and FHWA.

6.2.7 Traffic Volumes

Guidance:

- For existing and design year conditions, use peak hour volumes, unless otherwise directed by WSDOT. If forecasted traffic volumes are not available, develop future peak hour volumes based on existing traffic volumes (e.g., 10% of existing AADT) and using a reasonable growth factor provided by the WSDOT Traffic Office.
- For NEPA noise studies, it is not necessary to model non-uniform traffic distributions for multiple-lane highways up to 12 lanes wide.
- Non-uniform traffic distributions can be considered for final noise abatement design studies if all of the following conditions are met:
    - The facility is 8 general-purpose lanes or more;
    - Sound propagation occurs over soft ground;
    - There is a high percentage of heavy trucks (20% or more); and
    - The freeway is either elevated or depressed, such that intervening terrain blocks the line of sight between any number of lanes and receivers of interest.
- 10% of AADT is an acceptable surrogate for peak hour traffic volumes, when peak hour traffic is not available.

- Include buses in the medium truck category. Do not include motorcycles unless they are a significant percent of total volumes.

6.2.8 Traffic Speeds

Guidance: Use existing posted speeds for existing models. For future conditions, use design year posted speeds with the design peak hour volumes, unless otherwise directed by WSDOT.

Tip: The analyst should be aware sound levels change with speed and that propagation, barrier attenuation, ground attenuation and tree zone attenuation are sensitive to speed.

6.2.9 Roadway Flow Control

For TNM roadways with a traffic control device, TNM puts the flow control at the beginning of the roadway and computes accelerating speeds along the roadway's length as a function of vehicle type and roadway grade until the final speeds are attained or the end of the roadway is reached. For the next roadway, TNM begins anew with that roadway's input speeds. In other words, while TNM tracks speeds from one roadway segment to the next, it does not link speeds from one roadway to the next.

At a traffic-control device, TNM reduces vehicle speeds to your "speed constraint," for your "percentage of vehicles affected," and then accelerates this percentage of vehicles away from the device.

Acceleration continues until the vehicles come back up to your input speed, or until they reach the end of that TNM roadway. As vehicles accelerate, their noise emissions increase as compared to cruising vehicles at the same speed. The speed constraint is generally zero for all devices except on-ramp start points, where vehicles sometimes enter the on-ramp without completely stopping first.

Guidance: A reasonable start speed (speed constraint) for such on- ramps is 16 km/hr (10 mph).

If vehicles will continue to accelerate past the endpoint of the TNM traffic control roadway, the road must be extended to allow the vehicles to continue accelerating. For example, if heavy truck acceleration will continue past the physical merge point of an on-ramp with the mainline, the on-ramp should be extended past this physical merge point, parallel to the mainline, so that heavy trucks will approach the input speed before the end of the on-ramp roadway. Use Figure 45 from Appendix B of the TNM Technical Manual to compute this length.

The need to extend a ramp roadway to its full acceleration length depends on the number of trucks on the ramp compared to the mainline and the proximity of receivers.

Guidance: Model on-ramps and traffic control devices, including signals, stop signs and toll booths, and roundabouts using appropriate flow control as necessary. Extend the traffic-control roadway where heavy

truck acceleration is anticipated beyond the merge point with the mainline. If no flow control is used for on-/off-ramps these should be modeled with a speed of 45 mph or the posted advisory speed limit along their entire length.

6.2.10 Roundabouts

The key elements of modeling a roundabout are entry, circulation and exit speeds. Roundabouts are designed using yield signs instead of traffic signals for entry into the roundabout. Roundabouts are designed to move vehicles smoothly into and through or around before exiting and then accelerating away. Thus, in the TNM model the acceleration roadway should start after the vehicles have exited the roundabout.

Approach leg

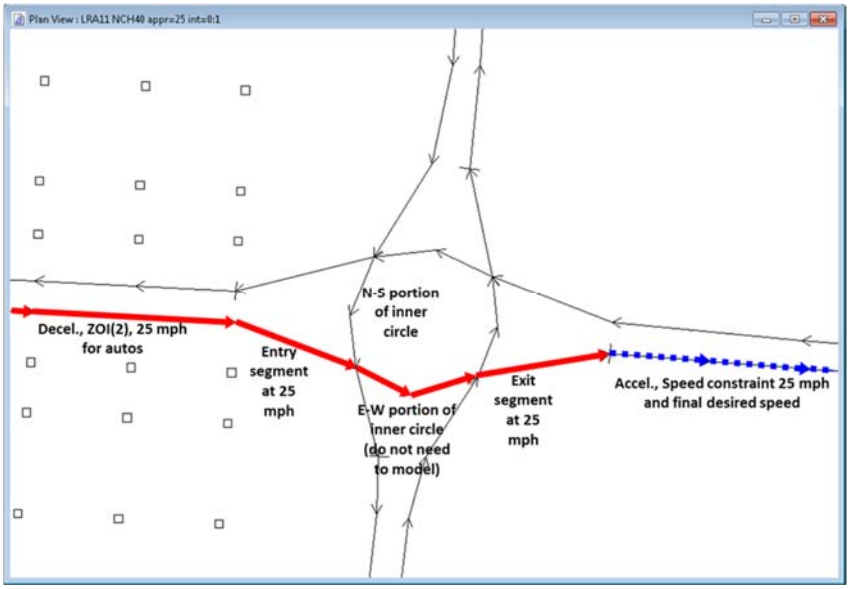
For a one lane inner circulatory road the approach to the roundabout may be modeled by a constant speed equal to the posted speed up to the beginning of the splitter island/crosswalk. Then, one 25-mph segment would be used to represent the entry leg, ending at the entry point to the circulatory road.

Inner circulatory road

The traffic on the inner circulatory road does not need to be modeled. The noise from the accelerating traffic departing the roundabout will dominate the overall sound levels.

Departure leg

For the departure leg, a one-segment constant-speed roadway would be modeled at a speed of 25 mph. It would start at the exit point from the inner circulatory road and end at the end of the reverse curve typically at the end of the splitter island/crosswalk. Then, a flow control acceleration roadway would be modeled from the point downstream to the end of the modeled site. The roadway would have a Speed Constraint of 25 mph and 100% Vehicles Affected with the posted or operating speed as final desired speed.



A roundabout with a two-lane inner circulatory road may be modeled essentially the same way as described for the one-lane inner circulatory road.

Because of the slightly higher speed typical of the two-lane case – on the order of 20-25 mph instead of 15-20 mph on the smaller diameter one-lane road and the greater circumference – there might be a desire to model the inner circulatory road, especially if receivers are immediately adjacent. However, if the inner roads' entry and approach legs are modeled for each leg, then it is unlikely that the inner road itself needs to be modeled, especially because of the noise of vehicles accelerating away from the roundabout

6.2.11 Additional Roadway Modeling Guidance

Guidance: Use stationing to name roadway points if possible. Alternatively you could name all roadway points so the direction and milepost or stationing are clear. For example, a point on eastbound I-90 at STA 335+00 could be named I90EB335.

