

Noise compliance requirements for distribution transformers

1. Brief description

This guideline outlines the acceptable placement of new distribution transformers including mobile generators which can be connected, to ensure compliance with the *Environmental Protection (Noise) Regulations 1997*.

1.1 Related policies

This guideline is made under and supports the *Safety, Health & Environment Policy (EDM 31986289)*.

1.2 Introduction

The purpose of this document is to outline the acceptable placement of new distribution transformers including mobile generators which can be connected, in the Western Power (WP) network so that they are Deemed to Comply with the *Environmental Protection (Noise) Regulations 1997* (known as the Noise Regulations). This document also provides guidance on what measures can be put in place to achieve compliance in more complex scenarios where separation distances are not able to be achieved.

1.3 Scope

This guideline is to be referenced in planning the location and placement of new distribution transformers including mobile generators which can be connected. WP will use this document to assess compliance of a proposed distribution transformer location with the Noise Regulations.

This guideline only applies to new ground mounted distribution transformers. WP has an Approval through *Regulation 17 of the Noise Regulations* that outlines compliance requirements for existing distribution transformers connected to the network.

For subdivision applications, this document should be read in conjunction with the *Western Australian Service and Installation Requirements (WASIR) (EDM 27130164)*. Pole mounted transformers are not included in this document due to their additional separation from nearby receptors in most circumstances.

Out of scope: Pole top mounted transformers

2. Context

2.1 The regulations

The Noise Regulations prescribe the allowable noise levels for residential, commercial and industrial premises. These regulations govern the level of noise that WP is allowed to emit from its facilities. The regulations prescribe assigned levels for various times of the day and include adjustments for the surrounding context, such as proximity to Major Roads (Influencing Factors), as well as for Tonal Noise. In the most stringent situations, WP is required to ensure that the noise level received from the transformers and its associated infrastructure outside neighbouring residential properties is no more than 30dB(A) (as transformers also have a 5dB(A) tonal penalty).

2.2 The development of this guideline

The Department of Water and Environmental Regulation and the Urban Development Institute of Australia (UDIA) have worked with WP to develop a simple process for both WP and external parties to use to achieve compliance with the Noise Regulations. The process is informed by planning schemes and traffic levels through the application of Influencing Factors. The approach uses a distance-based method and steps through a hierarchy of controls in order to achieve compliance.

2.3 Application

Generally, transformers are located close to residential properties to allow for efficient distribution of electricity to the public. The separation distance between the transformer and the Noise Sensitive Premises is the main factor that determines the impact at this premise. The size of the transformer and the attached mobile generator, presence of a fence or boundary wall and the amount of nearby commercial land, industrial land and Major Roads will determine the required separation distance.

3. Details

The instructions outlined in this document allows the user to work their way through each step until they have achieved compliance with the Noise Regulations. The approach is intended to be flexible to ensure that in complying with Noise Regulations, the public is not then negatively impacted (for example visual impact or the cost of compliance).

Compliance with this guideline and the Regulation 17 Approval is conditional on procurement of transformers compliant with the reduced sound power level of *AS/NZS 60076.10:2023 Power transformers Determination of sound levels* (Data calculations in this document are based on 3dB below the reduced sound power levels in the standard based on transformer sound power tests). If the transformer to be used does not meet this standard, the designer is required to demonstrate that the installed transformer and its associated infrastructure will still meet the requirements of the Noise Regulations (whether through a sufficient buffer or installed mitigation).

The designer shall provide WP with information on each development or project , documenting how each transformer and its associated infrastructure has complied with this guideline (e.g. site drawings, completed National Engineering Register (NER) Certification of noise compliance. WP may audit this information as part of the existing design conformance review process. Worked examples are included in Appendix 1 of this document.

The key steps associated with locating new distribution transformers in order to achieve compliance are outlined below.

Step 1: Determine distance from transformer to property boundary of nearest noise sensitive premise

The transformer and its associated infrastructure is Deemed to Comply if the distances in *Table 1: Separation distances* can be met.

Note: Designers must still ensure minimum fire risk separation distances are met as per the *Western Australian Service and Installation Requirements (WASIR) (EDM 27130164)* and Distribution Substation Plant Manual (DSPM).

Table 1: Separation distances

Transformer	Distance of transformer to lot boundary
1000kVA	7 metres
Up to 630kVA	5.5 metres

If the above distances cannot be achieved, move to Step 2.

Step 2: Determine distance requirements from transformer to property boundary with Influencing Factor

The Noise Regulations provide an allowance to increase the received noise levels when noise sensitive premises are located close to Major Roads and industrial or commercial precincts. This allowance is termed an Influencing Factor and is based on the amount of industrial and commercial lands, as well as the major and Secondary Roads within two defined circles – 100m and 450m from the receiving point.

