
NCHRP RESEARCH REPORT 984

**Breaking Barriers: Alternative
Approaches to Avoiding and Reducing
Highway Traffic Noise Impacts**

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Subscriber Categories

Design • Environment • Highways

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Considering a Solid Safety Barrier for Noise Reduction? Start Here

Solid Safety Barrier

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

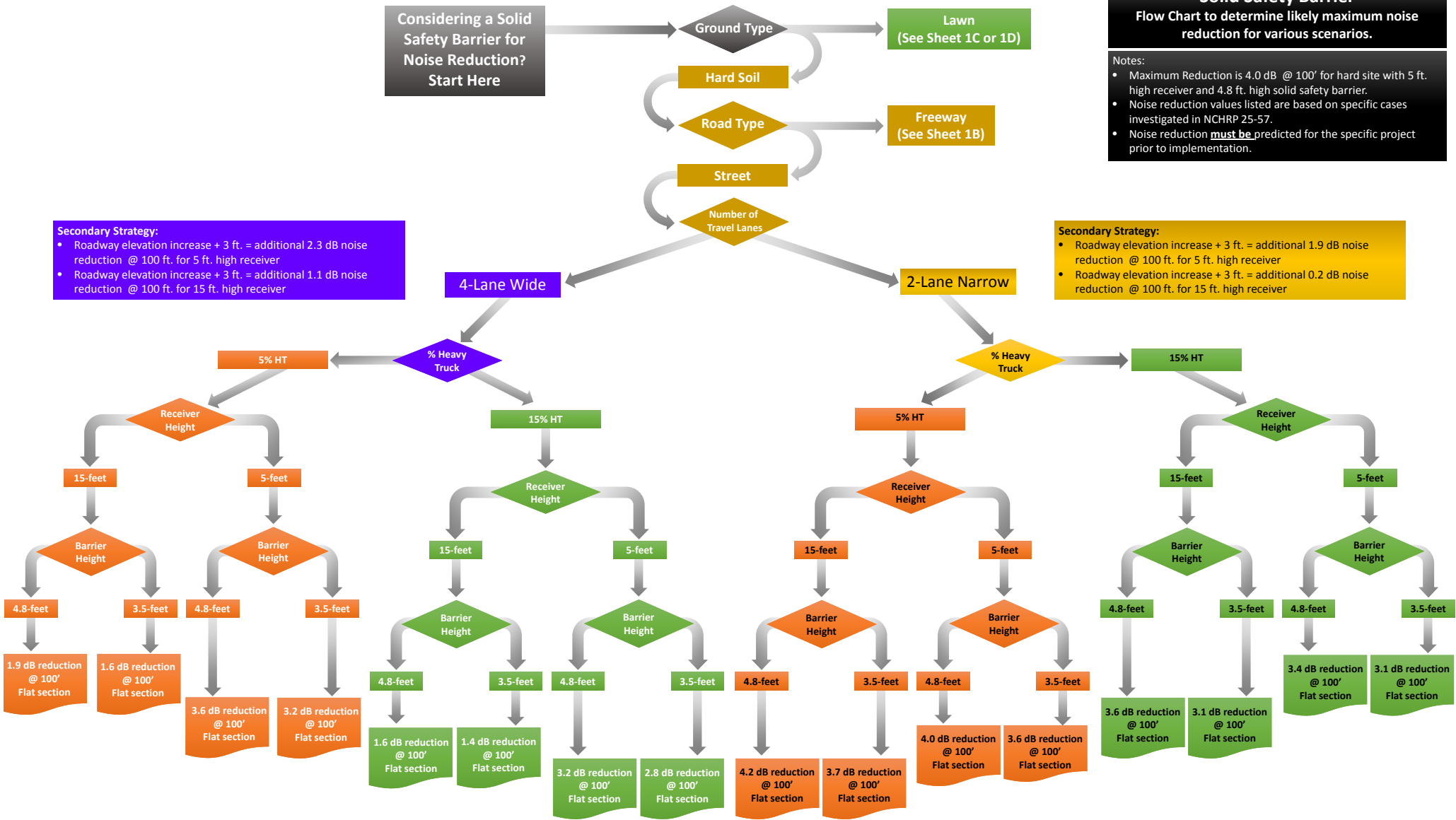
- Maximum Reduction is 4.0 dB @ 100' for hard site with 5 ft. high receiver and 4.8 ft. high solid safety barrier.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Noise reduction **must be** predicted for the specific project prior to implementation.

Secondary Strategy:

- Roadway elevation increase + 3 ft. = additional 2.3 dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 1.1 dB noise reduction @ 100 ft. for 15 ft. high receiver

Secondary Strategy:

- Roadway elevation increase + 3 ft. = additional 1.9 dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 0.2 dB noise reduction @ 100 ft. for 15 ft. high receiver