If the project does not yet have stationing, roadway point names should reflect the direction of travel, differentiate one roadway point from another, and give some indication of where along the project the roadway point is located.

Tip: Exercise caution when modeling super-elevated roadways, since super-elevation can significantly affect predicted sound levels and the design of noise barriers. One method might be to model each lane separately with each lane having a slightly different elevation to represent the superelevation.

6.3 Receivers

Model receivers according to WSDOT's 2020 Noise Policies and Procedures available online: (WSDOT Noise Policy (2020))

Guidance: Include all impacted receivers within the traffic noise study area. The traffic noise study area will extend beyond the project limits the same distance as it extends out from the edge of the nearest travelled lane when the project limit ends within a residential community. If the project limits end within a commercial zone the noise study area will terminate at the project limit.

6.3.1 Dwelling Units and Sound Level Criteria

Guidance: The number of Dwelling Units/Residential Equivalents in the models must be consistent with the number of Dwelling Units/Residential Equivalents within the final discipline report.

Tip: Changing receiver Dwelling Units or any of the Sound Level Criteria values in TNM 2.5 after calculation incorrectly invalidates calculated results.

6.3.2 Adjustment Factors

Adjustment factors were originally designed to convert shielding

factors (such as building rows, terrain features and ground zones) in Stamina into adjustment factors in TNM. However, TNM 2.5 can include elements such as building rows, terrain lines and ground zones.

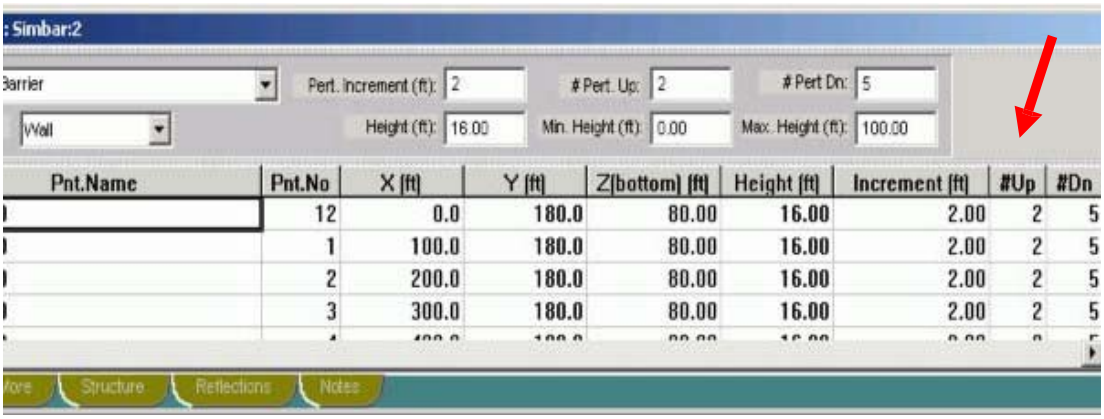
Guidance: Do not use adjustment factors, unless approved by WSDOT. Use shielding elements such as building rows, terrain lines and ground zones in TNM instead.

6.4 Barriers

Two types of proposed barriers can be modeled in TNM: Barrier and Berm. Barrier attenuation is *not* in the "no barrier" LAeq1h, so the "no barrier" and "with barrier" LAeq1h are different.

1. ***Perturb-able height barrier:*** Set "# Up," "# Down," and "Increment" to non-zero values except for private or existing walls with fixed heights. For existing noise barriers with impacts in the future build scenario set the height at the existing height and the number of down perturbations to zero. Set the increment to two feet and the number of up perturbations to 10 or less. This will allow the analyst to evaluate whether raising the height of the existing barrier can reduce noise levels behind the wall to below impact and then determine if that extended height barrier is feasible and reasonable to build.

2. ***Fixed height barrier*** (noise barrier with a single height or existing/planned safety-barrier next to roadway): Leave "# Up," "# Down" at zero, but make "Increment" size non-zero.



Guidance: Follow WSDOT standard specs for stepping the modeled noise barrier (no more than 2 feet increment steps, sections 6-12.3(5) and 6-12.3(6)) and/or the Urban Design Criteria, where appropriate.

Avoid the 'saw toothed' effect of the top of wall during barrier optimization caused by u sing too few modeled receivers behind the noise wall which tends to result in higher noise wall panels at the modeled receivers and shorter panels in-between modeled receivers
The wall should remain a relatively constant height between receivers except during substantial changes in terrain and modeling receivers at every home or at a minimum every other home can minimize this effect. Be sure to evaluate if receivers can see over the top of the wall in front of them and to the left/right and recommend using the line-of-sight check feature in TNM if the top of wall elevation is close to the line of sight from receiver to traffic.

Tip: For modeled barriers with long panel widths over steeply changing grade, it may be advantageous to divide the panels into smaller panel lengths (e.g., approximately 12 foot lengths) and step them according to standard specs or to the Urban Design Criteria for stepping requirements in a particular corridor.

According to FHWA Supplemental TNM Guidance TNM has a large L_{eq} sensitivity whenever sound paths just graze across diffracting edges such as terrain lines and the outer edge of roadways.

Guidance: When conducting a Barrier Analysis in TNM do not include other noise walls or terrain lines in the barrier analysis unless the second noise wall is an adjacent existing noise barrier or is being analyzed as part of a noise barrier 'system'.

Types of barriers that exist or will be constructed as part of the project but not as noise barriers might include:

- Median or shoulder safety barriers
- Masonry block walls/fences
- Large buildings
- Parapet walls
- Crash barriers

Model these objects as fixed height barriers for validation and "no-build" conditions, where appropriate. Existing barrier attenuation *is* included in the "no barrier" L_{Aeq}(1h) column. If no other barriers are present, Noise Reduction would be zero in the Results table. Set all perturbation values to zero for these fixed height barrier types.

6.4.1 Optimizing Noise Barriers

Consider using the FHWA Noise Barrier Optimization Tool (NBOT). Otherwise, noise barriers should be evaluated to determine if they are highly cost effective according to our 2020 Noise Policies and Procedures and/or to determine which wall height will benefit the most noise sensitive receivers while still meeting the reasonableness criteria. If the noise wall cost and reasonableness allowance are relatively close optimization can sometimes help to meet the reasonableness criteria.