The Influencing Factor can be calculated using zoning information from local structure plans, local planning schemes, town planning schemes and Main Roads traffic data. *Schedule 3 – Determination of Influencing Factor on noise sensitive premises* of the Noise Regulations provides instruction on how to calculate Influencing Factors.

The influencing factor should be considered at the design phase when locating or upgrading a distribution transformer and may reduce the distance required between a transformer and a property boundary to comply. *Table 2: Separation distances and Influencing Factors*, below, outlines the influencing factor and the distance reduction they result in.

Table 2: Separation distances and influencing factors

Influencing factor	0dB	2dB	4dB	6dB
Description of typical Influencing Factor (example)	No major or Secondary Roads, no commerce or industry within 450m	Major Road between 100 and 450m; or Secondary Road within 100m; or 20% of land within 450m is Zoned industrial; or 40% of land within 450m is Zoned commercial	Two Secondary Roads within 100m; or 1 Secondary Road within 100m and 40% of land within 450m Zoned commercial	Major Road within 100m; or 1 Secondary Road within 100m and 40% of land within 450m Zoned industrial
Multi story residence or single story, no fence - Deemed to Comply distance between transformer and property boundary	5.5m for <=630kVA transformers	4.5m for <=630kVA transformers	3.5m for <=630kVA transformers	3.0m for <=630kVA transformers
	7m for 1000kVA transformers	5.5m for 1000kVA transformers	4.5m for 1000kVA transformers	3.5m for 1000kVA transformers

Notes:

- Distances apply between the boundary and edge of the main transformer tank.
- If multiple transformers are being installed the designer is required to demonstrate that the substation will still meet the requirements of the Noise Regulations.
- If the premises has already been built, this distance can be measured to the nearest Habitable Room.

If the above distances are met, it is Deemed to Comply. If the above distances cannot be achieved, move to Step 3.

Step 3a: Determine Noise Affected Area (with fence)

If the distance between the transformer and the property boundary is less than the distances outlined in Step 1 and Step 2, the installation of a fence or barrier is an effective way to reduce noise levels and therefore reduce the required separation distance. It will be necessary to determine the Noise Affected Area to see whether compliance can be achieved. To obtain the full effect, the fence must be solid, with no gaps and be constructed of brick, fibro, colourbond, steel, concrete or a similar material.

Note: Where electrically conductive materials are to be, or have been, used, the potential for step touch voltages needs to be considered. For more information refer to the *Western Australian Service and Installation Requirements (WASIR) (EDM 27130164)* Section 14.4.10.3.

Table 3: Separation distances and fences, below indicates the Noise Affected Area for varying fence heights and sides.

The distances listed in the table are the Noise Affected Areas (the distance from the transformer within which it could be expected that noise from the transformer will exceed the assigned levels in the Noise Regulations). If the green highlighted distances can be achieved, the transformer is Deemed to Comply.

Table 3: Separation distances and fences

Transformer rating	Fence height above transformer (mm)	Number of fenced sides	Influencing Factor			
			0dB	2dB	4dB	6dB
			Noise Affected Area – distance (m)			
<=630 kVA	400	3	2.8	2.2	1.8	<1.5
		2	2.5	2	1.7	<1.5
		1	2.2	1.8	<1.5	<1.5
	800	3	2.2	1.8	<1.5	<1.5
		2	2	1.7	<1.5	<1.5
		1	1.8	<1.5	<1.5	<1.5
1000 kVA	400	3	3.5	2.8	2.2	1.8
		2	3.1	2.5	2	1.7
		1	2.8	2.2	1.8	<1.5
	800	3	2.8	2.2	1.8	<1.5
		2	2.5	2	1.7	<1.5
		1	2.2	1.8	<1.5	<1.5

Note: Distances apply to the edge of the main transformer tank. Interpolation of table figures is permitted for fence heights in between 400mm and 800mm above the transformer height.

How to use and interpret Table 3: Separation distances and fences

- If there is a premise already established:
 - The Regulation 17 Approval provides that an exceedance is permitted so long as the Noise Affected Area does not intrude into a Habitable Room within the noise sensitive premise. An intrusion is only considered likely if a Habitable Room has, or is likely to have, a window (of 1m² area or greater) within the Noise Affected Area.
- Where there is no premise established:

- As the *Residential Design Codes (R-codes)* do not permit a Major Opening to a habitable area to be located within 1.5m of the boundary of the lot, and the minimum distance permitted between a transformer and a lot boundary is 0.7m, a minimum of 2.2m separation will be achieved in most circumstances.
- Therefore, all Noise Affected Areas calculated at 2.2m or less (green cells) will automatically be Deemed to Comply and no further action is required.
- If the size of the Noise Affected Area is greater than 2.2m, the area may be reduced by raising the height of the boundary fence (as per 'Fence height above transformer (mm)' column in *Table 3: Separation distances and fences*).
- As the goal is to protect the occupants of a future property, WP will require evidence that a fence will ultimately be included once a premise is established. This may be in the form of a model contract, statutory declaration or similar.

