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SKY STEEL
From here we go to the world

WAVE TYPE STEEL CLVERTPIPE
SKY STEEL

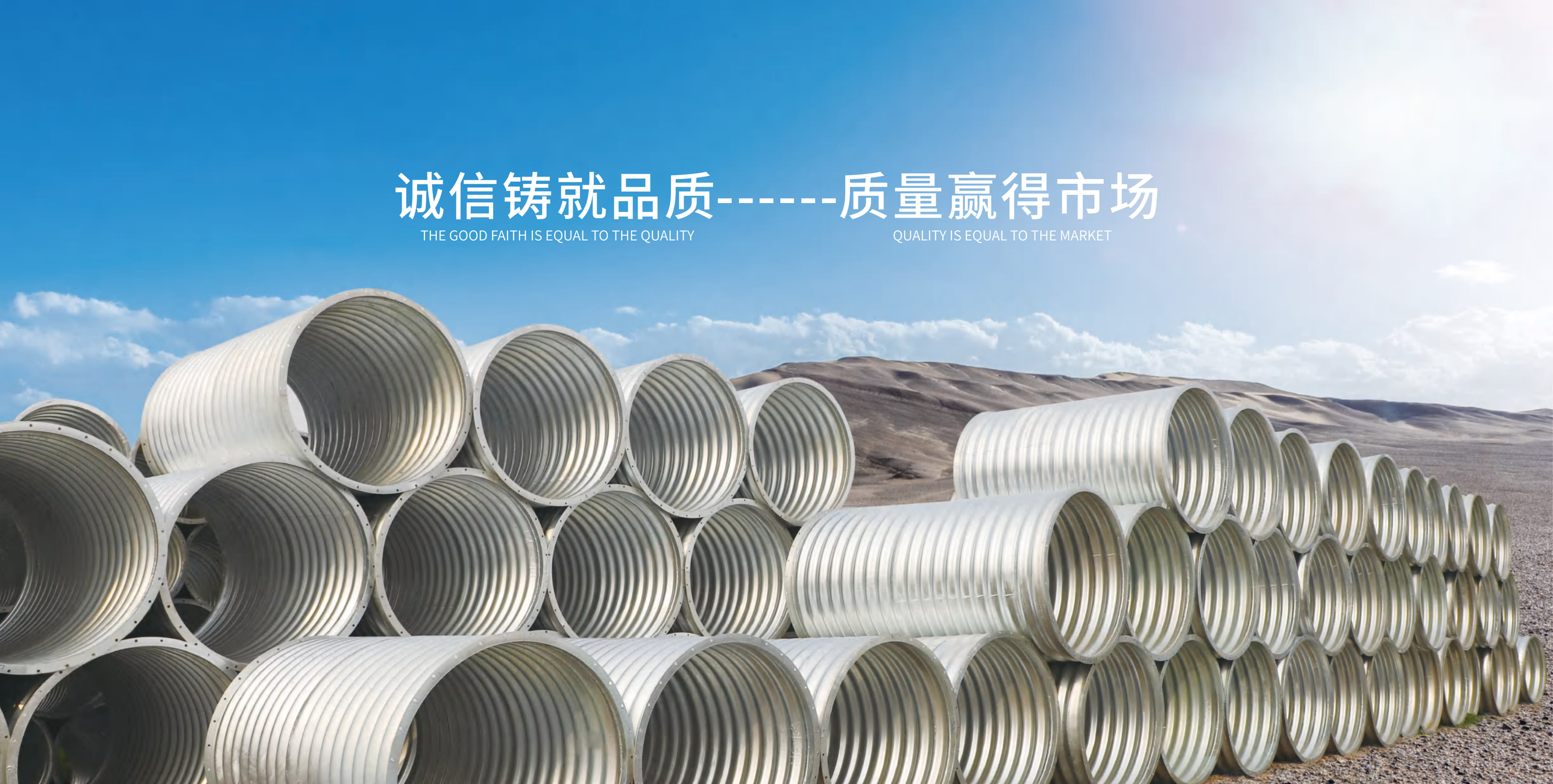
MATERIALS OF HUIDE ROAD AND BRIDGE

天钢建业有限公司

诚信铸就品质------质量赢得市场

THE GOOD FAITH IS EQUAL TO THE QUALITY

QUALITY IS EQUAL TO THE MARKET



CHARACTERISTICS OF METAL CORRUGATED CULVERT

金属波纹涵管特征

金属波纹涵管是指铺埋在公路、铁路下面的涵洞用波纹钢管，它是由Q235碳钢板卷制而成或用半圆波形钢片拼制成的圆形波纹管，在国内是一项新技术。其以性能稳定、安装方便、有利环保、造价低等优点迅速在公路施工中替代传统的钢筋混凝土，发展前景非常广阔，主要应用于公路、小桥、通道、挡土墙以及各种矿场、巷道挡墙支护、旧桥涵加固、隧道、路基排水沟、逃生舱等众多工程中。

Metal corrugated culvert pipe refers to the corrugated steel pipe used for Culverts buried under highways and railways. It is a circular corrugated pipe made of Q235 carbon steel plate or semi-circular corrugated steel sheet. It is a new technology in China. With the advantages of stable performance, convenient installation, environmental protection and low cost, it can quickly replace the traditional reinforced concrete in highway construction, and has a very broad development prospect. It is mainly used in highway, small bridge, passage, retaining wall and various mine, roadway retaining wall support, old bridge reinforcement, tunnel, subgrade drainage ditch, escape chamber and many other projects.

强度高

由于其独特的波纹结构使其比同口径的水泥管耐压强度大15倍以上。

运输方便

波纹管涵的重量只有同口径水泥管的1/10到1/5，即使在狭窄的场地没有运输设备情况下，人工也可运输。

使用寿命长

金属波纹涵管是采用钢板热浸镀锌，使用寿命长，一般为80-100年，在腐蚀性特别大的环境下使用时，采用内外表面沥清附层的钢制波纹管，可在原使用寿命基础上提高约20年以上。

施工方便

波纹管涵是采用螺母螺栓固定或法兰方式连接，而且可以根据需要定制长度，即使是非熟练工也可以操作，施工以少量的手工操作，可在短时间内完成，既快捷又方便。

优良的经济性

连接方式简便，可大大缩短工期。

High Strength:
Because Of Its Unique Corrugated Structure, It Is 15 Times Greater Than That Of Cement Pipe Of The Same Diameter.
Convenient Transportation:
The Weight Of Corrugated Pipe Culvert Is Only 1 / 10 To 1 / 5 Of The Same Diameter Cement Pipe. Even If There Is No Transportation Equipment In Narrow Site, It Can Be Transported Manually.
Long Service Life:
The Metal Corrugated Culvert Pipe Is Hot Dip Galvanized With Steel Plate, So It Has A Long Service Life And A Life Of 80-100 Years. When Used In A Very Corrosive Environment, Steel Corrugated Pipe With The Inner And Outer Surface Leached The Attached Layer Can Be Used To Improve The Original Service Life For About 20 Years.
Convenient Construction: Corrugated Pipe Culvert Is Connected By Bolt Fixing Or Flange, And Can Be Customized According To The Needs. Even Unskilled Workers Can Operate. The Construction Is Done By A Small Amount Of Manual Operation, Which Can Be Completed In A Short Time, Which Is Quick And Convenient.
Excellent Economy:
Simple Connection Way, Can Greatly Shorten The Construction Period.

CLASSIFICATION OF METAL CORRUGATED CULVERT

金属波纹涵管的分类

波形钢板涵（HDHG）是代替圆管涵、盖板涵、箱涵、拱涵和小桥的优质公路建材，可用于公路铁路横向通道、坑道、涵洞、排水管道和掩体等工程。

从国内外应用情况来看，波形钢板涵具有极强的适应能力，替代传统方式具有很大的优势，应用前景非常可观。

Corrugated steel plate culvert (hdhg) is a high quality highway building material to replace circular pipe culvert, slab culvert, box culvert, arch culvert and small bridge.It can be used in highway and railway transverse passage, tunnel, culvert, drainage pipeline and Shelter Engineering.
From the application situation at home and abroad, corrugated steel plate culvert has strong adaptability.It has great advantages to replace the traditional way.The application prospect is very considerable.