6.4.2 Median Barriers

Guidance: For receptors within 500 feet of the center of the nearest travel lane and below the elevation of the highway, model the median barrier. For receptors beyond 500 feet and below the elevation of the highway model the median barrier and use the appropriate reflected barrier technique in the TNM Supplemental Guidance (2014, Appendix D). For receptors that are between 50 and 500 feet of the highway and less than 6 feet above the highway elevation model the median barrier and if more than 6 feet consider reflections

Distance From Middle of Near Travel Lane	Height of Receptor With Respect to Roadway	
	Receptor Below to 6 Feet Above Roadway	Receptor More Than 6 Feet Above Roadway
50	Model Median Barrier and Ignore Reflections	Model Median Barrier and Consider Reflections
100		
200		
500		
1000	Model Median Barrier and Consider Reflections	

6.4.3 Building Shielding

Guidance: If the building is large (e.g., warehouses, large retail buildings and multifamily buildings), located between a receiver and a roadway and is not incorporated into a building row (Section 6.5), model the building as a fixed height barrier with a minimum of three sides which are facing the source and zero perturbations.

6.4.4 Parapet Walls

Guidance: If a roadway on an overpass is shielded by an existing parapet wall, model the parapet wall to include shielding in the validation model if it is required to validate the model. If it is included in the validation model also include the parapet wall in the existing and no-build models. Include in the build model unless it is removed as part of the project. Model the parapet wall as a fixed height wall with zero perturbations.

6.4.5 Crash Barriers

Guidance: If a roadway, or roadway on an overpass, includes an existing crash barrier include it in the validation model if it is required to validate the model. If included in the validation model also include the crash barrier in the existing and no-build model and the build alternative if it is not removed by the project. If a crash barrier is planned to be an element of the project design, model the crash barrier in the "build" alternative model. Model the crash barrier as a fixed height wall with zero perturbations.

6.4.6 Noise Barrier Points

Guidance: Noise barrier points should generally be located near the right-of-way line and line up with nearby modeled roadway points on the adjacent roadway to ensure consistency of vertical geometry between the roadway and barrier.

Barrier points should be modeled at least every 200 feet for situations where the barrier will be located near the edge of pavement (EOP) and/or where the roadway is at-grade or on fill. Where the barrier will be located near the top of cut, model barrier points at least every 100 feet and at smaller intervals, where appropriate, such as where there are significant changes in bottom of wall elevations.

For barrier point names, indicate the direction and station of the adjacent roadway. For example, a barrier point at the EOP of eastbound I-90 at STA

335+00 could be called EB335. If barrier points are not located at a whole station, then expand the barrier point name to identify the location of the barrier point. For example, a barrier point at the EOP of eastbound I-90 at STA 335+30 could be called EB335.3.

If project stationing has not yet been developed, then develop a generic barrier point labeling system.

6.4.7 Berms

To create a berm within the TNM model using terrain lines the toe of the berm (bottom of slope) cannot overlap a roadway or receiver or you will cause an "invalid results" modeling error, instead of sound levels, in the Sound Level Results table after calculations. The top width of the berm must be entered into the program as zero.

Guidance: To simplify modeling, model berms as noise walls with the noise wall aligned along the centerline of the berm and with the assumption that there is sufficient right-of-way for the berm. If a berm is modeled using terrain lines only place one terrain line representing the top of the berm and one representing each toe of slope of the berm and insure that the distance between terrain lines is more than four feet in all areas.

The wall-on-berm feature in TNM does not work properly. Only use a wall to model a wall-on-berm for proposed abatement. If modeling an existing wall-on-berm combination, use the base of the wall to define the top of the berm and terrain lines to define the toes of the berm.

Guidance: The feasibility of berms highly depends on available right-of-way, current and proposed slopes, and drainage issues. Consult with WSDOT before modeling berms as noise abatement.

6.4.8 Barrier Unit Costs

Guidance: WSDOT provides unit costs for all noise barrier analyses in the WSDOT Noise Policies and Procedures, (2020), Exhibit 11, available online: WSDOT Noise Policy (2020)

Tip: Barrier unit costs on the "More" tab of the "Barrier" input dialog box apply to all segments of the barrier. If barrier costs vary on different sections of the barrier (e.g., barrier on a bridge), these costs can be computed outside of TNM.

6.4.9 Barrier Segments on Structure

WSDOT does not typically model noise barriers on structure because it is understood that the cost to construct a noise barrier on an existing structure can be very expensive and the noise barrier will not be reasonable. However, if a noise wall on structure is required for the project, follow the following procedure.

Structure barrier segments may shield both *structure* roadway segments and *non-structure* roadway segments.

Guidance: All roadways on structure that are potentially shielded by the barrier should be included in the shielded list.

Tip: The graphical method of assigning shielded roadway segments to a structure barrier segment is the most straightforward input method.

Modifying roadway segments in the shielded list for structure barriers can corrupt the entire shielded list. WSDOT recommends developing the shielded lists late in the TNM run process and checking it thoroughly before running TNM.

6.5 Building Rows

Attenuation from a building row is much less than from a noise barrier of the same height and length. In the case of multiple building rows, TNM first calculates the most effective building row attenuation at a frequency of 630 Hz. Exact values are calculated only for the building row with the highest attenuation at 630 Hz. For all remaining rows that block the line-of-sight, attenuation of 1.5 dB is assigned to each 1/3 octave band, regardless of building height and gap. As a result, TNM may over-predict sound levels back into a community, particularly where there is a high density of intervening structures. Building rows also define terrain. Therefore, validation of receivers back into a community to the point where noise impacts no longer occur is important.

Guidance: Model all intervening building rows between a source and a receiver, but recognize that TNM may over-predict sound levels at locations two or more rows back into a community. Validate the noise model with noise measurements two or more rows back into a community to reduce potential for over-prediction.

6.5.1 Average Building Height

Guidance: ± 2 m (6 feet) is precise enough for average height when buildings are within a single story of one another and the road is not on fill, where the building height is critical.

6.5.2 Building Percentage

It is not necessary that building spacing be highly regular. The analyst does not have to be overly precise in this parameter.

Guidance: Model all intervening building rows with a building percentage between 20% and 80% to an accuracy of ±10%. Generally, older neighborhoods should use a building percentage of 20% and newer neighborhoods/condos should use a building percentage of 80%. Model the building row as a fixed-height barrier when building percentage exceeds 80%.

6.6 Terrain Lines

6.6.1 General Modeling

The TNM web site FAQ notes: *"TNM has shown some weaknesses in the diffraction algorithms, which would be invoked when computing the effects of terrain lines; thus, it is recommended that terrain lines only be used to locate substantial changes (± 3 feet) in terrain elevation." Terrain lines*

should be used on elevated roadways at the toe of slope adjacent to the roadway and for roadways on structure placed at the ground just off the edge of the structure and never be located less than four (4) feet apart. Otherwise, terrain lines should only be used when necessary to validate the noise model.

The August 2002 TNM Validation Report, in referring to a particular study site, states that: *"...undulations of this size (+5 to -20 feet) should not be ignored."*

Then in the Conclusions, it states that you should model undulations of "± 5 feet or more."