If the above criteria are met, it is Deemed to Comply. If the above criteria cannot be met, move to Step 4.

Step 3b: Determine Noise Affected Area (without fence)

Alternatively, developers or designers may choose to apply special design controls to the affected lots (in lieu of fencing or in the case of non-standard fencing which does not provide the required mitigation) to comply. If this is the case, refer to Step 4 for guidance. Compliance with the Regulation 17 Approval will still need to be demonstrated when submitting the standard assessment template.

Step 4: Other noise mitigation methods

Where the Noise Affected Area is or is likely to intrude into a Habitable Room, further measures are required to achieve compliance.

Existing noise sensitive premises

Where a building is already present, noise control measures must be implemented to reduce the Noise Affected Area in order to achieve compliance. Control measures may include treatments at the premise (e.g. double glazing or other noise reduction treatments) or at the transformer (e.g. barrier or enclosure). Verification that an alternative treatment method meets the requirement of the Regulation 17 Approval shall be submitted to WP.

Future noise sensitive premises

Where a building is not yet present (e.g. in new developments) a planning measure will need to be put in place to ensure that the design of the building is carried out in such a way that a Habitable Room is not impacted by a Noise Affected Area. This may take the form of a notification on the title (e.g. 70A of the *Transfer of Land Act 1893*) or – if there is a Detailed Area Plan (DAP) in place – a clause in the DAP. The notification should identify the noise affected portion of the lot (i.e. the Noise Affected Area). A suggested notification could read as follows:

- A small portion of this lot may be affected by noise from a distribution transformer located near to the property boundary. The building design must ensure that windows of Habitable Rooms are acoustically treated or not located within <<<distance to be determined using Table 1: Separation distances and Table 2: Separation distances and Influencing Factors in this document and advised to Western Power in the application form>>> metres of the lot boundary adjacent to the transformer.

4. Dictionary

Words in the first column of the following table are defined terms and have the corresponding meaning shown in the second column of the table. Defined terms appear in this document as capitalised.

Defined term	Meaning
Approval	means the <i>Environmental Protection (Western Power Electrical Distribution Transformer Noise Emissions) Approval 2014 (EDM 43478480)</i>
Deemed To Comply	For this guideline, this means based on instructions provided in this document, the location of the transformer is considered to be compliant with the Regulations.
Detailed Area Plan (DAP)	These are design guidelines approved by individual councils under their structure plan provisions.
Guideline	Statements or practices aimed at streamlining a particular business process according to a set routine or sound practice. Guidelines can be mandatory or optional.
Habitable Room	As per the State Planning Policy 3.1: Any room used for normal domestic activities that includes bedrooms, living rooms, lounge rooms, music room, sitting rooms, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio. Excludes: Bathroom, laundry, water closet, food storage pantry, walk in wardrobe, corridor, hallway, lobby, photographic dark room, clothes drying room, veranda, unenclosed swimming pool or patio or other spaces of a specialised nature occupied neither frequently nor for extended periods of time.
Influencing Factor	An adjustment to assigned noise levels for noise sensitive premises located close to Major Roads and industrial or commercial precincts, outlined in Schedule 3 of the Noise Regulations.
Major Opening	As per the State Planning Policy 3.1: A window, door or other opening in the external wall of a Habitable Room that provides an external means of light or view for that room, but does not include openings that: <ul style="list-style-type: none"> • In aggregate do not exceed 1 square metre in any such wall (provided that adjoining or continuous windows at the junction of two walls forming an internal angle of 90 degrees or less shall be aggregated. • Are glazed in an obscure material and are unable to be opened or have a sill height of not less than 1.6 metres above floor level.
Major Road	As per Schedule 3 of the Noise Regulations, Major Roads are those with an estimated average daily traffic count of >15,000 vehicles. Roads that are planned to have a volume above these thresholds may be used to adjust the Influencing Factor for distribution transformers.
Noise Affected Area	Means distance measured from the casing of a transformer within which the noise emissions from the transformer are likely to exceed the assigned levels specified in the Noise Regulations.
Noise Regulations	Means the Environmental Protection (Noise) Regulations 1997
Notification on Title	Means a notification to be placed on a certificate of title to inform future design takes into account Noise Regulations compliance.
Noise sensitive premises	As defined in Schedule 1 Part C of the Noise Regulations, key examples include premises occupied solely or mainly for residential or accommodation purposes. A full list is provided in the Schedule.