Considering a Solid Safety Barrier for Noise Reduction? Start Here

Solid Safety Barrier

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

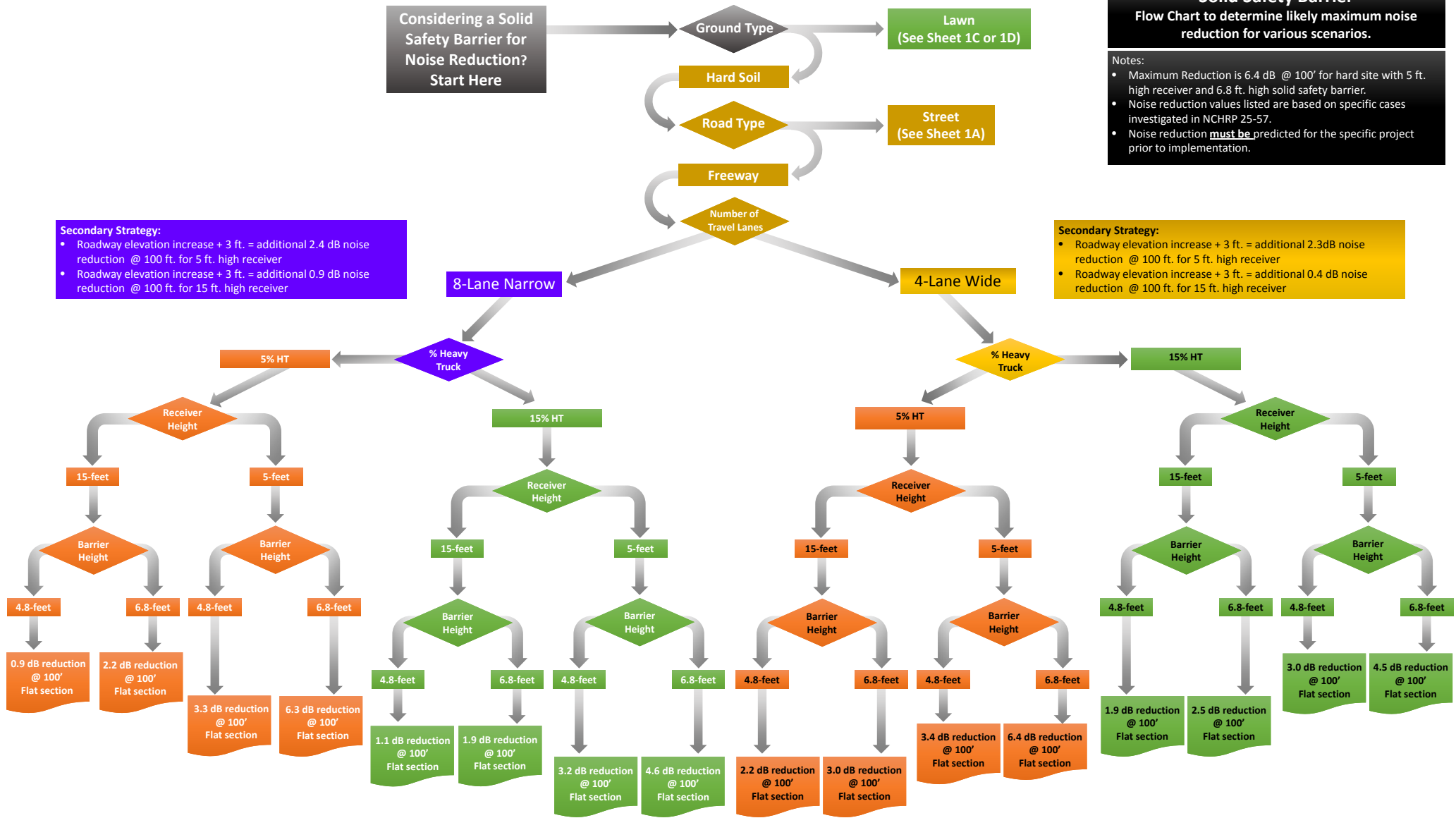
- Maximum Reduction is 6.4 dB @ 100' for hard site with 5 ft. high receiver and 6.8 ft. high solid safety barrier.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Noise reduction **must be** predicted for the specific project prior to implementation.

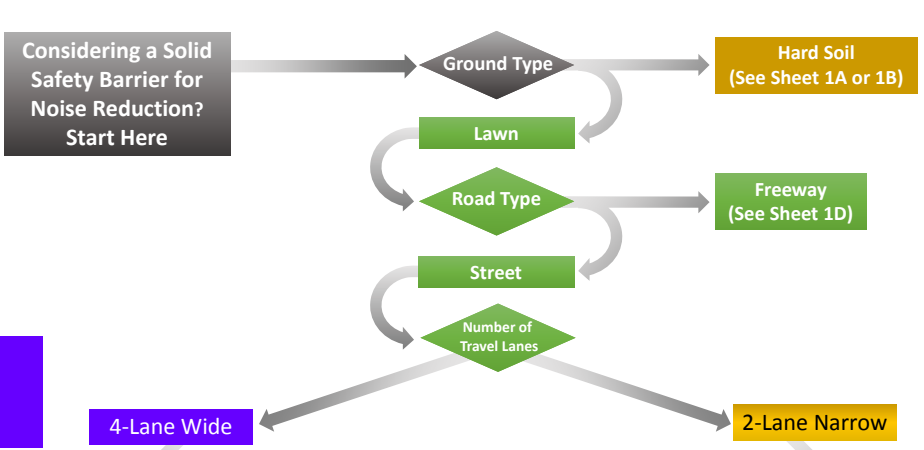
Secondary Strategy:

- Roadway elevation increase + 3 ft. = additional 2.4 dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 0.9 dB noise reduction @ 100 ft. for 15 ft. high receiver

Secondary Strategy:

- Roadway elevation increase + 3 ft. = additional 2.3dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 0.4 dB noise reduction @ 100 ft. for 15 ft. high receiver





Solid Safety Barrier

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

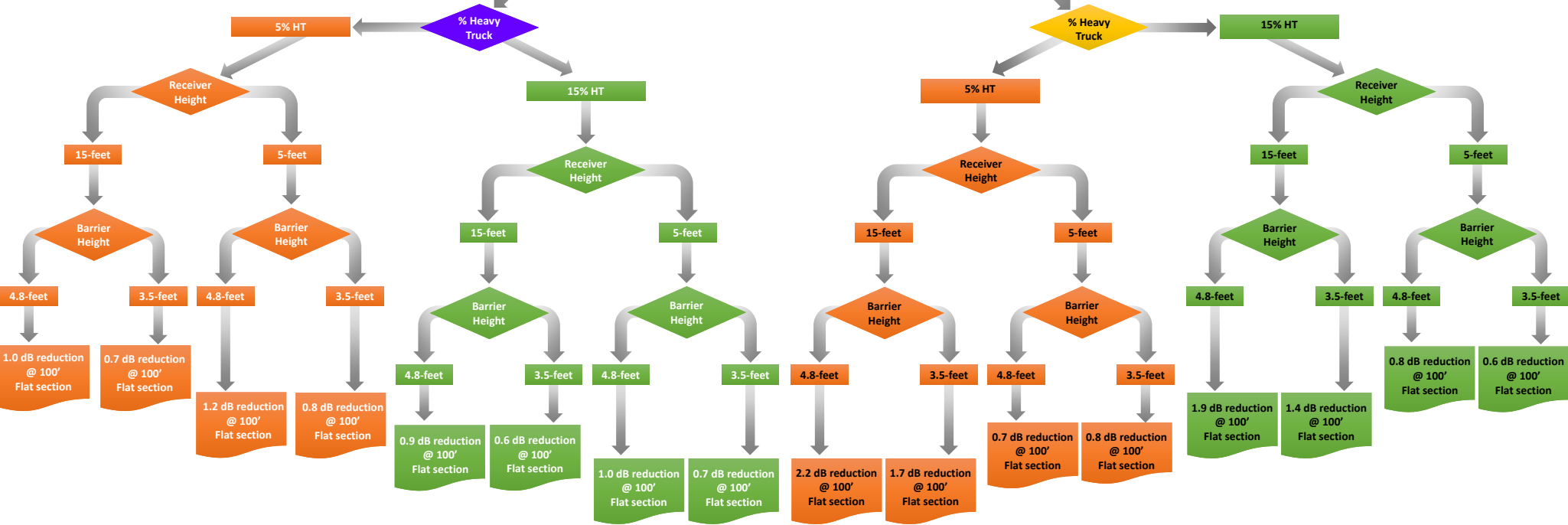
- Maximum Reduction is 1.2 dB @ 100' for soft site with 5 ft. high receiver and 4.8 ft. high solid safety barrier.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Noise reduction **must be** predicted for the specific project prior to implementation.

