

CONCRETE CULVERT DESIGN AND DETAILING MANUAL



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Book Descriptions:

concrete culvert design manual

It eliminates the lengthy computations previously required. The manual includes standard installations using the indirect design method. More than 330 pages of tables and figures covering hydraulics of sewers and culverts, live loads and earth loads, supporting strengths and supplemental design data are listed. Detailed example problems of specific applications illustrate the use of the time saving design aids included in the manual. The Design Manual is a companion volume to the CONCRETE PIPE HANDBOOK. The Concrete Pipe Design Manual includes a hardbound book with accompanying CD ROM. If thus required, Refer to district specific If corrosion resistant Do not apply the edge beam requirement Precast box culverts may be designed. Precast concrete box culvert will be used in this design tutorial. It is typically used for conveying water and also frequently used for pedestrian or cattle underpasses. Currently, most box culvert installations are provided in precast form due to the huge reduction of time for place production and construction. These include Hydraulics of Precast Concrete Conduits Pipes and Box Culverts 4.4 MB A detailed guideline to assist engineers with the hydraulic design of concrete culverts in Australia and New Zealand. The manual includes the theoretical concepts of hydraulic design, as well as containing the appropriate design aspects for runoff, culverts, drains, sewers and pressure pipes. This manual considers the design concepts required for such types of application, as well as installation design characteristics. Only where this is not possible shall the location of stormwater pipes within private property be considered. In such cases the pipe shall be located so as not to reduce the building area available on the lot i.e. <http://cargolift-bg.com/userfiles/945gcm7-l-manual.xml>

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located as close as possible to a boundary or where it can be shown that a satisfactory house location site is available clear of the pipe, and that access points have been allowed for, suitably placed so that access will be available postdevelopment. Where stormwater pipes are installed adjacent to wastewater pipes within the berm or under the footpath, they shall preferably be installed on the carriageway side of the wastewater pipe. The order of preference for the location of stormwater pipes is summarised as follows 1. Within overland flow path 2. Road reserve and other public land 3. Shared accessway 4. As close to the property boundary as is practicable, and parallel to the boundary. Pipelines adjacent to boundaries, structures and foundations shall be located at least a distance equal to the depth to invert away from such boundaries and the edge of such structures and foundations with an absolute minimum clearance of 1m in all cases Refer to drawing SW22 in Appendix B. The stormwater network layout shall ensure the following a Access to all parts of the reticulation shall remain available for inspection and maintenance. Adequate spacing of manholes, access points and access chambers shall be provided for regular maintenance and inspections including CCTV inspection, water jetting, root cutting and grouting. These will require specific design and approval. Horizontally or vertically curved pipelines will require specific design and approval by the council. Service crossings of open stormwater channels or watercourses shall be installed beneath the channel or watercourse. Design live loads shall be HNHO72 for motorways and arterial roads, HN for local streets and driveways, and 20kN wheel load for nontrafficable areas. The minimum acceptable support type shall be H2 as shown in drawing SW03 in Appendix B. The use of higher support types to reduce pipe class shall be subject to specific design and council approval. http://goraku-sangyo.com/userfiles/945gct-m-v1_0-manual.xml

The use of free flowing granular materials for pipe embedment as shown in drawings SW02 and

SW03 in Appendix B is recommended to reduce compaction stresses on pipes. Will be approved for use following demonstration of satisfactory specific design. The upstream point of a public main shall start at a manhole, nonaccess chamber or catchpit, and shall terminate at a manhole or outlet. If a capacity assessment indicates that 225mm is too small, the pipeline shall be a public main instead of a branch line. The cover shall be not less than 600mm including during the development of the site. In the road reserve the cover shall be not less than 1000mm. Where the reticulation pipelines are laid in the front yard of lots and the lots are elevated above the carriageway, the minimum cover on the pipelines within the lot area shall be 600mm below the adjacent road level. Cover mm Location where specific design shows no additional cover is required 600 Front yard of lot where the lot is elevated above the carriageway 600 below finished surface level of carriageway Road reserve 1000 For special cases and with agreement from Auckland Council, cover can be reduced by using higher class pipe, special bedding, concrete protection or a combination of these. Within these limits, the maximum gradient shall not exceed 25% 1 in 4, and the minimum gradient shall not be less than 0.1% 1 in 1000 for all pipes. Gradients outside these limits shall be at the council's discretion. The design of culverts shall comply with Auckland Transport Code of Practice ATCOP and the following criteria a The culvert shall be designed to cater for the flows and water levels generated by the 1% AEP event without affecting upstream or downstream property. The headwater pond created by the 10% AEP event shall not be higher than the soffit of the pipe.