Guidance: Any terrain lines used during validation shall be included in all modeled conditions/alternatives unless altered in the Build alternative. Do not model terrain lines closer than 4 feet apart and only use terrain lines when necessary for validation. Study ground contours to determine where terrain changes break the line-of-sight between a source and a receiver and model terrain lines that break line-of-sight.

Tip: Receivers do not define the terrain, except for themselves.

Use caution when placing terrain lines close to noise barriers as the diffraction caused by the combination of the barrier and terrain line could lead to erroneous results.

Guidance: Do not place terrain lines closer than 4 feet from a noise barrier.

6.7 Ground Zones

6.7.1 General Ground Zone Modeling

The effective flow resistivity values are similar for loose soil, lawn, and field grass.

Guidance: Only model pavement, water, or hard soil ground zones, not tree zones. Do not use custom effective flow resistivity values

TNM can have problems handling multiple diffraction points when a grassy median is modeled between roadways. In cases where the grass median is < 10 feet (3 m) wide, increase pavement widths so the pavements overlap slightly.

Guidance: When a grass median is less than 10 feet wide, increase the modeled widths of the adjacent roadways to slightly overlap.
Use a ground zone to model the median if a median is ≥ 10 feet and the median is a ground type other than the default. For ground zone medians, avoid overlapping or matching edges with the adjacent roadways.

6.8 Tree Zones

Per FHWA guidance, only use tree zones when vegetation meets the following condition:

"...sufficiently dense to completely block the view along the propagation path;i.e., it is

impossible to see a short distance through the foliage."

Tree zones use the default ground type. To define a new ground type for thetree zone, you must create a ground zone. FHWA recommends the following forground zones within tree zones:

"If you want a ground type other than the default, you must use a ground zone to define the type of ground inside tree zones. If you are using a tree zone, surround the tree zone with a ground zone of loose soil to account for the ground effects of that tree zone."

Guidance: Only model tree zones where trees are coniferous and density is sufficient to block the view from the receiver to the source. Do not model tree zones with depths less than 66 feet and predominantly deciduous trees.

6.9 Contour Zones

TNM has difficulties modeling noise contours and FHWA policy states the following on contours: *"TNM allows the user to model contour zones. However, calculating noise contours with TNM greatly increases run time. It is strongly recommended that this feature of TNM only be utilized for land-use planning activities and/or performing screening analyses to determine the number of impacted receivers in an area."*

Guidance: Do not produce TNM generated contours on WSDOT projects, unless authorized by WSDOT.

6.11 Input Check

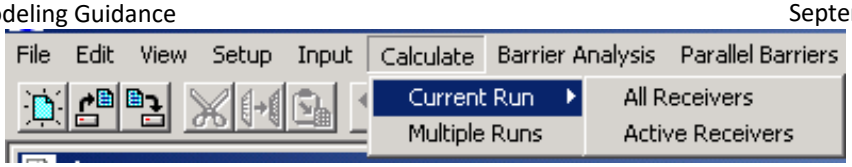
Input Check finds some, but not all, input errors in TNM. For example, Input Check will not find incorrect elevations for receivers, barriers, building rows, terrain lines, or tree zones and will only find incorrect roadway elevations when they cause the road to have a grade above a pre-defined limit. Errors not found in the input check are sometimes easily detected in the various TNM views or input tables during the normal review process.

Guidance: Review input tables and views before calculating.

TNM will give Input Check errors for vehicle types with speed but no volume, or volume but no speed. However, if none of the roadways in a TNM 2.5 run have traffic volumes or speeds, TNM 2.5 may give a "log10: argument singularity error" during the calculation phase, and not calculate further. This error only occurs when all TNM roadways are without traffic. If just one TNM roadway segment contains a single vehicle, and the remaining roadways have no traffic, TNM 2.5 will calculate results for this single vehicle. If some roadways have traffic and some roadways have no traffic, sound level results may look plausible but will be incorrect.

Guidance: Review traffic table before calculating.

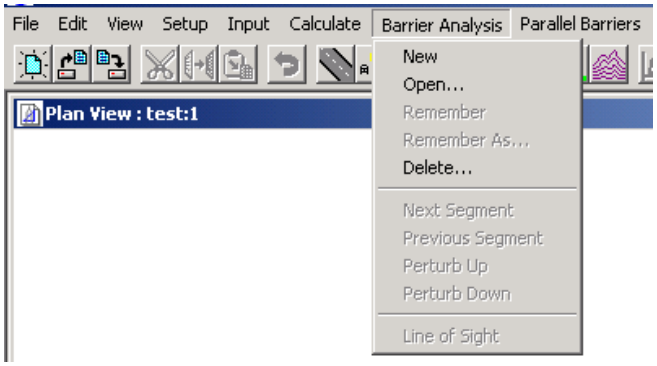
7.0 Calculate



TNM indicates the progress of the calculations in a Calculate Sound Levels window. The time "to go" feature is not particularly accurate.

7.1 Current Run, Active Receivers

Tip: Calculating newly "active" receivers invalidates previous active receiver results. If you run TNM with some receivers "active", then add more as "active", TNM will invalidate results for previously calculated receivers when you try to calculate for newly activated receivers. Exception: if you calculate "All" receivers using the "Calculate," "Current Run"," All Receivers" command after calculating only some receivers using the "Calculate," "Current Run"," Active Receivers" command. In this case, TNM will generate a message box asking if you want to re-calculate 1) already-calculated receivers or if 2) you want to skip re-calculating those receivers with results.



8.0 Barrier Analysis

8.1 New

Tip: At least one barrier and one receiver must be selected to create a Barrier Analysis design. A Barrier Analysis design may also contain roadways and building rows. Include any adjacent existing noise barriers in your new barrier analysis but do not include other noise walls in your barrier analysis unless you are analyzing them as a 'system'.

8.2 Remember and Remember As…

"Remember" saves a barrier design to its current name specified in the last Remember As command. (If no current design name, Remember saves design as "unsaved.")

"Remember As" means "create a new design name for upcoming changes." That is, Remember Next Design As.

"Remember As" also saves the current design under the current name while creating a new name for an upcoming design. Unlike "Save As" in word processors and spreadsheets, "Remember As" does not save any edits just completed under the name about to be entered.

Tip: When starting a Barrier Analysis, use "Remember As" and provide a design name.

After the first design, use Remember to save the design to that name. Then, use "Remember As" to create a new design name for upcoming changes. Use "Remember As" conservatively so as not to create too many different barrier design names which can become confusing. Name barrier designs clearly and delete any barrier designs that will not move forward.