HOW TO CHOOSE THE RIGHT WALL THICKNESS AND CORRUGATION TYPE

如何选择合适的壁厚和波纹型号

直径0.5—1.5m的钢波纹管涵，其最小管壁厚度为2mm。

直径2m的钢波纹管涵，其最小管壁厚度为2.75mm。

直径2.5m的钢波纹管涵，其最小管壁厚度为3.0mm。

The minimum wall thickness of steel corrugated pipe culvert with diameter of 0.5-1.5m is 2mm.

The minimum wall thickness of steel corrugated pipe culvert with diameter of 2m is 2.75mm.

The minimum wall thickness of steel corrugated pipe culvert with diameter of 2.5m is 3.0mm.

直径小于1.5m（0.5—1.25m）的钢波纹管涵，其波高为25mm，波距为75mm或125mm。

直径大于等于1.5m（1.5—2.5m）的钢波纹管涵，其波高为50mm，波距为150mm。

直径大于等于2.0m（2.0—8.0m）的钢波纹管涵，其波高为55mm，波距为200mm。

注：以上数据仅供参考，具体以施工要求为准。

The wave height and wave distance of steel corrugated pipe culvert with diameter less than 1.5m are 25mm and 75mm or 125mm respectively.

The wave height and wave distance of steel corrugated pipe culvert with diameter greater than or equal to 1.5 m (1.5-2.5 m) are 50 mm and 150 mm respectively.

The wave height and wave distance of steel corrugated pipe culvert with diameter greater than or equal to 2.0 m (2.0-8.0 m) are 55 mm and 200 mm respectively.

Note: the above data is for reference only, and the specific construction requirements shall prevail.

波形钢板涵和水泥涵管对比

COMPARISON OF CORRUGATED STEEL CULVERT AND CEMENT CULVERT

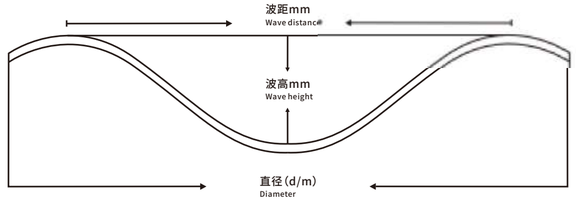
种类 Type	材质 Exture Of Material	壁厚 Wall Thickness	重量 Weight	连接方式 Connection Mode	使用年限 Service Life
水泥涵管 Cement culvert pipe	钢筋混凝土浇铸 Reinforced concrete casting	管节厚 (40mm-240mm) Pipe joint thickness (40mm-240mm)	重 Heavy	承插式连接 Socket connection	最高50年 Up to 50 years
钢波纹涵管 Steel corrugated culvert	Q235/345碳钢材质 Q235 / 345 carbon steel material	管节薄 (2.5mm-10.0mm) Thin pipe section (2.5mm-10.0mm)	轻,约为水泥管的1/10 Light, about 1 / 10 of cement pipe	法兰/承插式连接 Flange / socket connection	最高100年 Up to 100 years

1.根据涵管管径、填土高度选择波形参数

2.根据填土高度、特殊防腐要求选择钢板厚度

3.根据运输条件、安装环境选择组装方式

1. Select waveform parameters according to culvert pipe diameter and filling height
2. Select the thickness of steel plate according to the filling height and special anti-corrosion requirements
3. Select the assembly mode according to the transportation conditions and installation environment



使用防腐环境 Anticorrosive environment	波形钢板方案选择 Scheme selection of corrugated steel plate	适用特征 Applicable characteristics
弱腐蚀环境 Weak corrosive environment	普通热轧钢板+热镀锌、耐候钢 Common hot rolled steel plate + hot dip galvanized and weather resistant steel	普通桥涵、公路立交通道、城市共同沟、市政管网、无压地下排水、雨水收集、农林水利、农田灌溉、抗洪抢险等 Common bridges and culverts, highway overpass, urban common ditch, municipal pipe network, pressureless underground drainage, rainwater collection, agriculture, forestry and water conservancy, farmland irrigation, flood fighting and emergency rescue, etc
中腐蚀环境 Medium corrosive environment	普通热轧钢板+热镀锌+热浸塑、耐候钢+热镀锌 Common hot rolled steel plate + hot dip galvanizing + hot dip plastic, weather resistant steel + hot dip galvanizing	沿海地区，高盐、高碱地区，城市排污、特殊地质条件下的城市市政工程等 Coastal areas, high salt, high alkali areas, urban sewage, municipal engineering under special geological conditions, etc
强腐蚀环境 Strong corrosive environment	耐候钢+热镀锌+热浸塑、铝波纹管、不锈钢波纹板 Weathering steel + hot dip galvanizing + hot dip plastic, aluminum corrugated pipe, stainless steel corrugated plate	化工排水、排污、城市污水回收、排污管道、污水处理站等 Chemical drainage, sewage, urban sewage recovery, sewage pipeline, sewage treatment station, etc
说明 Explain	上述方案均可根据设计需要同时采用二次增涂防腐沥青或其他防腐涂层 According to the design requirements, the above schemes can be applied with secondary coating of anti-corrosion asphalt or other anti-corrosion coatings at the same time	

VARIETY TO MEET CUSTOMER NEEDS

种类齐全满足客户需求

环形整装波纹钢管涵常用型号及技术参数一览表
List of common models and technical parameters of ring integral corrugated steel pipe culvert

型号 MODEL	管径 (m) caliber(m)	壁厚 (mm) wall thickness(mm)	波纹型号 波高P (mm) /波距D (mm) Corrugated model Wave height P (mm) / wave distance D (mm)	连接方式 Connection mode
HDHGZZ-0.4	0.4	2.0，2.5,2.75，3.0,3.5,4.0	13/68,25/75,25/125	法兰连接 Flange connection
HDHGZZ-0.5	0.5	2.0，2.5,2.75,3.0,3.5,4.0	13/68,25/75,25/125	
HDHGZZ-0.6	0.6	2.0，2.5,2.75,3.0,3.5,4.0	13/68,25/75,25/125	
HDHGZZ-0.75	0.75	2.0，2.5,2.75,3.0,3.5,4.0	13/68,25/75,25/125	
HDHGZZ-0.8	0.8	2.0,2.5,2.75,3.0,3.5,4.0 4.5,5.0	13/68,25/75,25/125	
HDHGZZ-1.0	1.0	2.5,2.75,3.0,3.5,4.0,4.5 5.0,6.0	13/68,25/75,25/125 50/150,55/200	
HDHGZZ-1.2	1.2	2.5,2.75,3.0,3.5,4.0,4.5 5.0,6.0	25/75,25/125,50/150 55/200	
HDHGZZ-1.25	1.25	2.5,2.75,3.0,3.5,4.0,4.5 5.0,6.0,6.5	25/75,25/125,50/150 55/200	
HDHGZZ-1.5	1.5	2.5,2.75,3.0,3.5,4.0,4.5 5.0,5.5,6.0,6.5	25/75,25/125,50/150 55/200	
HDHGZZ-2.0	2.0	2.75,3.0,3.5,4.0,4.5,5.0 5.5,6.0,6.5	25/75,25/125,50/150 55/200,64/230	
HDHGZZ-2.5	2.5	3.0,3.5,4.0,4.5,5.0,5.5 6.0,6.5	50/150,55/200,64/230	
HDHGZZ-3.0	3.0	3.0,3.5,4.0,4.5,5.0,5.5 6.0,6.5	50/150,55/200,64/230	

注*:1.以上产品规格为常用规格　2.客户如需要其他特殊规格产品，我公司可根据技术要求进行专门设计加工

环形拼装波纹钢管涵常用型号及技术参数一览表
List of common models and technical parameters of ring assembled corrugated steel pipe culvert