Secondary Strategy:

- Roadway elevation increase + 3 ft. = additional 1.5 dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 0.9 dB noise reduction @ 100 ft. for 15 ft. high receiver

Secondary Strategy:

- Roadway elevation increase + 3 ft. = additional 1.7 dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 0.6 dB noise reduction @ 100 ft. for 15 ft. high receiver



Considering a Solid Safety Barrier for Noise Reduction? Start Here

Ground Type

Hard Soil
(See Sheet 1A or 1B)

Lawn

Road Type

Street
(See Sheet 1C)

Freeway

Number of Travel Lanes

8-Lane Narrow

4-Lane Wide

Secondary Strategy:

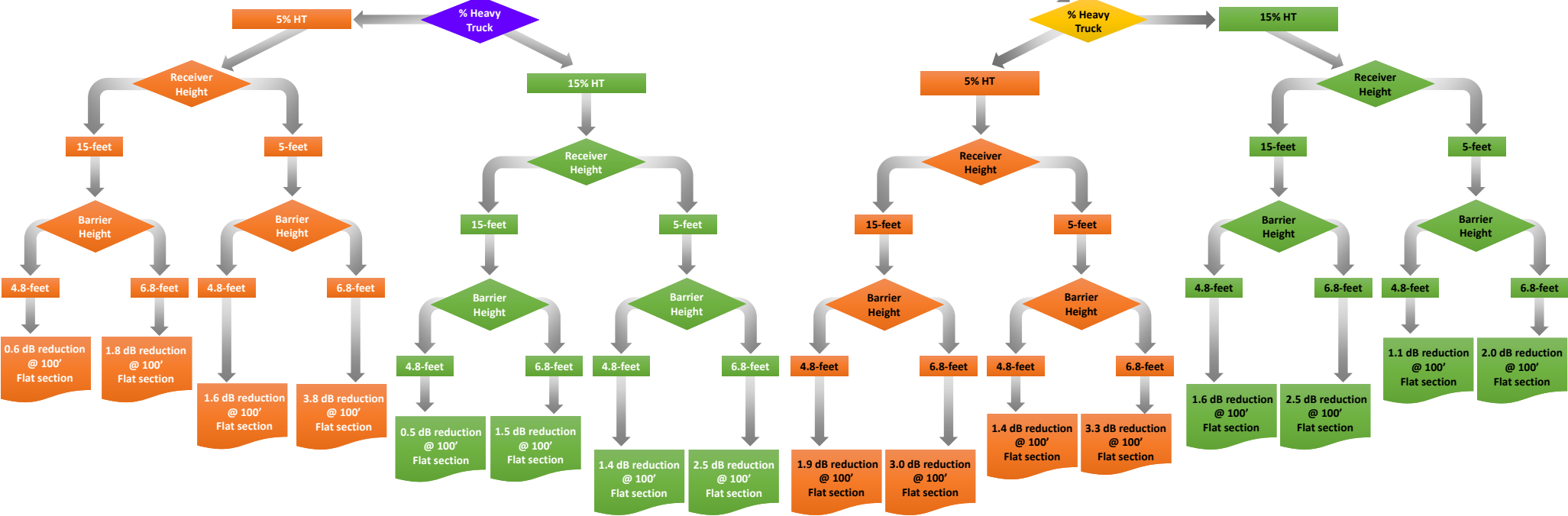
- Roadway elevation increase + 3 ft. = additional 1.9 dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 1.1 dB noise reduction @ 100 ft. for 15 ft. high receiver

Secondary Strategy:

- Roadway elevation increase + 3 ft. = additional 1.5 dB noise reduction @ 100 ft. for 5 ft. high receiver
- Roadway elevation increase + 3 ft. = additional 0.4 dB noise reduction @ 100 ft. for 15 ft. high receiver

Solid Safety Barrier
Flow Chart to determine likely maximum noise reduction for various scenarios.

- Notes:
- Maximum Reduction is 3.8 dB @ 100' for soft site with 5 ft. high receiver and 6.8 ft. high solid safety barrier.
 - Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
 - Noise reduction **must be** predicted for the specific project prior to implementation.