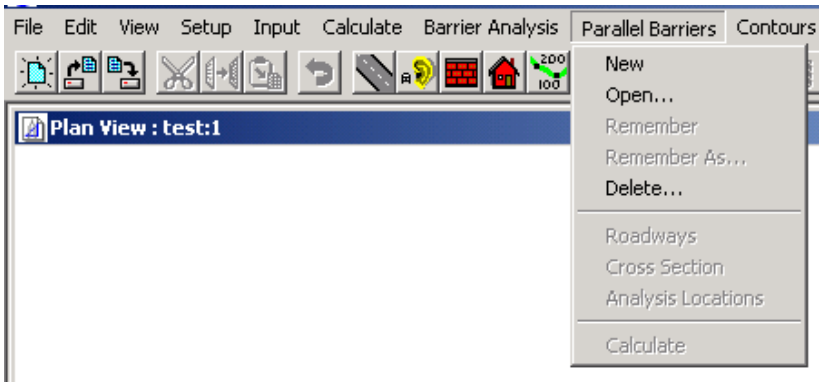
8.3 Line of Sight Check

When a barrier is present, the TNM "Line-of-Sight" function checks for a line-of- sight between a receiver and a source. Sources can include the pavement (tire noise), engine and elevated truck stacks. Check the source height and the distance from the receiver to the farthest point on the roadway and specify in the "Setup," "General" dialog box. These terms, sub-source height and distance limit, default to 11.48 feet and 492.13 feet, respectively, and should not be adjusted. The source height of 11.5 feet is based on a Caltrans study of 1,000 trucks in 1979.

The 50th percentile of the stack height data was 11.5 feet. A recent NCHRP study on the contribution of heavy truck stacks indicates that TNM may be over predicting the contribution of the stack noise (NCHRP, 2017).

Guidance: Perform a line-of-sight check on noise barriers. This is especially important to prevent construction of barrier panels that are too low for barriers with varying panel heights and/or with receivers on elevated slopes behind a barrier. Additionally, even when noise levels are below impact, residents may perceive a barrier as being less effective when there is a line-of-sight from receivers to truck stacks. However, taller walls to block the truck stacks may not meet the reasonableness criteria so a balance must be found.

9.0 Parallel Barriers



9.1 FHWA Policy on Parallel Barriers

FHWA policy on parallel barriers states the following: *"TNM allows the user to model parallel barriers. Studies have suggested that to avoid a reduction in the performance of parallel reflective noise barriers, the width-to-height ratio of the roadway section to the barriers should be at least 10:1. The width is the distance between the barriers, and the height is the average height of the barriers above the roadway. This means, that two parallel barriers 3 meters tall should be at least 30 meters apart. Accordingly, it is recommended that parallel plane surfaces not be modeled with TNM unless the width-to-height ratio of the surfaces is less that 10:1 (note that modeling parallel plane surfaces greatly increases TNM run time)."*

The actual increase in sound level due to reflections varies with receiver horizontal and vertical position, intervening shielding, and source location. Reflection problems due to parallel barriers can occur in cross-sections with a width-to-height ratio greater than 10:1.

Additionally, the effect of reflections can vary significantly from location to location in the same area. The site geometry should be reviewed to ensure that all potentially affected areas are identified and assessed. This may require modeling additional TNM receivers.

Guidance: Use the TNM parallel barrier module to assess potential noise barrier degradation from reflections. Model in the TNM parallel barrier module and verify results in the field.

9.2 General Parallel Barrier Modeling

"Open," "Remember," "Remember As," and "Delete" work the same for "Parallel Barrier" designs and "Barrier Analysis" designs.

This module cannot be used for single wall reflections, and each wall must be at least 6 feet tall.

When a parallel barrier section contains two separate vertical surfaces offset on the same side of a road (e.g., a retaining wall near the edge-of-pavement and a barrier at the right-of-way), TNM completely ignores the lower inside surface (e.g., retaining wall), leading to erroneous results.

Changes to "Parallel Barrier" input data after calculations do not invalidate parallel barrier results. Instead, the program states that the current data is valid after you have made a change to the parallel barrier input data and try to recalculate the parallel barrier results.

The TNM User's Guide suggests the use the calculated increases as "Adjustment Factors" in the main part of TNM for those receivers represented by the "Analysis Locations."

Guidance: Do not enter the parallel barrier increases as adjustment factors. Instead, use the Parallel Barriers module as a design module, where you may do one of the following:

1. *Analyze the effects of sound absorbing materials on barrier faces by changing the NRC of the Parallel Cross Section input dialog box*
2. *Analyze tilting the walls outward by adjusting the horizontal values for the wall tops (either graphically or in the "Parallel Cross Section" input dialog box).*

9.3 Roadways

If more than half of the lowest sub-source circle is below the road line, the lower source will not be computed properly.

Guidance: Make sure that the position of new Parallel Barrier roadways are slightly above the road surface.

9.4 Cross Section

The initial "cut" heights of parallel barriers are based on Input Heights entered into the Barrier input dialog box. If a parallel barrier analysis is completed for other heights, then adjust input heights graphically or in the Parallel Cross Section input dialog box. It is incorrect to assume that the calculated multiple reflections sound level increase will be the same for two different sets of barrier heights.

9.5 Analysis Locations

After the Parallel Barriers calculations are completed, the Parallel Analysis Locations table is automatically updated to show the computed increases in L_{Aeq}(1h). For TNM receivers being represented by Parallel Barrier Analysis Locations, these values are increases to the "With Barrier" L_{Aeq}(1h) values shown in the main Sound Level Results table. However, TNM does not automatically add these increases to those "With Barrier" levels.

Tip: Analysis location Z values are for the ear height, not the ground height.

Guidance: Beware of computed increases in LAeq1h of 0.0; sometimes, when the receiver Z is below the roadway Z, the result may be incorrectly calculated as zero.

10.0 Tables

10.1 Input Tables

Tip: The default ground type is not shown on any of the input tables. Future versions of TNM will have default ground type on the ground zone input table.

10.2 Barrier Design

The following tables may be helpful in the barrier design process:

1. "Sound Level Results" table
2. "Diagnosis by Barrier Segment" table
3. "Barrier Descriptions" table tracks total barrier cost
4. "Barrier Segment Descriptions" table helps track segment heights

Setting up windows to easily view these tables can be tricky. It helps to first check the "Barrier Design" lines to ensure the tables link to the intended design case, then "Hide" header rows of the tables.

The following issues need to be fixed in TNM 2.5 for the new Barrier Design Table:

1. The table takes up the full screen width with "Receiver" name and "Partial LAeq1h" on opposite sides; and "Calculated LAeq1h" and "Noise Reduction" in middle.
2. The full width of the table is not visible when the vertical scroll bar is on.
3. It is cumbersome to switch versions of the table back and forth to show/hide the "Important Segments" during barrier design.

10.3 Hide Rows

Tip: The "Tables," "Hide Rows" command works in TNM 2.5. However, all rows become unhidden when a table is printed.

10. 4 Print Tables

Tip: In TNM 2.5, when using the "Tables"," Print Tables" dialog box, the results tables are only printed for the "INPUT HEIGHTS" case, not the currently active barrier design. Open the table you want to print, select the window containing the table, click on "File," then "Print."