型号 MODEL	管径 (m) caliber(m)	壁厚 (mm) wall thickness(mm)	波纹型号 波高P (mm) /波距D (mm) Corrugated model Wave height P (mm) / wave distance D (mm)
HDHGPZ-0.75	0.75	2.0，2.5,2.75,3.0,4.0,5.0	25/125
HDHGPZ-0.8	0.8	2.0，2.5,2.75,3.0,4.0,5.0	25/125
HDHGPZ-1.0	1.0	2.0，2.5,2.75,3.0,4.0,5.0	25/125,50/150,55/200
HDHGPZ-1.2	1.2	2.0，2.5,2.75,3.0,4.0,5.0	25/125,50/150,55/200,64/230
HDHGPZ-1.25	1.25	3.0,4.0,5.0,6.0,7.0	25/125,50/150,55/200,64/230
HDHGPZ-1.5	1.5	3.0,4.0,5.0,6.0,7.0	25/125,50/150,55/200,64/230
HDHGPZ-2.0	2.0	3.0,4.0,5.0,6.0,7.0	25/125,50/150,55/200,64/230
HDHGPZ-2.5	2.5	3.0,4.0,5.0,6.0,7.0	50/150，55/200,64/230
HDHGPZ-3.0	3.0	4.0,5.0,6.0,7.0,8.0,9.0 10.0	50/150，55/200,64/230, 110/300,140/380,150/400
HDHGPZ-4.0	4.0	4.0,5.0,6.0,7.0,8.0,9.0 10.0	50/150，55/200,64/230, 110/300,140/380,150/400
HDHGPZ-5.0	5.0	5.0,6.0,7.0,8.0,9.0,10.0	50/150，55/200,64/230, 110/300,140/380,150/400
HDHGPZ-6.0	6.0	5.0,6.0,7.0,8.0,9.0 10.0	50/150，55/200,64/230, 110/300,140/380,150/400
HDHGPZ-7.0	7.0	6.0,7.0,8.0,9.0,10.0	50/150，55/200,64/230, 110/300,140/380,150/400
HDHGPZ-8.0	8.0	6.0,7.0,8.0,9.0,10.0	64/230,110/300,140/380,150/400
HDHGPZ-9.0	9.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400
HDHGPZ-10.0	10.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400
HDHGPZ-11.0	11.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400
HDHGPZ-12.0	12.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400
HDHGPZ-13.0	13.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400
HDHGPZ-14.0	14.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400
HDHGPZ-15.0	15.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400
HDHGPZ-16.0	16.0	6.0,7.0,8.0,9.0,10.0	110/300,140/380,150/400

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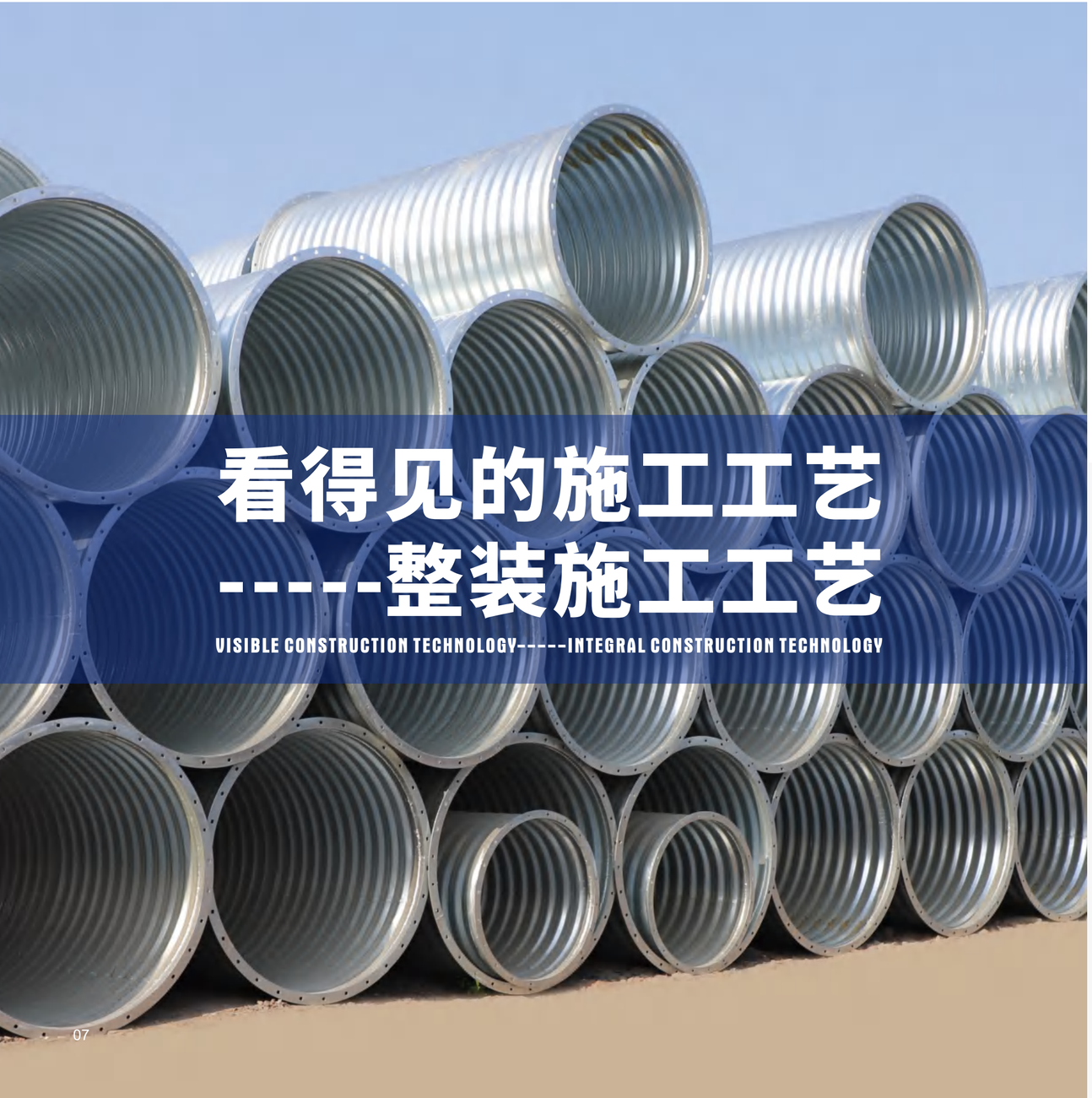


看得见的施工工艺
-----整装施工工艺

VISIBLE CONSTRUCTION TECHNOLOGY-----INTEGRAL CONSTRUCTION TECHNOLOGY

金属波纹涵管具有管节薄、重量轻、便于运输存放、施工工艺简单、现场安装方便、解决北方寒冷地区对桥梁和管涵的结构破坏问题、组装快速、工期短等优点。为防止波纹管涵锈蚀，波纹管节出厂前内外表面和紧固连接螺栓，进行了热浸镀锌处理，镀锌层厚度≥63μm，平均镀锌层厚度84μm；施工安装时增涂沥青涂层，其设计使用年限高达100年。金属波纹涵管是一种柔性结构，它建成后与周围土体形成一种组合结构，共同受力。所以波纹管涵两侧及楔形部的回填土在施工中要严格控制。

Metal corrugated culvert has the advantages of thin pipe section, light weight, convenient transportation and storage, simple construction technology, convenient on-site installation, solving the structural damage problem of bridges and culverts in northern cold areas, fast assembly and short construction period. In order to prevent corrosion of corrugated pipe culvert, the internal and external surfaces of corrugated pipe joint and fastening bolts were hot-dip galvanized before leaving factory, and the thickness of galvanized layer was more than 63 μ m. Average zinc coating thickness 84 μ m; The design service life of asphalt coating is up to 100 years. The metal corrugated culvert is a kind of flexible structure, which forms a combined structure with the surrounding soil after it is built, and bears the force together. Therefore, the backfill on both sides of the corrugated pipe culvert and the wedge part should be strictly controlled in the construction.

有设计要求时，按照设计要求开挖地基；没有设计要求时，基础垫层厚和开槽宽度参见下表，为了便于机械碾压，建议采用基础标准宽度。

When there are design requirements, the foundation shall be excavated according to the design requirements; If there is no design requirement, the thickness of foundation cushion and slotting width are shown in the table below. In order to facilitate mechanical rolling, the standard width of foundation is recommended.