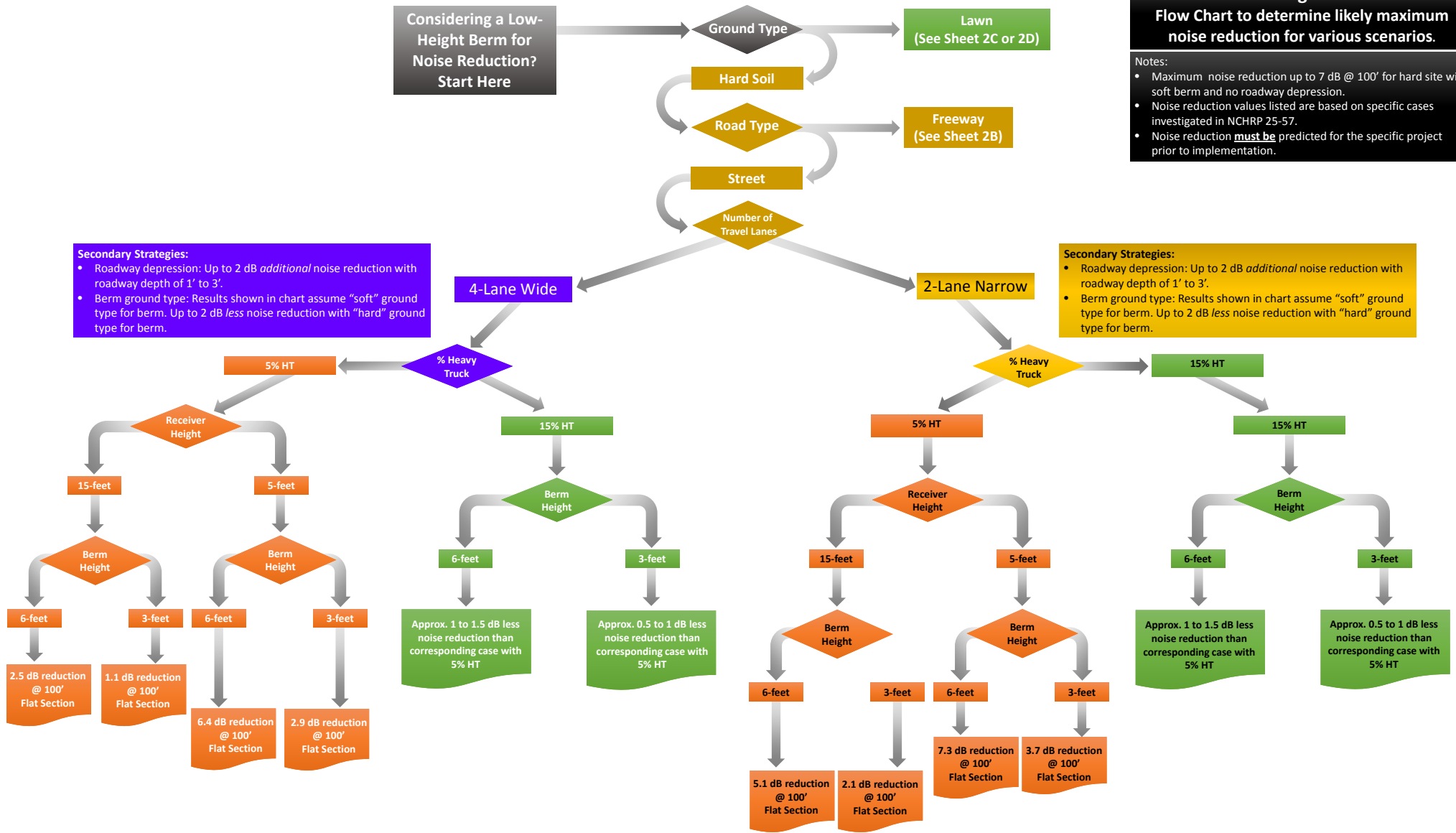
Considering a Low-Height Berm for Noise Reduction? Start Here

Low-Height Berm

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

- Maximum noise reduction up to 7 dB @ 100' for hard site with soft berm and no roadway depression.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Noise reduction **must be** predicted for the specific project prior to implementation.



Secondary Strategies:

- Roadway depression: Up to 2 dB *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 2 dB *less* noise reduction with "hard" ground type for berm.

Secondary Strategies:

- Roadway depression: Up to 2 dB *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 2 dB *less* noise reduction with "hard" ground type for berm.

Considering a Low-Height Berm for Noise Reduction? Start Here

Low-Height Berm

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

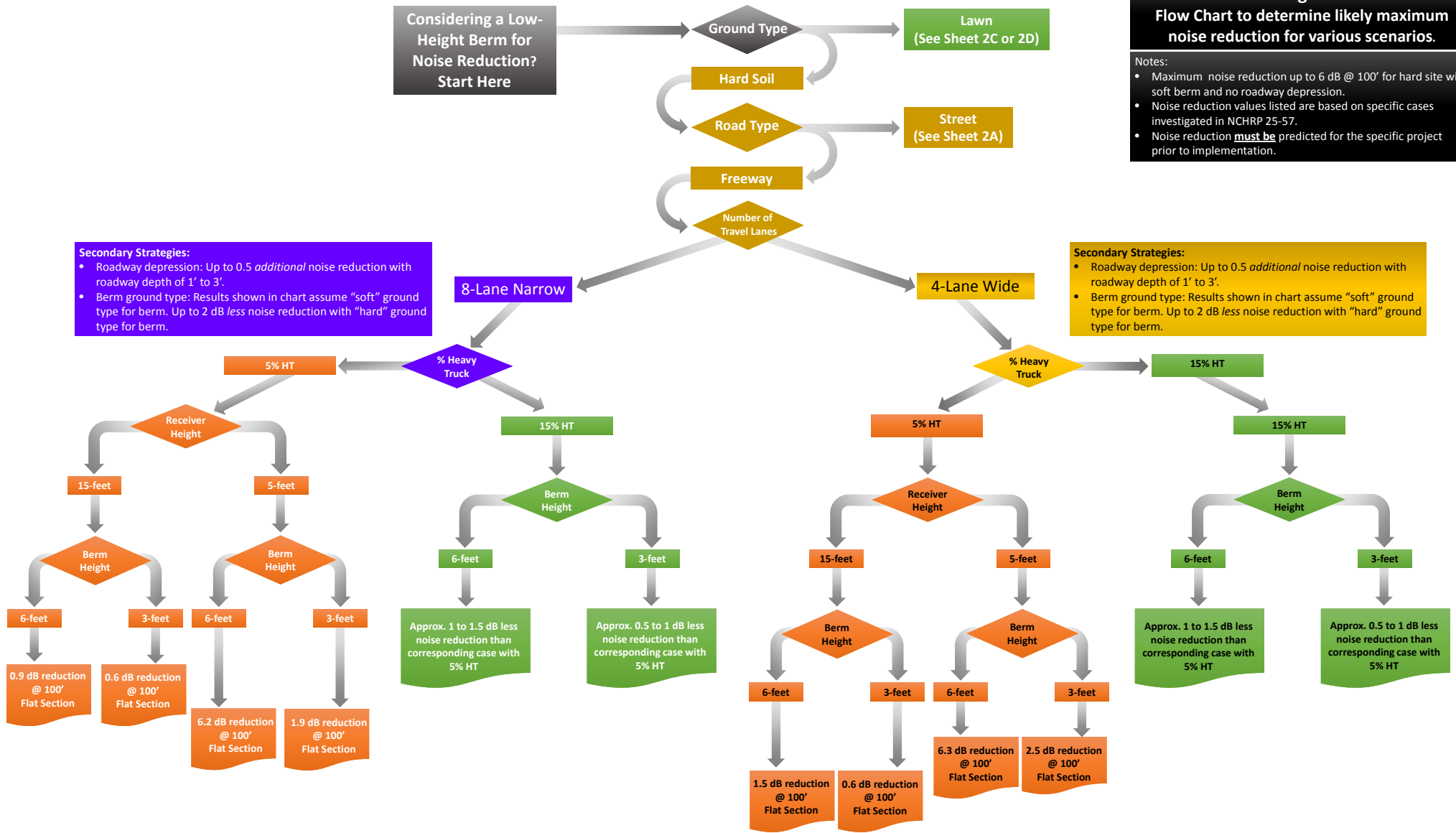
- Maximum noise reduction up to 6 dB @ 100' for hard site with soft berm and no roadway depression.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Noise reduction **must be** predicted for the specific project prior to implementation.

