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Dear Greg Yeoman

CHAMBERMaxx STORMWATER CHAMBER
STRUCTURAL LOADING TO NEW ZEALAND STANDARDS

Further to your request Dainty Alderton Consulting Engineers have carried out a Desk Top comparison of the structural loading requirements of the AASHTO HS-25 Highway Loading and the equivalent New Zealand Standards to the installed capacity of the Chambermaxx Stormwater Detention Chamber.

In general all buried flexible pipes resist external loading by a combination of stiffness of the pipe and the soil support developed as a result of deflecion under loading. This passive support provides the major portion of the total installed strength and is dependant on the type of soil, depth, and amount of compaction. Whilst the Chambermaxx is not a circular a pipe, it's successful performance also depends upon the type and depth of bedding and backfill.

Loading Standards

AASHTO Design Loading

The AASHTO HS-25 design load represents the loading that a 25 ton (50,000 lbs) semi-truck would exert onto a highway structure with it's greatest axle load being 177.9kN.

Transit Bridge Manual

The Transit (New Zealand) Bridge Manual (TBM) is applicable in terms of the design and loading requirements for major culverts and various highway structures, including items where failure would have a significant financial cost. The traffic loading within the code is refereed to as HN-HO-72 and contains a normal and a overload component. The live load factors contained within the load combination tables can be simplified as being (ULS) 2.22 Normal live load, or 1.48 Overload live load. Whilst the HO axle load is 240kN, due to the above factors the worst case loading is a 60kN wheel load.

The effect of the load which is transmitted to the chamber, from vehicle load applied at the surface of the fill diminishes as the depth of cover over the pipe increases due to the spreading of the applied live load through the soil column.

The TBM does not provide a method for calculating pressure on general buried objects, but rather specifies a specific formula for the pressure on buried corrugated metal structures [pipes and culverts] and is the HN-HO-72 live load pressure on the plan projected area of the structure. Conformation that this formula (Pv = 32H ^ -1.852 + 3.5) is applicable to Chambermaxx would need to be sort from the NZTA.

AS/NZS 2566 – Buried Flexible Pipelines

The joint New Zealand and Australian standard AS/NZS 2566 specifies a practice for the structural design and installation of buried flexible pipelines which rely upon side support to resist vertical loads. In this respect the standard may be considered relevant to the Chambermaax, and requires that vehicle loads be taken as

given in the AUSTROADS Bridge Design Code – Section 2 (unless otherwise specified by the regulatory authority). The standard does provide a method for calculating the plan projected load area at a given depth.

Design Loadings

Using data from the above codes the equivalent pressure plane at the top of the chamber has been calculated for a variety of depths. These results have then be used to establish the minimum depth of cover required in New Zealand at which the same pressure is asserted under the AASHTO requirements.

Whilst a direct comparison between the Transit Bridge Manual and the AASTO loading is difficult given there is no load distribution formula, a general comparison using both the formula for buried corrugated metal objects and the Australian Bridge Code (AS5100) load distribution has been provided – refer Table 2.

Adopting the more conservative result the minimum required cover for the chamber in an New Zealand application is calculated as being 555mm. This depth of cover results in an equivalent pressure plane as that experienced by the chamber under the HS-25 load at the manufacturer specified minimum depth of cover (457mm or 18 inches).

In addition to the above the AS/NZS2566 stipulates a minimum depth of cover for flexible pipes subject to traffic loading of 0.6m (sealed road).

Table 1 Summary

	HN-HO-72	**AASHTO HS-25**
Worst Case Wheel Load	60kN	88.98kN
Minimum cover	555mm	457mm
Live load pressure at top of chamber	243kPa	243kPa

As previously stated the total installed strength of a flexible pipe/chamber is largely dependant on the type of soil, depth, and amount of compaction. Whilst this report does not purport to have examined the manufacturer's excavation and backfilling specifications, filling within the Embedment Zone should be carried out to the highest standard applicable.

We trust that the above is satisfactory for your needs. Should you have any queries or require further information please do not hesitate to contact the undersigned at this office.

Yours faithfully
DAINTY ALDERTON CONSULTING ENGINEERS

Louise Mark BE
Engineer

APPENDIX

Table 2 Loads and Load Distributions

SUMMARY		HN-HO-72	TBM Pv = 32H^-1.852+3.5	AASHTO HS-25
Axle load		120kN		177.9kN
Worst case wheel load		60kN		88.95kN
Lane load				
Lane width		3000mm		3600mm
Dynamic impact factor	at 457mm	0.33		0.26
	at 583mm	1.32		
	at 1000mm	0.25		
Live Load Factor		2.22	2.22	1.75
Wheel length a		200mm		254mm
Wheel width b		500mm		508mm
Contact area		0.1m2		0.129m2
Load distribution		as per AS5100.2		a or b + 1.15H
Surface pressure		600kPa		689.5kPa
Factored surface pressure		1332kPa		1206.7kPa
Load area at depth H	at 457mm	0.55m2		0.81m2
	at 555mm	0.74m2		1.09m2
	at 1000mm	1.97m2		2.33m2
Live load pressure at top of chamber	at 457mm	360.5kPa	310.22kPa	**243.4kPa**
	at 524mm	265.3kPa	**242.59kPa**	206.2kPa
	at 555mm	**242.8kPa**	218.91kPa	180.0kPa
	at 1000mm	94.1kPa	78.8kPa	84.3kPa