地质条件	基础最小厚度(cm)		基础最小宽度	基础标准宽度
优质土地基	可直接将地基作基础		2x1.0+Ø m	2x3.0+Ø m
一般性	管径Ø<0.9m	20	2x1.0+Ø m	2x3.0+Ø m
	0.9m≤管径Ø≤2.0m	30	2x1.0+Ø m	2x3.0+Ø m
	管径Ø>2.0m	0.2Ø	2x1.0+Ø m	2x3.0+Ø m
岩石地基	20-40cm,但当填土高度大于5m 时, 填土高度每增加1.0m,其厚度 增加4cm		2x1.0+Ø m	2x3.0+Ø m
软土地基	0.3-0.5Ø或50cm以上		2x1.0+Ø m	2x3.0+Ø m

FOUNDATION EXCAVATION
挖基

1.基坑开挖应按要求进行，当基底土为淤泥等不良土层时，应换填处理，应避免超挖，如超挖，应将松动部分清除，其处理方案应报监理、设计单位批准。

2.挖至标高的土质基坑不得长期暴露，扰动或浸泡，并应及时检查基坑尺寸、高度、基底承载力。符合要求后，应立即进行基础施工。

3.各种土质地基的处理方法

3.1优质土地基

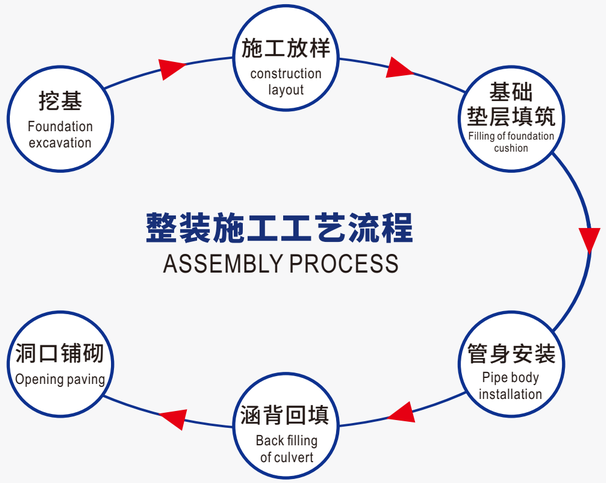
未经筛分的砂，碎石，砂砾土以及砂质土都是比较理想的地基材料，但需清除10cm以上的石块等硬物。

1. The excavation of foundation pit shall be carried out according to the requirements. When the base soil is bad soil layer such as silt, it shall be replaced, and over excavation shall be avoided. If over excavation occurs, the loose part shall be removed, and the treatment scheme shall be reported to the supervisor and design unit for approval.

2. The soil foundation pit excavated to the elevation shall not be exposed, disturbed or soaked for a long time, and the size, height and base bearing capacity of the foundation pit shall be checked in time. After meeting the requirements, the foundation construction shall be carried out immediately.

3. Treatment methods of various soil foundations

3.1 high quality land foundationUnselected sand, gravel, gravel soil and sandy soil are ideal foundation materials, but hard materials such as stones more than 10 cm need to be removed.



3.2一般性土质地基

承载能力不太高的普通地基，需设一定厚度的基础。但是，若将涵管地基槽原状土经严格夯实（其夯实度到重型击实密实度的90%以上）以后，也可直接将波纹管置于地基上。

3.3岩石地基

除设计要求有规定之外，波纹管不能直接置于岩石或混凝土基床上，因过于刚性的支承，不但会降低管壁本身所具有的良好柔性，而且还会减小涵管的承载能力。所以对岩石地基应挖掉一部分软岩，换填上一层优质土，并认真夯实。开挖软岩沟槽，不能使用烈性炸药和放深孔炮，以避免将过多的外层被炸松散。岩石风化层地基不能作为基础，需换填上3倍直径宽度的填土。

3.4软土地基

当涵管处于软土地基上时，需对软土路基进行处理，然后，在其上填一层大于20cm厚的优质砂砾垫层，并夯实紧密。

3.2 general soil foundationFor ordinary foundation with low bearing capacity, a certain thickness of foundation is needed. However, if the undisturbed soil of culvert trench is strictly compacted (the compaction degree is more than 90% of the heavy compaction degree), the corrugated pipe can also be directly placed on the foundation.

3.3 rock foundationIn addition to the design requirements, the corrugated pipe can not be directly placed on the rock or concrete foundation bed. Because of too rigid support, not only the good flexibility of the pipe wall itself will be reduced, but also the bearing capacity of the culvert pipe will be reduced. Therefore, for the rock foundation, a part of soft rock should be excavated, replaced with a layer of high-quality soil, and carefully tamped. When excavating soft rock trench, it is not allowed to use high explosive and deep hole gun to avoid too much outer layer being blown loose. The foundation of rock weathering layer can not be used as the foundation, so it needs to be replaced with 3 times of the diameter width of the fill.

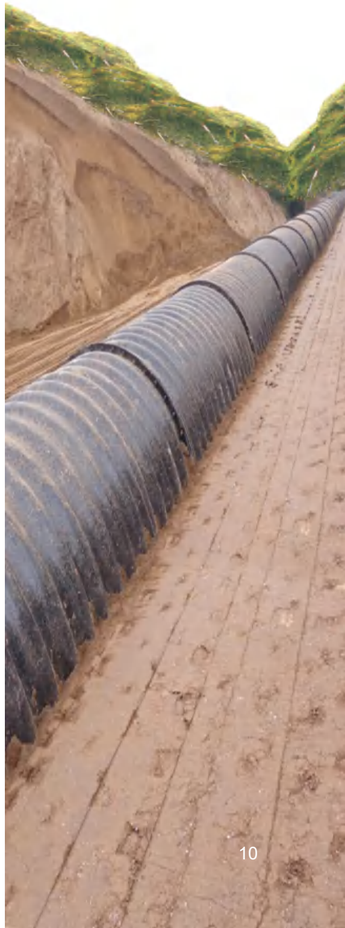
3.4 soft soil foundationWhen the culvert pipe is on the soft soil foundation, it is necessary to treat the soft soil subgrade, and then fill it with a layer of high-quality gravel cushion with a thickness of more than 20cm, and tamp it tightly.

4.预留拱度

埋设于一般土质地基上的波纹管，经过一段时间后，常会产生一定的下沉，而且往往是管道中部大于两端。因此，铺设于路堤下的波纹管的管身要设置预留拱度。其大小根据地基土可能出现的下沉量，涵底纵坡和填土高度等因素综合考虑，通常可为管长的0.2%~1%，以确保管道中部不出现凹陷或滑坡。

4. Reserved camber

After a period of time, the corrugated pipe embedded on the general soil foundation will often sink, and the middle part of the pipe is larger than both ends. Therefore, the reserved camber should be set for the pipe body of the corrugated pipe laid under the embankment. The size of the pipe can be 0.2% - 1% of the pipe length, which can ensure that there is no depression or landslide in the middle of the pipeline.



CONSTRUCTION LAYOUT
施工放样

对施工场地进行平整，安排布置各种材料堆放场地，组织所需机械设备。施工前组织测量人员根据设计文件放出管涵轴线，打好中边桩，在涵管中轴线和基础范围边缘撒上白色灰线，测出原地面高度。

The construction site shall be leveled, various material stacking sites shall be arranged, and necessary mechanical equipment shall be organized. Before construction, the surveyor shall set out the axis of the pipe culvert according to the design documents, drive the middle side pile, sprinkle the white gray line on the axis of the pipe culvert and the edge of the foundation range, and measure the original ground height.

FOUNDATION CUSHION FILLING
基础垫层填筑

基础垫层材料采用碎石土或砂砾填筑。

The foundation cushion material is filled with gravel soil or gravel.

PIPE BODY INSTALLATION
管身安装

一、安装前准备工作

1.1 备齐安装工具及所需配件：梅花扳手（16-18和22-24）、活口扳手、小撬棍（φ16mm长度50cm左右的圆钢）、撬杠（φ50mm长度1.8m左右的钢管）、手锤、凿子、螺丝刀（一字型）、千斤顶、螺丝及橡胶石棉垫、绑丝0.5kg。

1.2 检测波纹涵管各管节的累计长度、直径是否与该处涵洞相符合。

1.3 涂刷沥青

涵管出厂时，涵管及配套附件已通过镀锌处理，其镀锌厚度大于等于63微米，在没有盐碱水或有害工业废水浸泡以及涵管内经常流水的情况下，其镀膜即可防止锈蚀。

1、Preparation before installation

1.1 complete installation tools and accessories: ring spanner (16-18 and 22-24), open end spanner, small crowbar (φ 16mm long round steel (about 50cm long), crowbar (φ 50 mm steel pipe with length of about 1.8 m), hammer, chisel, screwdriver (straight), Jack, screw, rubber asbestos pad and binding wire 0.5 kg.