Secondary Strategies:

- Roadway depression: Up to 0.5 *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 2 dB less noise reduction with "hard" ground type for berm.

Secondary Strategies:

- Roadway depression: Up to 0.5 *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 2 dB less noise reduction with "hard" ground type for berm.



Considering a Low-Height Berm for Noise Reduction? Start Here

Ground Type

Hard Soil
(See Sheet 2A or 2B)

Lawn

Road Type

Freeway
(See Sheet 2D)

Street

Number of Travel Lanes

4-Lane Wide

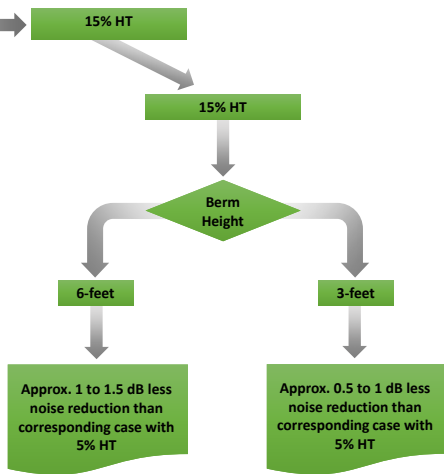
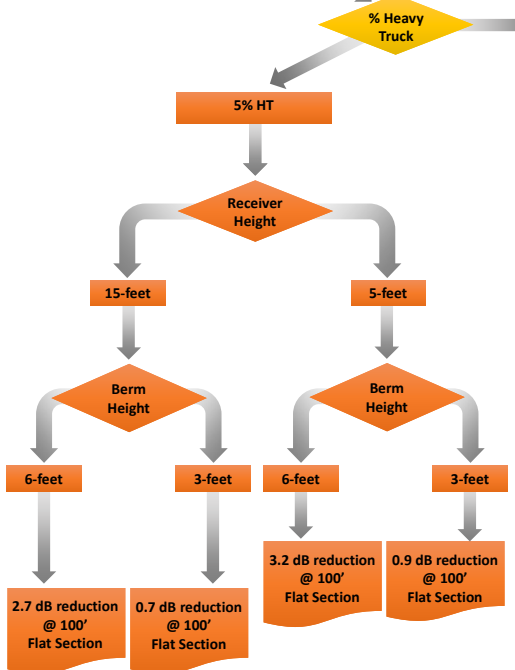
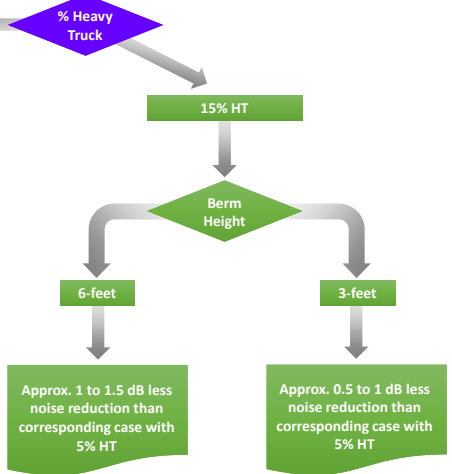
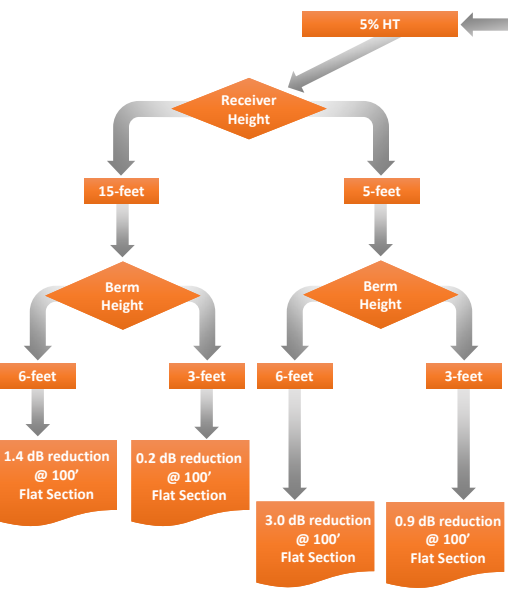
2-Lane Narrow

Secondary Strategies:

- Roadway depression: Up to 2 dB *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 0.5 dB *less* noise reduction with "hard" ground type for berm.

Secondary Strategies:

- Roadway depression: Up to 2 dB *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 0.5 dB *less* noise reduction with "hard" ground type for berm.



Low-Height Berm
Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

- Maximum noise reduction up to 3 dB @ 100' for soft (lawn) site with soft berm and no roadway depression.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Noise reduction **must be** predicted for the specific project prior to implementation.