Title 23 —Highways
Chapter I —Federal Highway Administration, Department of Transportation
Subchapter H —Right-of-Way and Environment

PART 772—PROCEDURES FOR ABATEMENT OF HIGHWAY TRAFFIC NOISE AND CONSTRUCTION NOISE

Authority: 23 U.S.C. 109(h) and (i); 42 U.S.C. 4331, 4332; sec. 339(b), Pub. L. 104–59, 109 Stat. 568, 605; 49 CFR 1.48(b).

Source: 75 FR 39834, July 13, 2010, unless otherwise noted.

§ 772.1 Purpose.

To provide procedures for noise studies and noise abatement measures to help protect the public's health, welfare and livability, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to title 23 U.S.C.

§ 772.3 Noise standards.

The highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials in this regulation constitute the noise standards mandated by 23 U.S.C. 109(1). All highway projects which are developed in conformance with this regulation shall be deemed to be in accordance with the FHWA noise standards.

§ 772.5 Definitions.

Benefited receptor. The recipient of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dB(A), but not to exceed the highway agency's reasonableness design goal.

Common Noise Environment. A group of receptors within the same Activity Category in Table 1 that are exposed to similar noise sources and levels; traffic volumes, traffic mix, and speed; and topographic features. Generally, common noise environments occur between two secondary noise sources, such as interchanges, intersections, cross-roads.

Date of public knowledge. The date of approval of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in 23 CFR part 771.

Design year. The future year used to estimate the probable traffic volume for which a highway is designed.

Existing noise levels. The worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area.

Feasibility. The combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure.

Impacted Receptor. The recipient that has a traffic noise impact.

L10. The sound level that is exceeded 10 percent of the time (the 90th percentile) for the period under consideration, with L10(h) being the hourly value of L10.

Leq. The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with Leq(h) being the hourly value of Leq.

Multifamily dwelling. A residential structure containing more than one residence. Each residence in a multifamily dwelling shall be counted as one receptor when determining impacted and benefited receptors.

Noise barrier. A physical obstruction that is constructed between the highway noise source and the noise sensitive receptor(s) that lowers the noise level, including stand alone noise walls, noise berms (earth or other material), and combination berm/wall systems.

Noise reduction design goal. The optimum desired dB(A) noise reduction determined from calculating the difference between future build noise levels with abatement, to future build noise levels without abatement. The noise reduction design goal shall be at least 7 dB(A), but not more than 10 dB(A).

Permitted. A definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of a building permit.

Property owner. An individual or group of individuals that holds a title, deed, or other legal documentation of ownership of a property or a residence.

Reasonableness. The combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.

Receptor. A discrete or representative location of a noise sensitive area(s), for any of the land uses listed in Table 1.

Residence. A dwelling unit. Either a single family residence or each dwelling unit in a multifamily dwelling.

Statement of likelihood. A statement provided in the environmental clearance document based on the feasibility and reasonableness analysis completed at the time the environmental document is being approved.

Substantial construction. The granting of a building permit, prior to right-of-way acquisition or construction approval for the highway.

Substantial noise increase. One of two types of highway traffic noise impacts. For a Type I project, an increase in noise levels of 5 to 15 dB(A) in the design year over the existing noise level.

Traffic noise impacts. Design year build condition noise levels that approach or exceed the NAC listed in Table 1 for the future build condition; or design year build condition noise levels that create a substantial noise increase over existing noise levels.

Type I project.

(1) The construction of a highway on new location; or,

(2) The physical alteration of an existing highway where there is either:

(i) Substantial Horizontal Alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition; or,

(ii) Substantial Vertical Alteration. A project that removes shielding therefore exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor; or,

(3) The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane; or,

(4) The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,

(5) The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,

(6) Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,

(7) The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.

(8) If a project is determined to be a Type I project under this definition then the entire project area as defined in the environmental document is a Type I project.

Type II project. A Federal or Federal-aid highway project for noise abatement on an existing highway. For a Type II project to be eligible for Federal-aid funding, the highway agency must develop and implement a Type II program in accordance with section 772.7(e).

Type III project. A Federal or Federal-aid highway project that does not meet the classifications of a Type I or Type II project. Type III projects do not require a noise analysis.

§ 772.7 Applicability.

(a) This regulation applies to all Federal or Federal-aid Highway Projects authorized under title 23, United States Code. Therefore, this regulation applies to any highway project or multimodal project that:

(1) Requires FHWA approval regardless of funding sources, or

(2) Is funded with Federal-aid highway funds.

(b) In order to obtain FHWA approval, the highway agency shall develop noise policies in conformance with this regulation and shall apply these policies uniformly and consistently statewide.

(c) This regulation applies to all Type I projects unless the regulation specifically indicates that a section only applies to Type II or Type III projects.

(d) The development and implementation of Type II projects are not mandatory requirements of section 109(i) of title 23, United States Code.

(e) If a highway agency chooses to participate in a Type II program, the highway agency shall develop a priority system, based on a variety of factors, to rank the projects in the program. This priority system shall be submitted to and approved by FHWA before the highway agency is allowed to use Federal-aid funds for a project in the program. The highway agency shall re-analyze the priority system on a regular interval, not to exceed 5 years.

(f) For a Type III project, a highway agency is not required to complete a noise analysis or consider abatement measures.

§ 772.9 Traffic noise prediction.

(a) Any analysis required by this subpart must use the FHWA Traffic Noise Model (TNM), which is described in "FHWA Traffic Noise Model" Report No. FHWA–PD–96–010, including Revision No. 1, dated April 14, 2004, or any other model determined by the FHWA to be consistent with the methodology of the FHWA TNM. These publications are incorporated by reference in accordance with section 552(a) of title 5, U.S.C. and part 51 of title 1, CFR, and are on file at the National Archives and Record Administration (NARA). For information on the availability of this material at NARA, call (202) 741–6030 or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* These documents are available for copying and inspection at the Federal Highway Administration, 1200 New Jersey Avenue, SE., Washington, DC 20590, as provided in part 7 of title 49, CFR. These documents are also available on the FHWA's Traffic Noise Model Web site at the following URL: *http://www.fhwa.dot.gov/environment/noise/index.htm*.

(b) Average pavement type shall be used in the FHWA TNM for future noise level prediction unless a highway agency substantiates the use of a different pavement type for approval by the FHWA.

(c) Noise contour lines may be used for project alternative screening or for land use planning to comply with § 772.17 of this part, but shall not be used for determining highway traffic noise impacts.

(d) In predicting noise levels and assessing noise impacts, traffic characteristics that would yield the worst traffic noise impact for the design year shall be used.

§ 772.11 Analysis of traffic noise impacts.

(a) The highway agency shall determine and analyze expected traffic noise impacts.