1.2 check whether the cumulative length and diameter of each pipe section of corrugated culvert are consistent with the culvert.

1.3 painting asphalt

When the culvert pipes leave the factory, the culvert pipes and supporting accessories have been galvanized, and the thickness of galvanizing is greater than or equal to 63 microns. In the case of no saline alkali water or harmful industrial wastewater immersion and frequent running water in the culvert pipes, the coating can prevent corrosion.

两种涂刷剂的配合比和涂刷方法如下

The mixing ratio and brushing method of the two brushing agents are as follows

含有石棉纤维的厚沥青涂料。 Thick asphalt coating containing asbestos fiber.	沥青与煤油的拌合物涂料。 Mixture coating of asphalt and kerosene.
涂料的溶剂是高质量的沥青，石棉粉的含量≥30%。喷涂方法：可用气压喷涂，或毛刷涂刷，每次喷涂层厚7mm~8mm，喷涂用量为1KG/㎡左右。被喷涂物表面应特别干爽，无油污。涂刷在废水浸泡或常水位以下部分的涵管。 The solvent of the coating is high quality asphalt, and the content of asbestos powder is more than 30%. Spraying method: air pressure spraying or brush painting can be used, each spraying layer thickness is 7mm ~ 8mm, spraying amount is about 1kg / ㎡. The surface of the object to be sprayed shall be dry and free from oil stain. Brush the culvert pipe immersed in waste water or below the normal water level.	涂料沥青与煤油之配合比为54：46，使用此涂料时应涂刷2遍，使涂刷层总厚度达到0.4mm~0.5mm，涂刷用量为0.6Kg/㎡。有条件时用喷枪喷涂，效果更好，涂刷部位与上述相同。 The mixture ratio of asphalt and kerosene is 54:46. The coating should be applied twice to make the total thickness of coating layer reach 0.4mm ~ 0.5mm, and the amount of coating is 0.6kg/㎡. If conditions permit, spraying with spray gun is better, and the brushing position is the same as above.

1.4检查基础平整度、坡度和标高以及涵管的轴线和进、出水口的方向是否符合设计要求，并注意端头管节和中间管节的位置。管涵的安装必须按照正确的轴线和图纸所示的坡度铺设。

1.5设涵管安装指挥员一名，负责指挥起吊及施工人员现场操作。

二、安装操作方法

2.1 根据涵洞实际情况，排放涵管，安装时从一侧排放第一根管节，使其管子中心和基础纵向中心线平行，同样把第二根管放置就位，当两根管相邻法兰间相距3-5cm的缝隙时，用小撬棍对准法兰上的螺栓孔，使其两根管法兰上的螺栓孔对正，这时从第二节管的另一端用撬杠撬动管节，使其纵向平移，使两法兰间距在2cm左右，然后全部穿上螺栓，拧上螺丝，但不要紧固螺栓，开始镶嵌石棉垫。此后依此方式逐节依次连接。

2.2 镶石棉垫：由于现场地势等原因，有时相邻两法兰之间间距较小，这时用手锤、凿子把两法兰之间凿开大约1cm的缝隙，用螺丝刀把石棉垫镶在两法兰之间，（石棉垫镶在螺栓内侧）有时管子顶部两法兰间距较大，石棉垫镶嵌困难，用绑丝把石棉垫绑在螺栓上固定，然后工人开始对称锁紧螺丝。直至从外观看两法兰之间只有2-5mm的缝隙即可。

2.3 用千斤顶校正整道涵管，使其中心在所规定的的中心线上。

三、安装注意事项

管身安装应紧贴在砂砾垫层上，使管涵能受力均匀。基础顶面坡度与设计坡度一致，并且在管身沿横向设预留拱度，以确保管道中部不出现凹陷或逆坡。

管节全部拼装完成后，应检查管节位置是否符合设计要求。

1.4 check whether the foundation flatness, slope and elevation, the axis of culvert pipe and the direction of water inlet and outlet meet the design requirements, and pay attention to the position of end pipe joint and middle pipe joint. Pipe culverts must be installed in accordance with the correct axis and the slope shown on the drawings.

1.5 a culvert installation commander shall be set to direct the lifting and site operation of construction personnel.

2、How to install

2.1 according to the actual situation of the culvert, discharge the culvert pipe. During installation, discharge the first pipe section from one side to make the pipe center parallel to the longitudinal center line of the foundation. Similarly, place the second pipe in place. When there is a gap of 3-5cm between the adjacent flanges of the two pipes, use a small crowbar to align the bolt holes on the flange to align the bolt holes on the two pipe flanges, At this time, pry the pipe section from the other end of the second section of pipe with a crowbar to make it move longitudinally, so that the distance between the two flanges is about 2cm, then put on all the bolts and screw on the screws, but do not tighten the bolts, and start to inlay the asbestos pad. After that, they are connected one by one in this way.

2.2 asbestos pad: due to the terrain of the site and other reasons, sometimes the distance between the two adjacent flanges is small. This is to use a hammer and chisel to open a gap of about 1cm between the two flanges, and use a screwdriver to insert the asbestos pad between the two flanges (the asbestos pad is embedded in the inner side of the bolt). Sometimes the distance between the two flanges at the top of the pipe is large and it is difficult to insert the asbestos pad, so the asbestos pad is fixed on the bolt with binding wire, Then the worker began to lock the screws symmetrically. When viewed from the outside, there is only 2-5mm gap between the two flanges.

2.3 correct the whole culvert pipe with Jack to make its center on the specified center line.

3、Installation precautions

The pipe body shall be installed close to the gravel cushion to make the pipe culvert bear uniform force. The top slope of the foundation is consistent with the design slope, and a reserved camber is set along the transverse direction of the pipe body to ensure that there is no depression or adverse slope in the middle of the pipe.

After all pipe joints are assembled, check whether the position of pipe joints meets the design requirements.

PIPE BACK BACKFILL
管背回填

一、为保证管底的回填质量，管底楔形部位处的回填可采用5种方案：

1.采用粗沙“水密法”振荡器密实。

2.采用级配良好的天然砂砾（含水量要求比最佳含水量大2%左右），人工用木棒在管身外向内侧进行夯实，木棒作用点必须紧贴管身，每个凹槽部位都必须夯实到位。

3.采用液态粉煤灰回填。

4.采用轻型混凝土回填。

5.最大粒径不超过3cm的级配碎石回填，然后用小型夯实机械斜向夯实，确保管底的回填质量。

二、涵背两侧的部位回填采用级配良好的天然砂砾或与路基同材料的回填料。在管身最大直径两侧30cm外使用18T压路机碾压，30cm范围内使用小型夯实机械夯实，以避免压路机等大型机械设备对管涵的撞击。

三、填筑时应分层填筑、分层压实，松铺厚度为20cm，压实度要求达到95%方可进行下层填筑。

四、填筑必须在涵管两侧同步对称进行。

五、管顶填土厚度大于或等于0.5m时，才允许施工运输车辆通过。

六、管体两侧及顶部2米范围内不允许使用强夯机械。

(1)In order to ensure the quality of backfilling at the bottom of the pipe, five schemes can be adopted for the backfilling at the wedge-shaped part of the bottom of the pipe

1. Adopt coarse sand "water density method" for compaction.

2. The natural gravel with good gradation (the water content is about 2% higher than the optimal water content) shall be used, and the wooden stick shall be used to tamp the outside and inside of the pipe body manually. The action point of the wooden stick must be close to the pipe body, and each groove must be tamped in place.

3. Backfill with liquid fly ash.

4. Light concrete backfilling is adopted.

5. The graded crushed stone with the maximum particle size less than 3cm shall be backfilled, and then the small tamping machine shall be used to tamp obliquely to ensure the backfill quality at the bottom of the pipe.