Considering a Low-Height Berm for Noise Reduction? Start Here

Ground Type

Hard Soil
(See Sheet 2A or 2B)

Lawn

Road Type

Street
(See Sheet 2C)

Freeway

Number of Travel Lanes

8-Lane Narrow

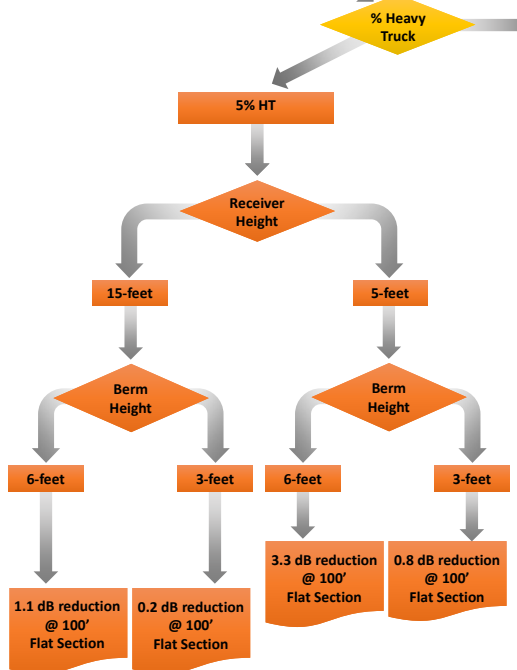
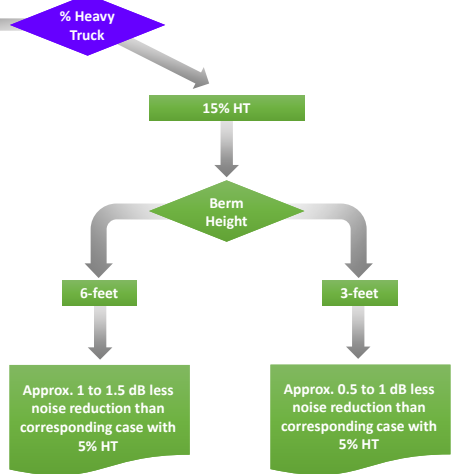
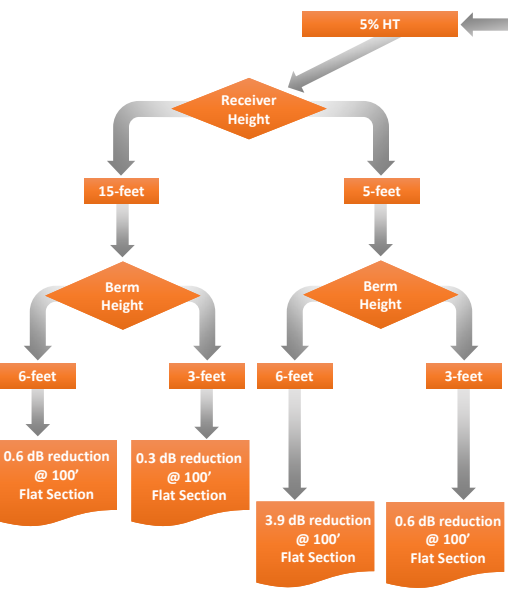
4-Lane Wide

Secondary Strategies:

- Roadway depression: Up to 0.5 dB *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 0.5 dB *less* noise reduction with "hard" ground type for berm.

Secondary Strategies:

- Roadway depression: Up to 0.5 dB *additional* noise reduction with roadway depth of 1' to 3'.
- Berm ground type: Results shown in chart assume "soft" ground type for berm. Up to 0.5 dB *less* noise reduction with "hard" ground type for berm.

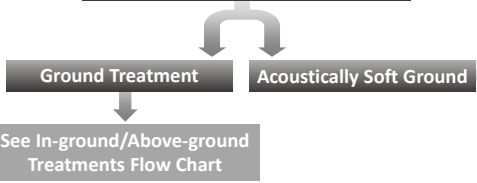


Low-Height Berm
Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

- Maximum noise reduction up to 4 dB @ 100' for soft (lawn) site with soft berm and no roadway depression.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Noise reduction **must be** predicted for the specific project prior to implementation.

Considering Acoustically Soft Ground for Noise Reduction?
Start Here



Acoustically Soft Ground

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

- Assumes use of gravel bed in strip adjacent to road.
- Maximum Reduction is less than 5 dB.
- Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
- Greatest effect \leq 200 ft from road
- Widest strip best (50 ft); for 5-ft high receiver, 1 dB less reduction for 20 ft, 2 dB less for 10 ft
- Noise reduction must be predicted for the specific project prior to implementation.

Lawn:
Max noise reduction generally $<$ 1 dB – ASG not recommended as a reduction strategy for acoustically soft ground sites (i.e., ground between road and receptor is mostly grass, other vegetation, forest floor, very loose dirt/sand, or other sound absorptive surface)

Site Ground Type

Hard Soil

Road Type

Freeway
(See Sheet 3B)