Defined term	Meaning
Residential Design Codes (R-Codes)	State Planning Policy 3.1. The R-Codes outline the design requirements which apply to residential development. They are used as the basis for assessing residential subdivision and development proposals. Further information is available: <ul style="list-style-type: none"> https://www.wa.gov.au/government/document-collections/residential-design-codes
Regulation 17 of the Noise Regulations	Process of seeking variation to the Noise Regulations where a person is of the opinion that he or she cannot reasonably or practicably comply with a standard prescribed under the Noise Regulations, or that a proposal of that person will not be reasonably or practicably capable of complying with that standard, that person may apply to the Minister for approval to allow the emission of noise in that case to exceed or vary from the standard.
Secondary Road	As per Schedule 3 of Noise Regulations, Secondary Roads are those with an estimated average daily traffic count of 6,000 – 15,000 vehicles. Roads that are planned to have a volume above these thresholds may be used to adjust the Influencing Factor for distribution transformers.
Tonal Noise	Measured noise limits are automatically increased if the levels are deemed to be tonal in nature (described as a ‘whining’ or ‘droning’ characteristic) as measured under section 9 of the Noise Regulations. Distribution transformers are generally tonal in nature.
Western Australian Service and Installation Requirements (WASIR)	Provides guidance and assistance in planning and achieving a new development or connection to Western Power’s distribution network.
Zone	Means land use zoning as shown in a Local Planning Scheme, Town Planning Scheme or an approved Local Structure Plan.

5. References

- AS/NZS 60076.10:2023 Power transformers Determination of sound levels
- Environmental Protection (Noise) Regulations 1997
- Residential Design Codes: <https://www.wa.gov.au/government/document-collections/residential-design-codes>
- Transfer of Land Act 1893

6. Related documents

Title	EDM reference
Environmental Protection (Western Power Electrical Distribution Transformer Noise Emissions) Approval 2014	43478480
Noise compliance requirements for distribution transformers guideline consultation register	42639104
Safety, Health & Environment Policy	31986289
Western Australian Service and Installation Requirements (WASIR)	27130164
Distribution Substation Plant Manual	See Depot Pack

7. Review

This guideline will be reviewed and evaluated by the content owner at least once in every three year period taking into account the purpose of the guideline and the outcome of the compliance review.

8. Content owner

Full name	Role title	Business unit
Paul Rogoysky	Environmental, Safety and Planning Assessments Team Leader	Safety, Health and Environment

9. Content approver

Full name	Role title	Business unit
Sue Nesci	Assurance Manager	Safety, Health and Environment

10. Approval history

Version	Approved by	Date of approval	Notes
1.0	Steven Hayward, SHE Governance Manager	16/12/2014	Initial issue.
2.0	Acting Head of Safety, Environment, Quality and Training	28/12/2017	Minor updates to clarify distances and updated template.
3.0	Gordon East, Assurance Manager	24/08/2021	Three year review: <ul style="list-style-type: none"> Replaced WADCM with WASIR. <i>Table 3: Separation distances and fences</i> and related text updated to shade values of 2.2m green. This follows advice that the minimum separation of TX to lot boundary is 0.7m rather than 0.6m. Therefore, the min separation is $0.7+1.5=2.2\text{m}$.
4.0	Sue Nesci Assurance Manager	11/09/2024	Update to state that the requirement apply to the distribution transformer and associated infrastructure. This includes mobile generators which can be connected to it.

11. Accountabilities

Head of Safety, Health and Environment Accountable for the development, maintenance, and publishing of this guideline in-line with the requirements of Western Power's SHE Management System and, so far as reasonably practicable influencing compliance with the arrangements prescribed by the details within this guideline.

If you have any questions in relation to this guideline, please contact either the Assurance Manager or the Environmental, Safety and Planning Assessment Team Leader.

Appendix 1 – Worked examples for distribution transformers including mobile generators which can be connected

The maps are indicative only and illustrate the concept of Influencing Factors from Major Roads, required separation distances and when memorial on titles may be required.

Please refer to the body of this document for further description of these concepts and WP compliance requirements for distribution transformer noise.