(1) For projects on new alignments, determine traffic noise impacts by field measurements.

(2) For projects on existing alignments, predict existing and design year traffic noise impacts.

(b) In determining traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs.

(c) A traffic noise analysis shall be completed for:

(1) Each alternative under detailed study;

(2) Each Activity Category of the NAC listed in Table 1 that is present in the study area;

(i) ***Activity Category A.*** This activity category includes the exterior impact criteria for lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential for the area to continue to serve its intended purpose. Highway agencies shall submit justifications to the FHWA on a case-by-case basis for approval of an Activity Category A designation.

(ii) ***Activity Category B.*** This activity category includes the exterior impact criteria for single-family and multifamily residences.

(iii) ***Activity Category C.*** This activity category includes the exterior impact criteria for a variety of land use facilities. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.

(iv) ***Activity Category D.*** This activity category includes the interior impact criteria for certain land use facilities listed in Activity Category C that may have interior uses. A highway agency shall conduct an indoor analysis after a determination is made that exterior abatement measures will not be feasible and reasonable. An indoor analysis shall only be done after exhausting all outdoor analysis options. In situations where no exterior activities are to be affected by the traffic noise, or where the exterior activities are far from or physically shielded from the roadway in a manner that prevents an impact on exterior activities, the highway agency shall use Activity Category D as the basis of determining noise impacts. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.

(v) ***Activity Category E.*** This activity category includes the exterior impact criteria for developed lands that are less sensitive to highway noise. Each highway agency shall adopt a standard practice for analyzing these land use facilities that is consistent and uniformly applied statewide.

(vi) ***Activity Category F.*** This activity category includes developed lands that are not sensitive to highway traffic noise. There is no impact criteria for the land use facilities in this activity category and no analysis of noise impacts is required.

(vii) ***Activity Category G.*** This activity includes undeveloped lands.

(A) A highway agency shall determine if undeveloped land is permitted for development. The milestone and its associated date for acknowledging when undeveloped land is considered permitted shall be the date of issuance of a building permit by the local jurisdiction or by the appropriate governing entity.

(B) If undeveloped land is determined to be perrmitted, then the highway agency shall assign the land to the appropriate Activity Category and analyze it in the same manner as developed lands in that Activity Category.

(C) If undeveloped land is not permitted for development by the date of public knowledge, the highway agency shall determine noise levels in accordance with 772.17(a) and document the results in the project's environmental clearance documents and noise analysis documents. Federal participation in noise abatement measures will not be considered for lands that are not permitted by the date of public knowledge.

(d) The analysis of traffic noise impacts shall include:

(1) Identification of existing activities, developed lands, and undeveloped lands, which may be affected by noise from the highway;

(2) For projects on new or existing alignments, validate predicted noise level through comparison between measured and predicted levels;

(3) Measurement of noise levels. Use an ANSI Type I or Type II integrating sound level meter;

(4) Identification of project limits to determine all traffic noise impacts for the design year for the build alternative. For Type II projects, traffic noise impacts shall be determined from current year conditions;

(e) Highway agencies shall establish an approach level to be used when determining a traffic noise impact. The approach level shall be at least 1 dB(A) less than the Noise Abatement Criteria for Activity Categories A to E listed in Table 1 to part 772;

(f) Highway agencies shall define substantial noise increase between 5 dB(A) to 15 dB(A) over existing noise levels. The substantial noise increase criterion is independent of the absolute noise level.

(g) A highway agency proposing to use Federal-aid highway funds for a Type II project shall perform a noise analysis in accordance with § 772.11 of this part in order to provide information needed to make the determination required by § 772.13(a) of this part.

§ 772.13 Analysis of noise abatement.

(a) When traffic noise impacts are identified, noise abatement shall be considered and evaluated for feasibility and reasonableness. The highway agency shall determine and analyze alternative noise abatement measures to abate identified impacts by giving weight to the benefits and costs of abatement and the overall social, economic, and environmental effects by using feasible and reasonable noise abatement measures for decision-making.

(b) In abating traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs.

(c) If a noise impact is identified, a highway agency shall consider abatement measures. The abatement measures listed in § 772.15(c) of this part are eligible for Federal funding.

(1) At a minimum, the highway agency shall consider noise abatement in the form of a noise barrier.

(2) If a highway agency chooses to use absorptive treatments as a functional enhancement, the highway agency shall adopt a standard practice for using absorptive treatment that is consistent and uniformly applied statewide.

(d) ***Examination and evaluation of feasible and reasonable noise abatement measures for reducing the traffic noise impacts.*** Each highway agency, with FHWA approval, shall develop feasibility and reasonableness factors.

(1) ***Feasibility*** :

(i) Achievement of at least a 5 dB(A) highway traffic noise reduction at impacted receptors. The highway agency shall define, and receive FHWA approval for, the number of receptors that must achieve this reduction for the noise abatement measure to be acoustically feasible and explain the basis for this determination; and

(ii) Determination that it is possible to design and construct the noise abatement measure. Factors to consider are safety, barrier height, topography, drainage, utilities, and maintenance of the abatement measure, maintenance access to adjacent properties, and access to adjacent properties (*i.e.* arterial widening projects).

(2) ***Reasonableness*** :—

(i) ***Consideration of the viewpoints of the property owners and residents of the benefited receptors.*** The highway agency shall solicit the viewpoints of all of the benefited receptors and obtain enough responses to document a decision on either desiring or not desiring the noise abatement measure. The highway agency shall define, and receive FHWA approval for, the number of receptors that are needed to constitute a decision and explain the basis for this determination.

(ii) ***Cost effectiveness of the highway traffic noise abatement measures.*** Each highway agency shall determine, and receive FHWA approval for, the allowable cost of abatement by determining a baseline cost reasonableness value. This determination may include the actual construction cost of noise abatement, cost per square foot of abatement, the maximum square footage of abatement/benefited receptor and either the cost/benefited receptor or cost/benefited receptor/dB(A) reduction. The highway agency shall re-analyze the allowable cost for abatement on a regular interval, not to exceed 5 years. A highway agency has the option of justifying, for FHWA approval, different cost allowances for a particular geographic area(s) within the State, however, the highway agancy must use the same cost reasonableness/ construction cost ratio statewide.

(iii) ***Noise reduction design goals for highway traffic noise abatement measures.*** When noise abatement measure(s) are being considered, a highway agency shall achieve a noise reduction design goal. The highway agency shall define, and receive FHWA approval for, the design goal of at least 7 dB(A) but not more than 10 dB(A), and shall define the number of benefited receptors that must achieve this design goal and explain the basis for this determination.

(iv) The reasonableness factors listed in § 772.13(d)(5)(i), (ii) and (iii), must collectively be achieved in order for a noise abatement measure to be deemed reasonable. Failure to achieve § 772.13(d)(5)(i), (ii) or (iii), will result in the noise abatement measure being deemed not reasonable.