The secondary flow path design shall assume the total blockage of the culvert in cases where it is less than 1500mm in diameter, and 50% blockage of the culvert where it is greater than or equal to 1500mm in diameter. The risk of blockage resulting from the contributing catchment shall be assessed on a casebycase basis this includes situations where a safety grille or trash screen is used to determine if specific culvert design including consideration of a secondary inlet is required. For all culverts to be maintained by Auckland Transport, markings shall be in accordance with ATCOP requirements. Refer to ATCOP for special requirements adjacent to roads. This shall include, but not be limited to access to inlet and outlet for inspection, debris removal and scour protection maintenance, and any other activities stated in the operation and maintenance manual. Note that culverts for private vehicle crossings i.e. serving a private property within the road reserve will be owned and maintained by the property owner. 4.3.9.9. Inlets and Outlets Where a pipeline discharges into a natural or constructed waterway, or vice versa, consideration shall be given to energy dissipation or losses, erosion control, and land instability. For outlets, the design shall ensure nonscouring velocities at the point of discharge. Design of inlet and outlet structures in highamenity open space areas requires additional consideration to achieve a sympathetic and unobtrusive design. Auckland Council Community Services Department is to be consulted when the outlet is located in public reserve land. Direct discharge to a waterway or the sea may require a discharge permit from the council unless authorised by a Network Discharge Consent held by the council, or a permitted activity under the relevant plans. Refer to Auckland Transport Code of Practice ATCOP. With respect to health and safety, all inlets to the stormwater network greater than 375mm diameter shall be fitted with a safety grille.

The inlet grille shall be specifically designed and requires Auckland Council approval. The grille shall have a clear opening of 100mm between bars. Note that grilles are not required on manholes or, generally, at the inlet to a culvert. Culvert inlets are not generally screened for safety reasons. When designing inlets to culverts, debris screening may be required as discussed in Section 4.3.9.8 above. However, a risk assessment shall be undertaken on each culvert and the surrounding catchment to ascertain if a grille is required to prevent accidental entry to the culvert. If a grille is required, provision shall be made for the effects of debris buildup against that grille. There shall also be suitable access for maintenance personnel and for any mechanical plant required to remove debris buildup from the grille. Similarly, for tidal outfalls, peak flow may or may not coincide with

extreme high tide levels. A full dynamic analysis and probability assessment may be required. In circumstances where a flap valve or flood gate is necessary, specific design and approval from the council is required. Sea level rise shall be taken into account in design see Section 4.3.5.8. 4.3.9.11. Subsoil Drains All subsoil drains to provide land stability are considered to be private and should be self-contained within the individual lot. Where private subsoil drains are installed behind a retaining wall, subsoil drains shall discharge into a silt trap before connecting into the public drainage system via the private connection pipe. Retaining walls shall be positioned to ensure that subsoil drainage will be capable of connecting into the drainage system at the public connection point. Where gradients of pipes are in excess of 20%, anchoring will be required to prevent movement. Anchor blocks also help to prevent Bedding scour Migration of fine granular particles Separation of joints Transfer of groundwater through the backfill material surrounding the pipe.

<https://www.arquetopia.org/images/canon-a1-manual-battery.pdf>

In situations where anchor blocks are to be implemented, pipelines shall be laid from downstream to upstream with sockets facing upstream. Spacings between anchor blocks shall not exceed 6m, measured centre to centre. Waterstops Where a pipeline is to be installed between an area with a high water table and an area with a lower water table or in tidally affected areas, transfer of groundwater through the backfill material in the reinstated trench is likely to occur. A waterstop shall be used to prevent transfer of groundwater where required. For pipelines up to 750mm diameter, an anchor block as shown in drawing SW23 in Appendix B shall be used to provide a waterstop at a maximum spacing of 10m. Waterstops for pipelines in excess of 750mm diameter are subject to specific design and approval, including spacing. 4.3.9.13. Trenchless Technology In general, open cut trenching is the default stormwater pipe installation method. Any trenchless technology and installation methodology shall be chosen to be compatible with achieving the required gravity pipe gradients. Materials and Gradient The two types of pipe approved for trenchless installation are polyethylene and reinforced concrete. Reinforced concrete pipes shall be specifically manufactured for jacking operations. Pipe classes for each type are subject to specific design. The joints for all pipes are subject to specific approval by the council. The methodology used shall ensure that the design gradients are met along with hydraulic efficiency of the pipeline. Microtunnelling is recommended where gradients are less than 1.5%. For fusion welded polyethylene pipe, removal of internal weld beads debonding is generally not required. Acceptance Where trenchless methods of construction are used, the resulting pipeline will not be accepted if it contains sags or crests in the vertical plane which will retain flow and consequently lead to siltation in the pipeline.

<http://arredomilano.com/images/canon-a1-slr-camera-manual.pdf>

Horizontal deviation from alignment is acceptable without loss of vertical alignment provided that the maximum horizontal deviation is not more than one pipe diameter. Note that where the annulus is grouted, this profiling shall be undertaken 30 days after grouting. 4.3.9.14. Pipeline and Culvert Ownership The ownership rules in the SWCoP apply to assets vested after the publication date of the SWCoP. Where approval has been granted for a watercourse in private land to be piped and for the constructed pipe to be vested in the council, the pipe shall be deemed to be a public asset. The Manual is not part of the Unitary Plan While the Manual sits outside the Unitary Plan. We manufacture a wide range of box culverts, base slabs and link slabs. Large volumes of stormwater can be transmitted with the rectangular shape not impacting on stream flow or width. Applications stormwater culverts ducts for underground services conveyor housing pedestrian and livestock underpasses detention tanks.