Example 1

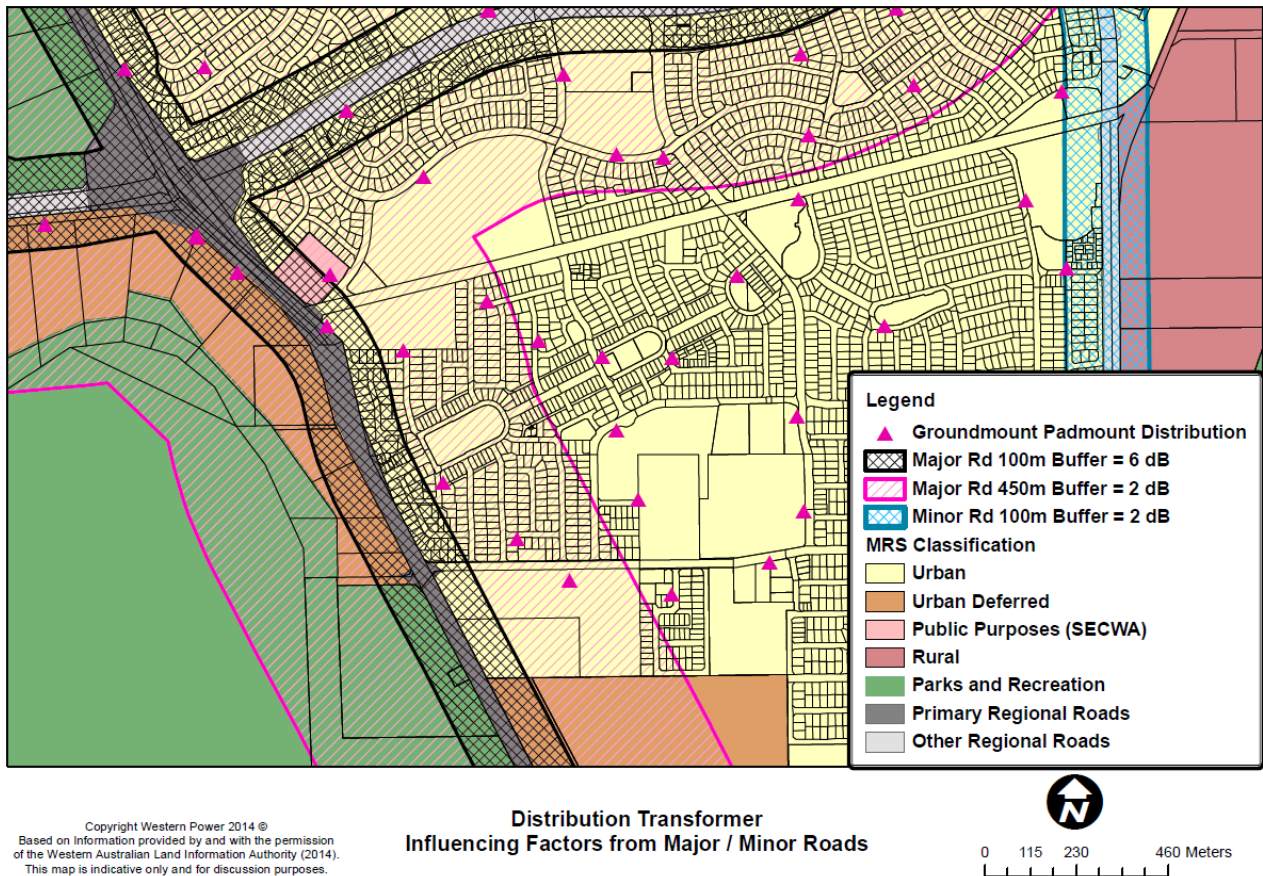


Figure 1 - Influencing Factor from Roads

Residents that live within 100m from a minor road and up to 450m from a Major Road (carriageway) will receive between 2-6dB(A) allowance known as an Influencing Factor. This translates into a reduction in the required buffer distance.

Example 2

The width of a local road carriageway is sufficient to provide the required buffer distance between a transformer and noise sensitive premise. In this example, the transformer has been placed in public open space however any non-sensitive premise (such as the carpark of a local shopping centre) could be used.