(2)Natural gravel with good gradation or backfill with the same material as subgrade shall be used for backfilling at both sides of culvert back. 18t roller shall be used to roll the pipe 30cm away from the maximum diameter of the pipe, and small tamping machine shall be used to tamp the pipe within 30cm to avoid the impact of large mechanical equipment such as roller on the pipe culvert.

(3)When filling, it should be filled and compacted layer by layer. The thickness of loose paving should be 20cm, and the compaction degree should reach 95%.

(4)The filling must be carried out simultaneously and symmetrically on both sides of the culvert.

(5)Only when the thickness of the filling soil on the top of the pipe is greater than or equal to 0.5m, can the construction transportation vehicles pass through.

(6)It is not allowed to use dynamic compaction machinery within 2 meters of both sides and top of the pipe.

OPENING PAVING AND SLOPE PROTECTION
洞口铺砌及护坡防护

洞口采用端墙型式或与路基同坡率的斜口形式。洞口铺砌及护坡防护为M7.5浆砌片石，应选择几何尺寸相对长和短的石块交错在同一层使之形成错锁结构，保证错缝砌筑，不得出现竖缝、通缝。外露面要选择石块质地适当，细致色泽均匀，无风化剥落无裂纹的大石块进行凿面凿纹，以确保工程外露面的平整和准确的几何尺寸。

The opening adopts the end wall type or the inclined opening with the same slope rate as the subgrade. The opening paving and slope protection are M7.5 mortar rubble. The stones with relatively long and short geometric dimensions shall be staggered in the same layer to form a staggered lock structure to ensure staggered joint masonry, and no vertical joints and through joints shall be allowed. The stone should be selected for the exposed surface with proper texture, fine color and even color, and large stone blocks without weathering and peeling and crack to chisel the surface to ensure the flatness and accurate geometric dimension of the exposed surface of the project.

看得见的施工工艺
-----拼装施工工艺

VISIBLE CONSTRUCTION TECHNOLOGY-----ASSEMBLY CONSTRUCTION TECHNOLOGY

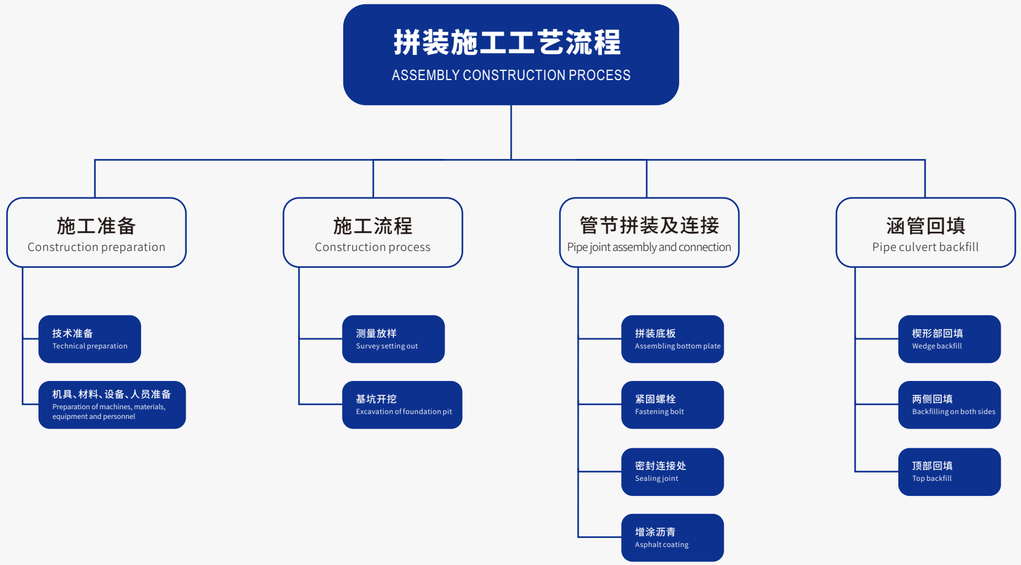
SKY STEEL
From here we go to the world

拼装波纹涵管是由多片波形板片用螺栓螺母固定拼接而成，具有板片薄，重量轻，便于运输存放，施工工艺简单，现场安装方便，解决北方寒冷地区对桥梁和管涵结构的破坏问题，具有组装快速，工期短等优点。进行纵向连接成型。连接螺栓采用M20,8.8级高强度螺栓及弧形垫圈，边缝及螺栓用密封胶处理，钢板表面采用热浸镀锌。组装完成后用喷涂沥青。洞口铺砌及护坡采用M7.5浆砌片石铺砌或采用钢筋混凝土浇筑洞口。

钢波纹管涵是一种柔性结构，它建成后与周围土体形成一种组合结构，共同受力。波纹管涵楔形部及两侧的回填土很关键，如果回填不密实或有楔形部中空或局部有大石块直接作用于管体，将出现局部有较大变形或局部有凸起，存在安全隐患，严重的可能会造成质量事故，所以波纹管涵两侧及楔形部的回填土在施工中要严格控制。

The assembled corrugated culvert pipe is composed of several corrugated plates which are fixed and spliced with bolts and nuts. It has the advantages of thin plate, light weight, convenient transportation and storage, simple construction technology, convenient on-site installation, solving the damage problem of bridge and pipe culvert structure in northern cold area, and has the advantages of fast assembly and short construction period. The longitudinal connection molding is carried out. M20, 8.8 high strength bolts and arc washer are used for connecting bolts. Edge seams and bolts are treated with sealant. The surface of steel plate is hot-dip galvanized. Spray asphalt after assembly. M7.5 mortar rubble is used for paving and slope protection of the portal or reinforced concrete is used for pouring the portal.

The steel corrugated pipe culvert is a kind of flexible structure. It forms a combined structure with the surrounding soil after it is completed. The joint stress is the key to the wedge-shaped part and the backfill soil on both sides of the corrugated pipe culvert. If the backfill is not dense or there is a wedge-shaped part hollow or local large stones directly acting on the pipe body, there will be local large deformation or local bulge, which will cause potential safety hazards, Serious may cause quality accidents, so the backfill on both sides of corrugated pipe culvert and wedge part should be strictly controlled in the construction.



CONSTRUCTION PREPARATION
施工准备

技术准备
Technical preparation

1、熟悉相关规范、图纸，掌握钢波纹管涵的设计要求。
2、放样测量出基础的平面位置控制点，根据控制点弹出管涵位置线。
3、在施工组织设计中明确钢波纹管涵的施工流程。
4、施工前向施工班组及技术人员进行书面技术、安全、环保交底。

1. Familiar with relevant specifications and drawings, master the design requirements of steel corrugated pipe culvert.
2. Set out and measure the plane position control points of the foundation, and pop up the position line of pipe culvert according to the control points.
3. In the construction organization design, the construction process of steel corrugated pipe culvert should be clarified.
4. Before construction, the construction team and technical personnel shall be provided with written technical, safety and environmental disclosure.

机具、材料、设备、人员准备
Preparation of machines, materials, equipment and personnel

1、钢筋钩子、撬棍、扳子、汽车吊、墨斗、尺子、钢丝绳等。
2、人员进场计划：钢波纹管施工部分计划进场人员20人，现场施工管理人员2人。在工程开工前一次性全部进齐。
3、设备进场计划：挖掘机2台，装载机2台，运输车4台，25吨吊车2台，发电机4台。分布在沿线各处，完全可满足钢波纹管涵施工要求。

1. Steel hook, crowbar, wrench, truck crane, ink bucket, ruler, wire rope, etc.
2. Personnel mobilization plan: 20 personnel and 2 on-site construction management personnel are planned for steel bellows construction. All of them shall be completed at one time before the commencement of the project.
3. Equipment mobilization plan: 2 excavators, 2 loaders, 4 transport vehicles, 2 25t cranes and 4 generators. It is distributed along the line and can fully meet the construction requirements of steel corrugated pipe culvert.

CONSTRUCTION PROCESS
施工流程

测量放样
Survey setting out

管涵施工前，首先应准确定出管涵中心及纵横轴线。基坑边坡坡度可依土质情况按设计和规范要求所列基坑坑壁坡度适当放陡。基坑宽度与涵洞基础的尺寸相同，放边桩应考虑换填厚度，一次放够尺寸。

Before the construction of pipe culvert, the center and vertical and horizontal axis of pipe culvert shall be determined accurately. The slope of foundation pit slope can be steep according to the soil conditions according to the design and specification requirements. The width of foundation pit is the same as that of culvert foundation. The replacement thickness shall be considered for the side pile laying, and sufficient size shall be placed at a time.