Street

Number of Travel Lanes

4-Lane Wide

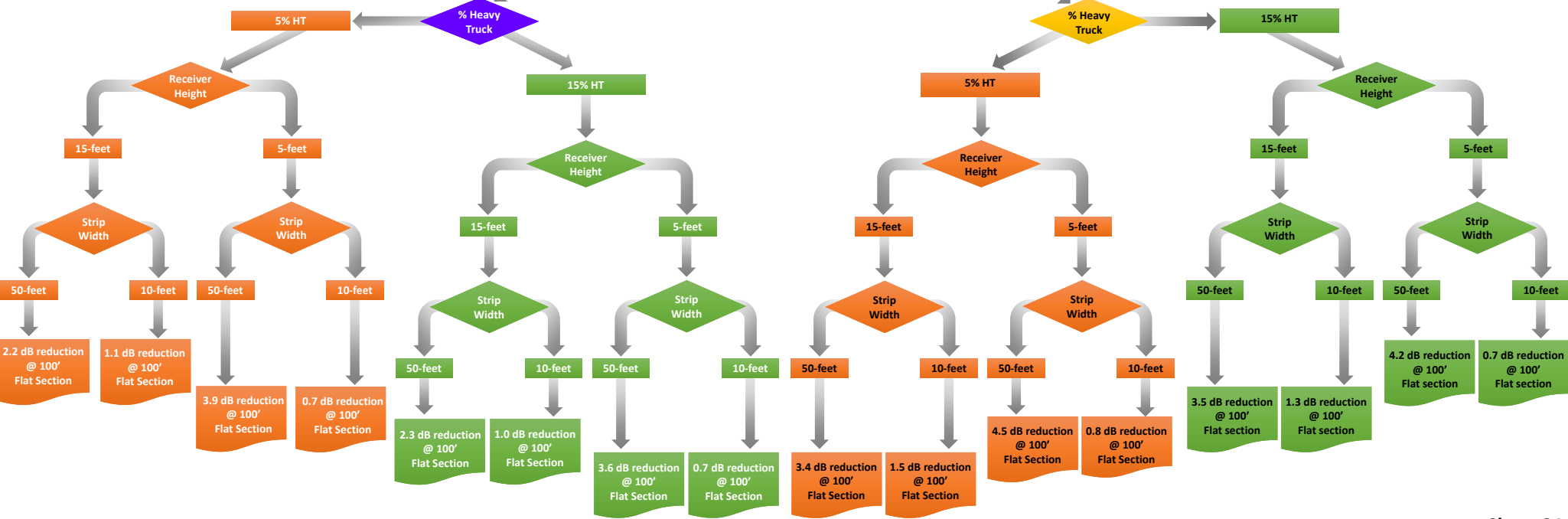
2-Lane Narrow

Secondary Strategies:

- Quieter pavement (OGAC) = additional 1-2 dB noise reduction (compared to TNM Average pavement), reduces with distance
- Greater reduction is expected for pavements quieter than TNM OGAC (e.g., rubberized OGAC)
- For combined strategies, at lower frequencies, reduction is controlled by the ASG strip; at higher frequencies, reduction is controlled by quieter pavement and the strip

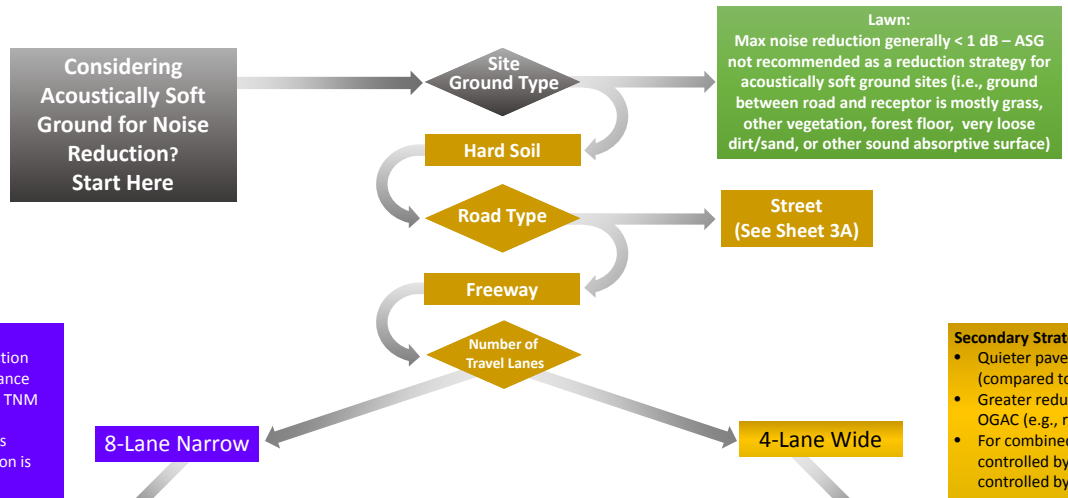
Secondary Strategies:

- Quieter pavement (OGAC) = additional 1-2 dB noise reduction (compared to TNM Average pavement), reduces with distance
- Greater reduction is expected for pavements quieter than TNM OGAC (e.g., rubberized OGAC)
- For combined strategies, at lower frequencies, reduction is controlled by the ASG strip; at higher frequencies, reduction is controlled by quieter pavement and the strip



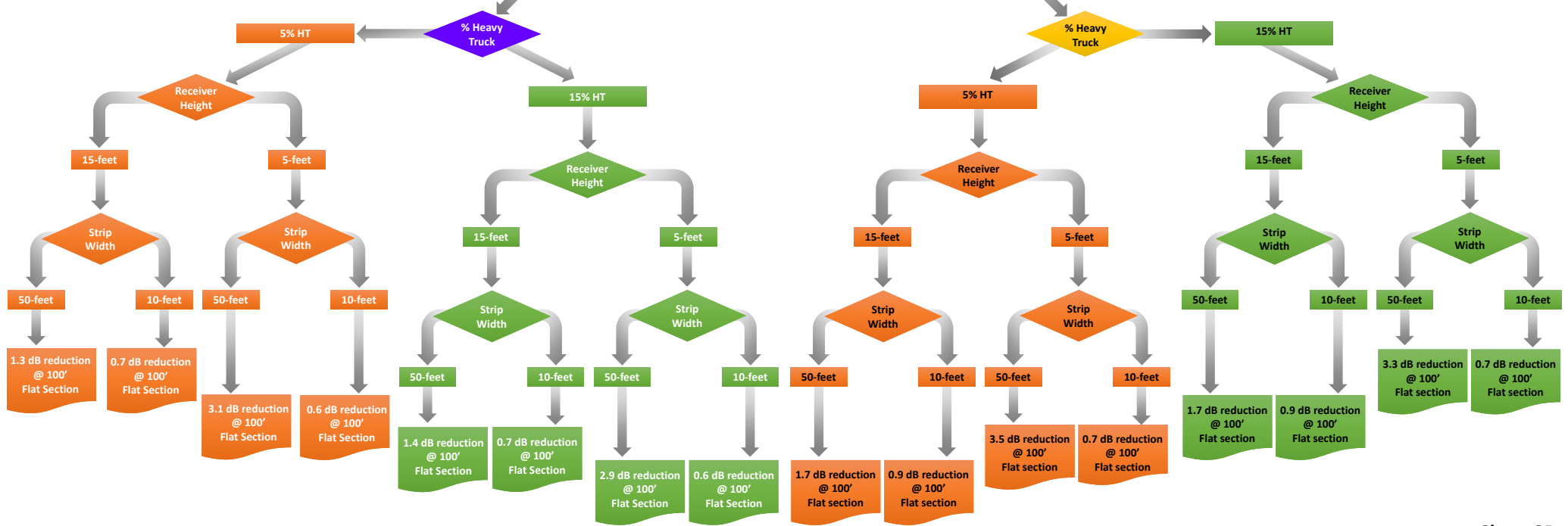
Acoustically Soft Ground Flow Chart to determine likely maximum noise reduction for various scenarios.