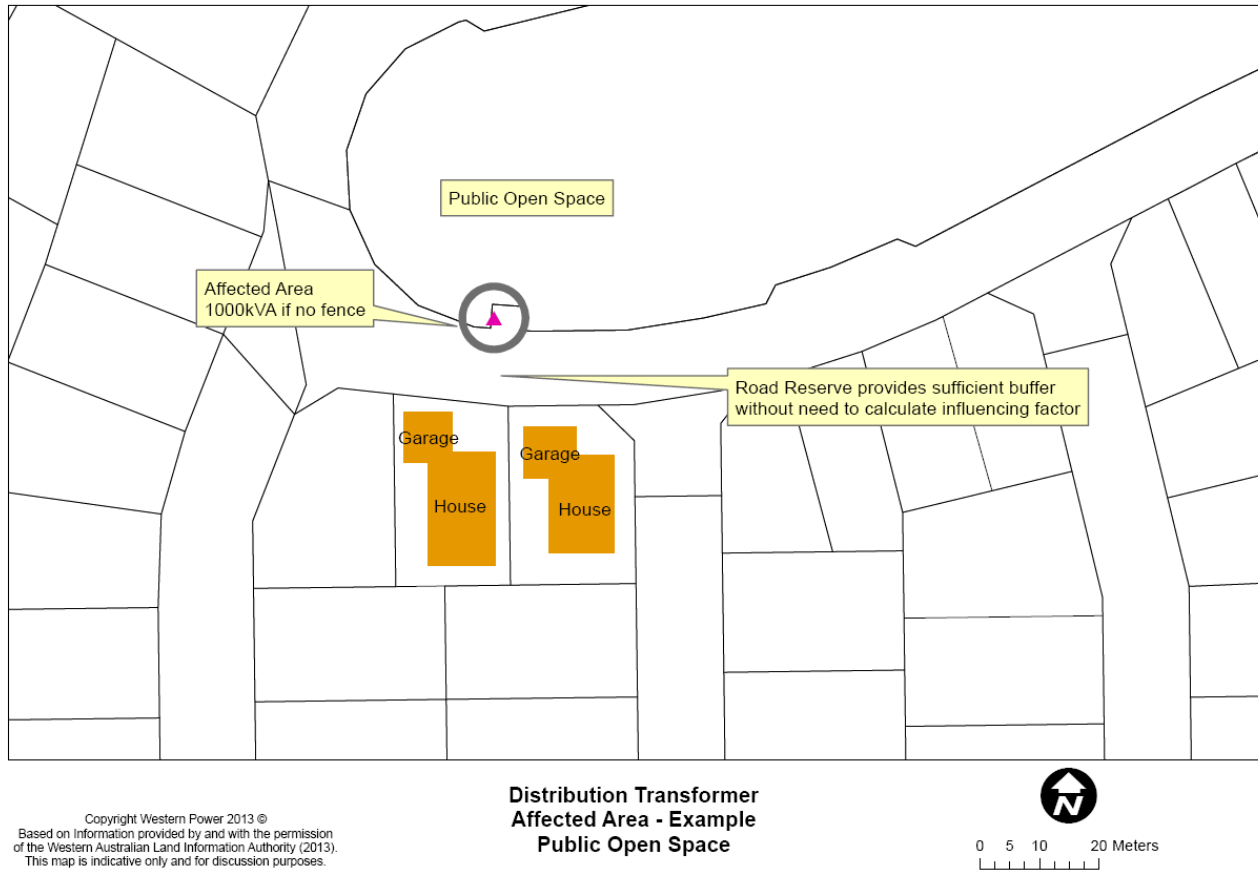


Figure 2 - Using roads to provide required buffers

The width of a local road carriageway is sufficient to provide the required buffer distance between a transformer and noise sensitive premise. In this example, the transformer has been placed in public open space however any non-sensitive premise (such as the carpark of a local shopping centre) could be used.