(v) In addition to the required reasonableness factors listed in § 772.13(d)(5)(i), (ii), and (iii), a highway agency has the option to also include the following reasonableness factors: Date of development, length of time receivers have been exposed to highway traffic noise impacts, exposure to higher absolute highway traffic noise levels, changes between existing and future build conditions, percentage of mixed zoning development, and use of noise compatible planning concepts by the local government. No single optional reasonableness factor can be used to determine reasonableness.

(e) Assessment of Benefited Receptors. Each highway agency shall define the threshold for the noise reduction which determines a benefited receptor as at or above the 5 dB(A), but not to exceed the highway agency's reasonableness design goal.

(f) ***Abatement measure reporting*** : Each highway agency shall maintain an inventory of all constructed noise abatement measures. The inventory shall include the following parameters: type of abatement; cost (overall cost, unit cost per/sq. ft.); average height; length; area; location (State, county, city, route); year of construction; average insertion loss/noise reduction as reported by the model in the noise analysis; NAC

category(s) protected; material(s) used (precast concrete, berm, block, cast in place concrete, brick, metal, wood, fiberglass, combination, plastic (transparent, opaque, other); features (absorptive, reflective, surface texture); foundation (ground mounted, on structure); project type (Type I, Type II, and optional project types such as State funded, county funded, tollway/turnpike funded, other, unknown). The FHWA will collect this information, in accordance with OMB's Information Collection requirements.

(g) Before adoption of a CE, FONSI, or ROD, the highway agency shall identify:

(1) Noise abatement measures which are feasible and reasonable, and which are likely to be incorporated in the project; and

(2) Noise impacts for which no noise abatement measures are feasible and reasonable.

(3) ***Documentation of highway traffic noise abatement*** : The environmental document shall identify locations where noise impacts are predicted to occur, where noise abatement is feasible and reasonable, and locations with impacts that have no feasible or reasonable noise abatement alternative. For environmental clearance, this analysis shall be completed to the extent that design information on the alterative(s) under study in the environmental document is available at the time the environmental clearance document is completed. A statement of likelihood shall be included in the environmental document since feasibility and reasonableness determinations may change due to changes in project design after approval of the environmental document. The statement of likelihood shall include the preliminary location and physical description of noise abatement measures determined feasible and reasonable in the preliminary analysis. The statement of likelihood shall also indicate that final recommendations on the construction of an abatement measure(s) is determined during the completion of the project's final design and the public involvement processes.

(h) The FHWA will not approve project plans and specifications unless feasible and reasonable noise abatement measures are incorporated into the plans and specifications to reduce the noise impact on existing activities, developed lands, or undeveloped lands for which development is permitted.

(i) For design-build projects, the preliminary technical noise study shall document all considered and proposed noise abatement measures for inclusion in the NEPA document. Final design of design-build noise abatement measures shall be based on the preliminary noise abatement design developed in the technical noise analysis. Noise abatement measures shall be considered, developed, and constructed in accordance with this standard and in conformance with the provisions of 40 CFR 1506.5(c) and 23 CFR 636.109.

(j) Third party funding is not allowed on a Federal or Federal-aid Type I or Type II project if the noise abatement measure would require the additional funding from the third party to be considered feasible and/or reasonable. Third party funding is acceptable on a Federal or Federal-aid highway Type I or Type II project to make functional enhancements, such as absorptive treatment and access doors or aesthetic enhancements, to a noise abatement measure already determined feasible and reasonable.

(k) On a Type I or Type II projects, a highway agency has the option to cost average noise abatement among benefited receptors within common noise environments if no single common noise environment exceeds two times the highway agency's cost reasonableness criteria and collectively all common noise environments being averaged do not exceed the highway agency's cost reasonableness criteria.

§ 772.15 Federal participation.

(a) ***Type I and Type II projects.*** Federal funds may be used for noise abatement measures when:

(1) Traffic noise impacts have been identified; and

(2) Abatement measures have been determined to be feasible and reasonable pursuant to § 772.13(d) of this chapter.

(b) ***For Type II projects.***

(1) No funds made available out of the Highway Trust Fund may be used to construct Type II noise barriers, as defined by this regulation, if such noise barriers were not part of a project approved by the FHWA before the November 28, 1995.

(2) Federal funds are available for Type II noise barriers along lands that were developed or were under substantial construction before approval of the acquisition of the rights-of-ways for, or construction of, the existing highway.

(3) FHWA will not approve noise abatement measures for locations where such measures were previously determined not to be feasible and reasonable for a Type I project.

(c) ***Noise abatement measures.*** The following noise abatement measures may be considered for incorporation into a Type I or Type II project to reduce traffic noise impacts. The costs of such measures may be included in Federal-aid participating project costs with the Federal share being the same as that for the system on which the project is located.

(1) Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement measure.

(2) Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.

(3) Alteration of horizontal and vertical alignments.

(4) Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise. This measure may be included in Type I projects only.

(5) Noise insulation of Activity Category D land use facilities listed in Table 1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding.

§ 772.17 Information for local officials.

(a) To minimize future traffic noise impacts on currently undeveloped lands of Type I projects, a highway agency shall inform local officials within whose jurisdiction the highway project is located of:

(1) Noise compatible planning concepts;

(2) The best estimation of the future design year noise levels at various distances from the edge of the nearest travel lane of the highway improvement where the future noise levels meet the highway agency's definition of “approach” for undeveloped lands or properties within the project limits. At a minimum, identify the distance to the exterior noise abatement criteria in Table 1;

(3) Non-eligibility for Federal-aid participation for a Type II project as described in § 772.15(b).

(b) If a highway agency chooses to participate in a Type II noise program or to use the date of development as one of the factors in determining the reasonableness of a Type I noise abatement measure, the highway agency shall have a statewide outreach program to inform local officials and the public of the items in § 772.17(a)(1) through (3).

§ 772.19 Construction noise.

For all Type I and II projects, a highway agency shall:

(a) Identify land uses or activities that may be affected by noise from construction of the project. The identification is to be performed during the project development studies.

(b) Determine the measures that are needed in the plans and specifications to minimize or eliminate adverse construction noise impacts to the community. This determination shall include a weighing of the benefits achieved and the overall adverse social, economic, and environmental effects and costs of the abatement measures.

(c) Incorporate the needed abatement measures in the plans and specifications.

Table 1 to Part 772—Noise Abatement Criteria

[Hourly A–Weighted Sound Level __ decibels (dB(A))[1]]

Activity category	Activity Leq(h)	Criteria[2] L10(h)	Evaluation location	Activity description
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	70	Exterior	Residential.
C[3]	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[3]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F.
F				Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G				Undeveloped lands that are not permitted.

[1] Either Leq(h) or L10(h) (but not both) may be used on a project.

[2] The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

[3] Includes undeveloped lands permitted for this activity category.