基坑开挖
Excavation of foundation pit

采用人工配合机械开挖的办法，对开挖深度小，土质较好地段边坡可放陡甚至垂直开挖，对开挖深度较深，有水的地方，以稳定边坡为主，依土质情况以1:0.5至1:1之间的坡比进行放坡，弃土统一运往弃土场。基坑边缘需要堆放的材料设备等必须距离基坑壁1米以上，以免应坑壁受压引起坑壁坍塌伤人。

The excavation depth is small and the slope in the better soil section can be steep or vertical excavation by manual and mechanical excavation. For the places with deep excavation depth and water, the slope shall be stabilized mainly, and the slope ratio between 1:0.5 and 1:1 shall be carried out according to the soil conditions, and the spoil shall be transported to the spoil site. The material and equipment to be piled at the edge of the foundation pit must be more than 1 m away from the foundation pit wall to avoid the collapse of the pit wall and injury caused by the pressure of the pit wall.

不同地质条件下的基底处理

砂砾石、碎石土地基	基底可不作处理，只在其设置10cm厚的粗砂垫层并满足压实度要求。
一般地基	一般地基（指地基为粘土、轻亚粘土、亚粘土、细纱及破碎岩层时）采用具有一定级配的天然砾石换填30cm并满足压实度要求；但在寒冷冰冻地区，基底应采用非冻胀材料如砂砾石进行换填，换填厚度为0.8倍冻土厚度且不小于60cm。
岩石地基	超挖30~40cm(当填土高度大于5m时，填土高度每增加1m,其超挖厚度增加4cm),然后采用砂砾石换填并满足压实度要求。
软土地基	先按路基上的软基处理方式（如塑料插板、碎石桩等）进行处理，然后再开挖基础，基底采用砂砾石材料换填，厚度为0.3~0.5倍管径，且不小于50cm。
需要进行基底换填时	砂砾石垫层应分层压实，压实度不小于规范要求，对于高寒季节性冻土地区，应重视基础换填材料，特别是对粉黏粒含量应严格控制，以防产生冻胀破坏，基础材料应采用具有一定级配的天然砂砾石 最大粒径不能超过50mm，0.074mm以下粉黏粒含量不得超过3%。
若当地砂砾石材料缺乏时	可采用换填碎石、砾石或河砂及碎石土，但填料应满足最大粒径要求（不大于50mm)和抗冻胀要求。

Basement treatment under different geological conditions

(1) Sand gravel, gravel soil foundation

The base can be treated without treatment, only 10cm thick coarse sand cushion shall be set and the compaction degree requirements shall be met.

(2) General foundation

The general foundation (refers to the clay, light clay, clay, yarn and broken rock stratum) is replaced with natural gravel with certain gradation and meets the requirements of compaction degree; However, in cold and frozen areas, the foundation should be replaced with non frost heaving materials such as sand gravel, with the replacement thickness of 0.8 times the thickness of frozen soil and not less than 60cm.

(3) Rock foundation

Over excavation is 30-40cm (when the height of fill is greater than 5m, the overbreak thickness increases 4cm for every 1m increase of filling height), and then gravel is used to replace and fill and meet the requirements of compaction.

(4) Soft soil foundation.

The foundation shall be treated according to the soft foundation treatment method (such as plastic insert plate, gravel pile, etc.) on the subgrade, and then the foundation shall be excavated. The foundation shall be replaced with sand gravel material, with a thickness of 0.3-0.5 times of pipe diameter and not less than 50cm.

(5) When the foundation is required to be replaced

The gravel cushion shall be compacted in layers, and the compaction degree shall not be less than the specification requirements. For the frozen soil areas with high cold season, the foundation replacement materials shall be paid attention to, especially the content of silt shall be strictly controlled to prevent frost heaving damage. The maximum particle size of natural sand gravel with certain gradation shall not exceed 50mm, The content of clay particles of powder under 0.074mm shall not exceed 3%.

(6) If the local sand gravel materials are lack

The replacement of gravel, gravel or river sand and gravel soil can also be used, but the filling shall meet the requirements of maximum particle size (not more than 50mm) and frost resistance.

管节拼装及连接
Pipe joint assembly and connection

1、施工前准备：检查涵管底部平整度、标高及基础预拱度的设置，确定涵管的位置、中心轴线、中点。

(1) Preparation before construction: check the flatness, elevation and pre camber setting of the culvert pipe bottom, and determine the position, central axis and midpoint of culvert pipe.

2、拼装底板：以中心轴线、中点为基准，第一张波纹板定位，以此为起点向两侧延伸，直至涵管进出口两端；第二张板叠在（搭接长度为50mm)第一张板上面，对正连接孔。螺栓由内向外插入螺孔，对面套上垫圈螺母，用套筒扳手预紧螺母。

(2) Assembling the bottom plate: Based on the center axis and the midpoint, the first corrugated plate is positioned, and extends to both sides from this point to both ends of culvert pipe inlet and outlet; The second plate is overlapped on the first plate (the lap length is 50mm), and the connection hole is aligned. Insert the bolt hole from the inside and out, and insert the washer nut opposite the bolt, and pre tighten the nut with the socket wrench.

3、拼装环形圈由下向上顺次拼装：搭接部分上板覆盖下板，圆周向连接采用阶梯形，即上面二块板的连接叠缝与下面二块板的叠缝错位，连接孔对正后，用螺栓由内向外插入螺孔，用套筒扳手预紧螺母。

(3) Assembly ring is assembled from bottom to top in sequence: the upper plate of the lap part covers the lower plate, and the circular connection adopts the stepped shape, that is, the joint overlap of the upper two plates is staggered with the overlap joint of the lower two plates. After the connection holes are aligned, insert the screw holes from the inside and outside with the bolts, and pre tighten the nuts with a socket wrench.

4、每米长度拼装成型后，要测定截面形状，达到标准再继续拼装，达不到标准应及时调整。圆周向拼装到环形圈合拢时，测定截面形状，采用定位拉杆固定，调整预紧螺栓，拼装波纹管。

(4) After assembling and forming each meter length, the section shape shall be determined, and the assembly shall be continued after reaching the standard. If the standard is not reached, it shall be adjusted in time. When assembling to ring ring closing in circumferential direction, determine the section shape, fix with positioning rod, adjust the pre tightening bolt and assemble bellows.

5、涵管拼装全部完成后，用定扭汽动扳手，按扭力矩135.6~203.4N · m紧固所有螺栓，依次序，不得遗漏，紧固后底螺栓用红漆标示。所有螺栓（包括纵向和环向接缝）应在回填之前拧紧，保证波纹的重叠部分紧密地嵌套在一起。

(5) After the culvert pipe assembly is completed, fasten all bolts with fixed torque steam spanner, and tighten all bolts with the torque of 135.6-203.4n · m, and sequence them in sequence, and the bolts at the rear end shall be marked with red paint. All bolts, including longitudinal and circumferential joints, shall be tightened before backfilling to ensure that the overlapping parts of the ripples are closely nested together.

6、为保证达到螺栓扭力矩的要求值，在回填之前随机抽取结构上纵向接缝上2%的螺栓，用定扭扳手进行抽检试验。如果有任一螺栓扭力矩值范围达不到规定值，则应抽检纵向和环向接缝所有螺栓的5%。如果上述抽检试验均满足要求，则认为安装是合格的。否则应重新复核，以确定测到的扭力矩值是否满足要求。

(6) In order to ensure the required torque of bolts, 2% of the bolts on the longitudinal joints of the structure are randomly selected before backfilling, and the sampling test is carried out with fixed torque wrench. If any bolt torque value is not within the specified value, 5% of all bolts in longitudinal and circumferential joints shall be sampled. If all the above sampling tests meet the requirements, the installation is considered to be qualified. Otherwise, recheck to determine whether the measured torque value meets the requirements.