Example 3

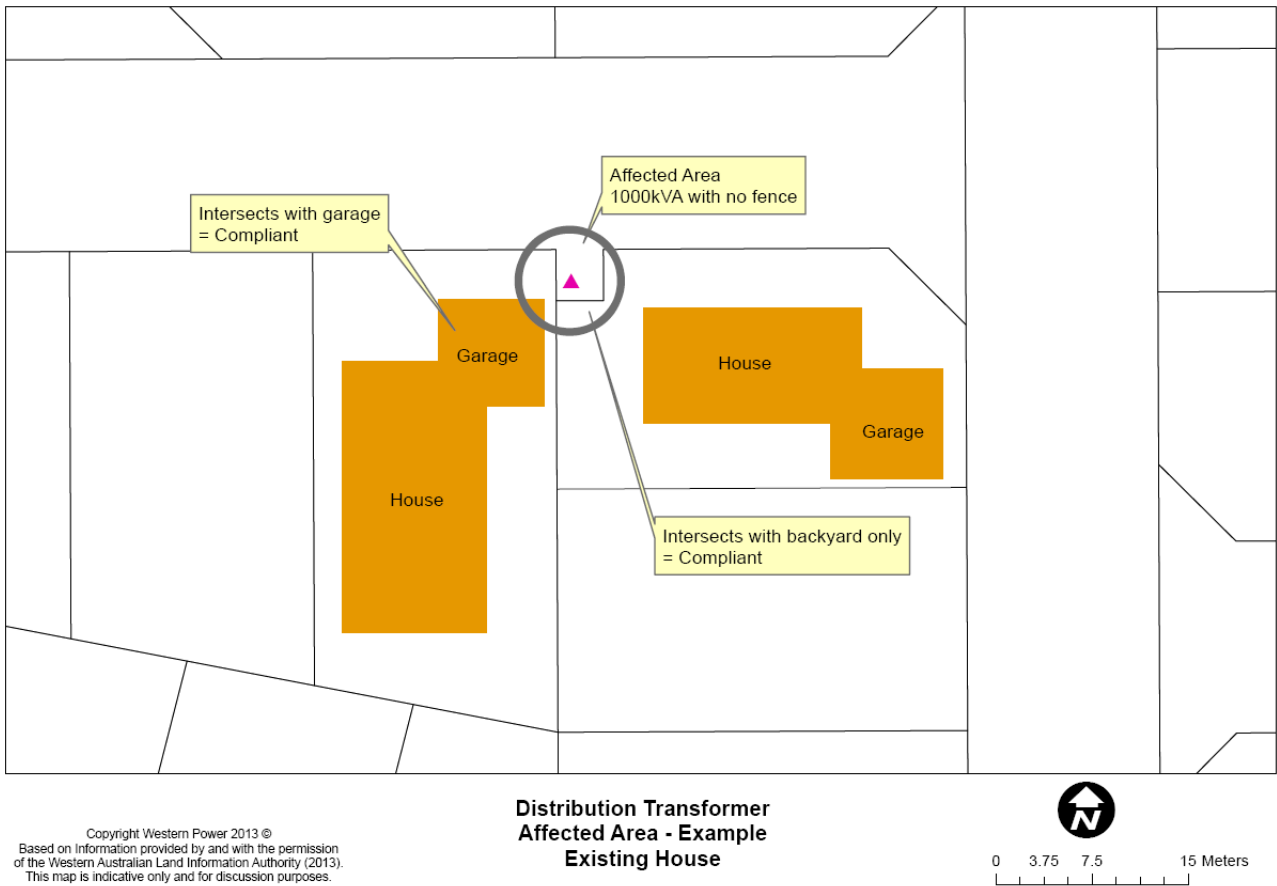


Figure 3 - Transformer between existing premises

There is no longer a requirement to meet the compliance levels in non-habitable areas such as garages, backyards, laundries and toilets. In this example, the transformer is sufficiently far enough from the habitable areas of the premise, meaning the design is compliant.