- Notes:
- Assumes use of gravel bed in strip adjacent to road.
 - Maximum Reduction is less than 4 dB.
 - Noise reduction values listed are based on specific cases investigated in NCHRP 25-57.
 - Greatest effect ≤ 200 ft from road
 - Widest strip best (50 ft); for 5-ft high receiver, 1 dB less reduction for 20 ft, 2 dB less for 10 ft
 - Noise reduction **must be** predicted for the specific project prior to implementation.



- Secondary Strategies:
- Quieter pavement (OGAC) = additional 1-2 dB noise reduction (compared to TNM Average pavement), reduces with distance
 - Greater reduction is expected for pavements quieter than TNM OGAC (e.g., rubberized OGAC)
 - For combined strategies, at lower frequencies, reduction is controlled by the ASG strip; at higher frequencies, reduction is controlled by quieter pavement and the strip

- Secondary Strategies:
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 - Greater reduction is expected for pavements quieter than TNM OGAC (e.g., rubberized OGAC)
 - For combined strategies, at lower frequencies, reduction is controlled by the ASG strip; at higher frequencies, reduction is controlled by quieter pavement and the strip



Vegetated Screens

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

- Random grid of trees, shrubs, and bushes is ideal
- Width of a vegetation belt is critical
- Deciduous trees can be effective depending upon the time of year outdoor space is used

Considering Vegetated Screens for Noise Reduction?
Start Here

Available ROW Width

Less than 65-feet

Minimal (One Row of Trees)

More than 65-feet

1 to 3 dB reduction @ receiver with optimized planting

No reduction possible
psychological benefit

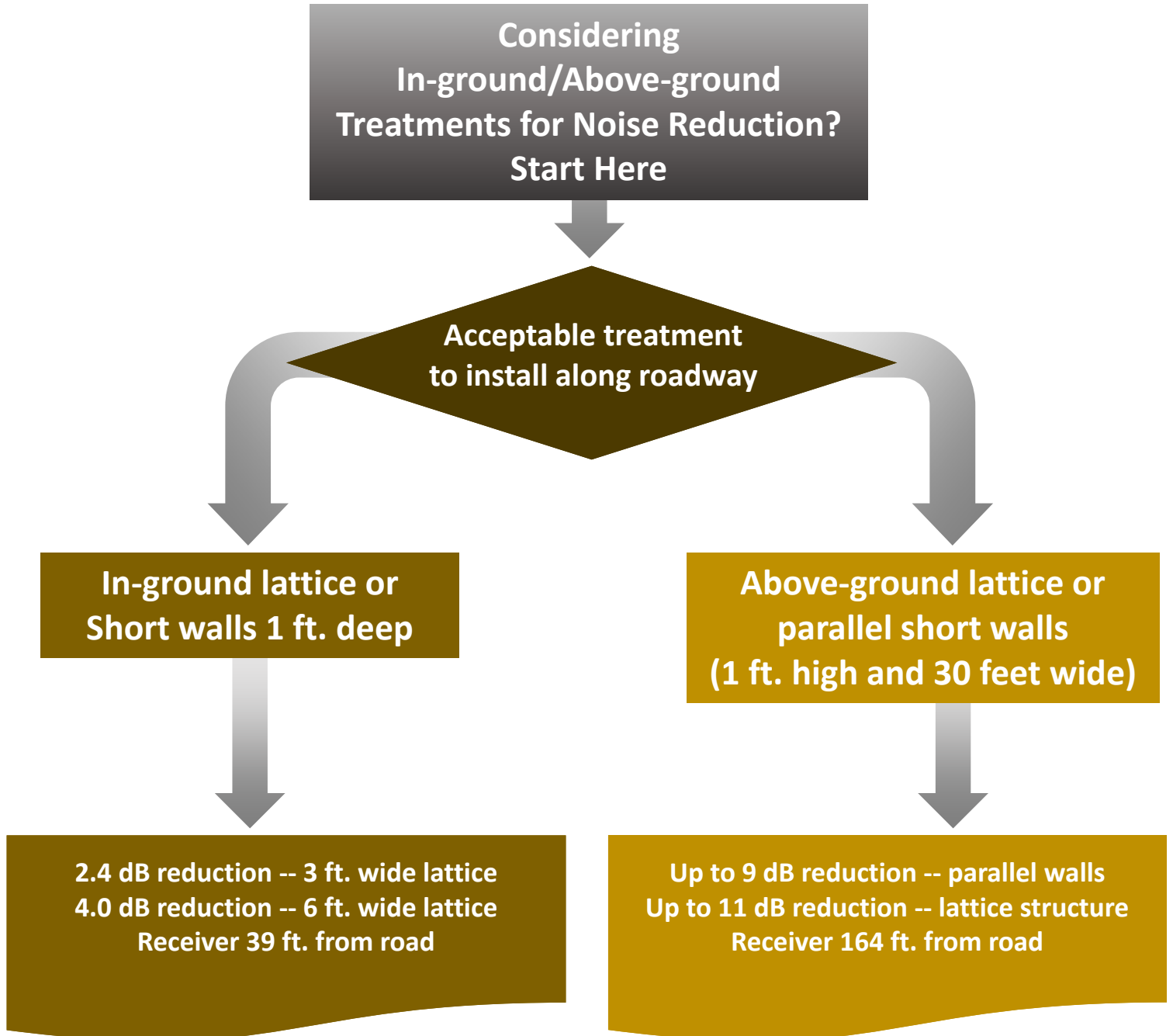
3 to 9 dB reduction @ receiver with optimized planting

In-ground/Above-ground Treatments

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

- Width of treatment is the critical consideration
- Above-ground structures may pose safety concerns placed near the travel lane
- In-ground structure may be as an extension of the shoulder



Sound Absorptive Treatment

Flow Chart to determine likely maximum noise reduction for various scenarios.

Notes:

- Absorptive treatment can provide changes in spectral content, potentially reducing adverse reactions after application

Considering Sound Absorptive Treatment for Noise Reduction? Start Here