Example 4

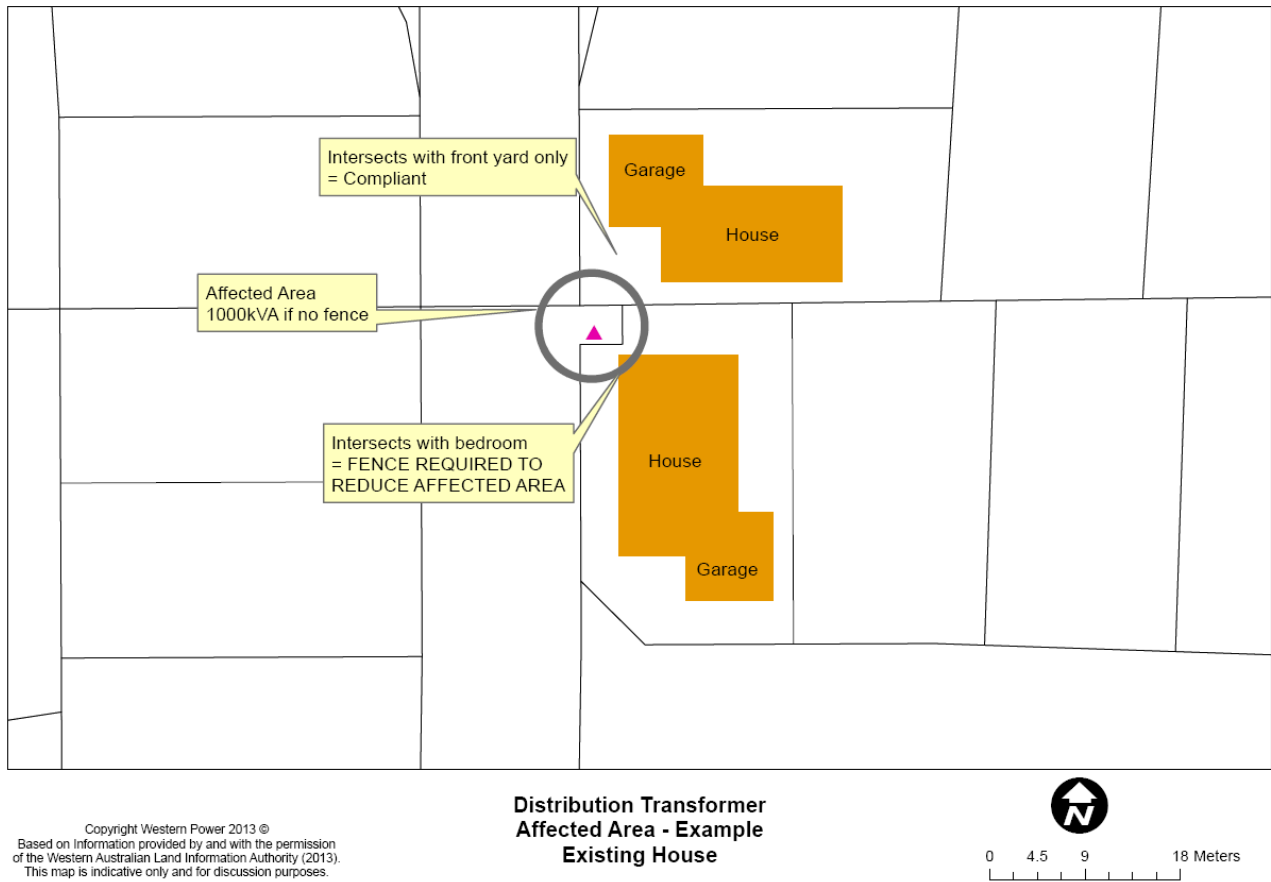


Figure 4 - Transformer between existing premises requiring fence

In this example, the affected area includes a habitable area of the premise. Therefore mitigation, such as a fence is required for the design to be compliant.

Example 5

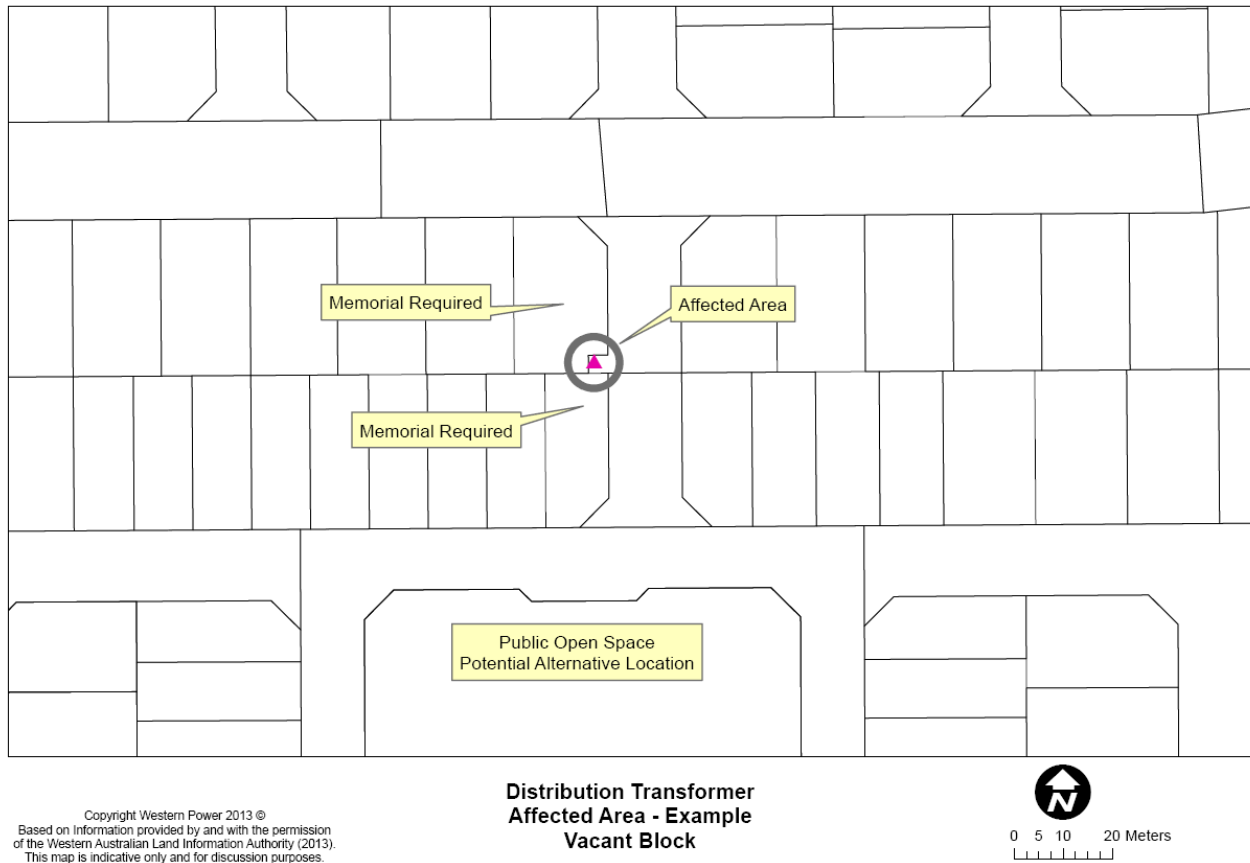


Figure 5 - Undeveloped land

In this example, no premises have been constructed and there is potential for non-compliance as the affected area around the transformer extends into the residential lot. The site would become non-compliant if a habitable area was built in this Zone. To make the design compliant, the land holder must be made aware of the potential for transformer noise