7、外圈搭接处螺栓拧紧并符合要求后，为防止波形钢板板缝和螺栓孔处渗水，在钢板连接处和螺栓孔处采用专用密封材料密封，以防波纹板连接处渗水。

(7) After the bolts at the outer ring lap are tightened and meet the requirements, in order to prevent water leakage at the joint of corrugated steel plate and bolt hole, special sealing materials are used to seal the joint and bolt hole of steel plate to prevent water leakage at the joint of corrugated plate.

8、安装完毕后，在管内外均匀涂刷两道沥青，沥青可为热沥青或乳化沥青，沥青涂层的总厚度应不小于1mm.

(8) After installation, two coats of asphalt shall be evenly applied inside and outside the pipe. The asphalt can be hot asphalt or emulsified asphalt. The total thickness of asphalt coating shall not be less than 1mm.

两侧及顶部 (0.5~2m范围内)	回填材料要求同基础换填材料一样，顶部2m以上部分采用路基填筑材料：寒冷地区两侧及顶部（0.5~2m范围内）回填材料还应满足抗冻性要求（具有一定级配的天然砂砾石，最大粒径不超过50mm,0.074mm以下粉黏粒含量不得超过3%)。
楔形部回填	钢波纹管涵的楔形部密实度很重要，回填材料采用C15砼。
涵管两侧部位回填	填土之前，可在波纹管涵两侧面用红油漆按每15cm高度作出填高标示，填筑时按标注线控制。在管身最大直径两侧50cm外采用12~18T的压路机压实，50cm范围内采用小型夯实机械夯实，以避免大型机械设备对管涵的撞击。靠近管体周围0.5米范围内，不允许有大于50mm的石块等硬物。填筑时应分层填筑、分层压实，每层压实厚度为15cm,压实度要求达到规范要求后方可进行下一层填筑。填筑必须在涵管两侧对称同步进行，两侧的回填土高差不得大于15cm。
涵管顶部回填	涵管上方当回填厚度小于50cm时采用手扶振动压路机或采用小于6t的静碾压路机压实，压实度应满足规范要求。当涵管顶填土大于50cm后，方可采用18T压路机压实，每层厚度15cm,压实度应满足规范要求。涵管没有达到最小填土高度时，严禁一切重型车辆通行。
对有端部挡墙的涵洞	从涵洞两端向结构的中心进行回填；对没有端部挡墙的涵洞，从涵洞的中心向两端进行回填。
涵管顶部及两侧2米范围内不允许使用机械进行强夯。	
从回填开始到涵顶填土结束，最终截面尺寸与组装时的尺寸差异最大不得超过2%。如截面变形量超过变形范围，应立即终止施工，查明原因，采取相应措施将变形量控制在标准要求范围内。	

(1) The backfill materials at both sides and top (within the range of 0.5 ~ 2m) shall be the same as the foundation replacement materials, and the subgrade filling materials shall be used for the part above 2m of the top. The backfill materials at both sides and top (within the range of 0.5 ~ 2m) in cold areas shall also meet the frost resistance requirements (natural gravel with certain gradation, the maximum particle size shall not exceed 50mm, and the content of silt and clay below 0.074mm shall not exceed 3%).
(2) Wedge part backfill: the density of wedge part of steel corrugated pipe culvert is very important, and the backfill material is C15 concrete.
(3) Backfilling at both sides of culvert: before filling, red paint can be used to mark the filling height on both sides of corrugated culvert according to the height of 15cm, and the filling shall be controlled according to the marking line. In order to avoid the impact of large mechanical equipment on the pipe culvert, a 12 ~ 18t roller is used to compact the pipe 50cm away from the maximum diameter of the pipe, and a small tamping machine is used to tamp the pipe 50cm away from the maximum diameter of the pipe. Within the range of 0.5m around the pipe body, hard objects such as stones larger than 50mm are not allowed. When filling, it should be filled and compacted layer by layer, the compaction thickness of each layer is 15cm, and the next layer can be filled only after the compactness meets the specification requirements. The filling must be carried out symmetrically and synchronously on both sides of the culvert, and the height difference of backfill on both sides shall not be greater than 15cm.
(4) Backfill at the top of culvert: when the backfill thickness above the culvert is less than 50cm, hand-held vibratory roller or static roller less than 6T shall be used for compaction, and the compaction degree shall meet the specification requirements. When the culvert top filling is greater than 50cm, 18t roller can be used for compaction. The thickness of each layer is 15cm, and the compaction degree shall meet the specification requirements. When the culvert does not reach the minimum filling height, all heavy vehicles are strictly forbidden to pass.
(5) For culverts with end retaining walls, backfill from both ends of the culvert to the center of the structure; For culvert without end retaining wall, backfill from the center of culvert to both ends.
(6) It is not allowed to use machinery for dynamic compaction within 2 meters of the top and both sides of the culvert.
(7) From the beginning of backfill to the end of culvert top filling, the maximum difference between the final section size and the size at the time of assembly shall not exceed 2%. If the section deformation exceeds the deformation range, the construction shall be terminated immediately, the causes shall be found out, and corresponding measures shall be taken to control the deformation within the standard range.

CULVERT PIPE INSTALLATION PROCESS

涵管安装流程

01 基础开挖
Foundation excavation

02 涵管连接
Culvert pipe connection

03 增涂沥青
Asphalt coating

04 沙砾基础
Gravel foundation

05 接缝处理
Joint treatment

06 基础回填
Foundation backfill

07 两侧回填
Backfilling on both sides

08 两侧碾压
Rolling on both sides

09 压实度检测
Compactness test

10 管顶回填
Pipe top backfill

APPLICATIONS IN VARIOUS FIELDS

各个领域的应用

公路与铁路：
涵洞、通道、小桥、隧道、明洞、涵隧大修、
临时便道、渗水井、路基排水沟

市政及建筑：
共同沟、光电缆保护、排水沟、塔吊围堰、
垂直庄外壳、城市管廊、旧结构加固

军事：
军事便道、
防空通道、疏散通道

煤矿：
矿产输送管道、
人员及采矿机械通道、竖井

民用：
电子烟道、粮食储备仓、发酵罐、风力发电、
泉水引流管、输水倒虹吸管、储水罐

Highway and Railway:
culvert, passage, small bridge, tunnel, open cut tunnel, culvert and tunnel overhaul, temporary access roadSeepage well, subgrade drainage ditch
Municipal and construction:
common ditch, optical cable protection, drainage ditch, tower crane cofferdam, vertical village shell, urban pipe gallery, old structure reinforcement
Coal mine:
mineral transportation pipeline, personnel and mining machinery channel, shaft
Civil:
electronic flue, grain storage bin, fermentation tank, wind power generation, spring drainage pipe, water inverted siphon, water storage tank
Military:
Military Road, air defense channel, evacuation channel

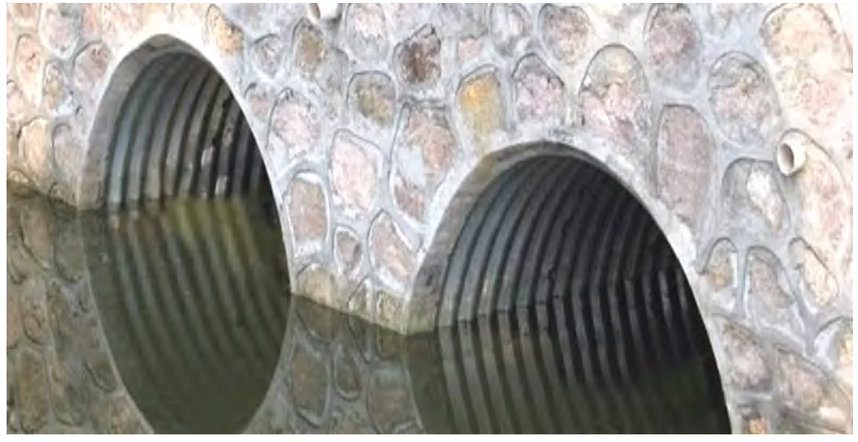
农业用储罐/Agricultural storage tank
高性能、高强度、高可靠性，施工工期短。
High strength, high reliability, short construction period.

钢波纹板库房/Corrugated steel plate warehouse
自重轻，对基础要求低，降低基础费用。
Light weight, low requirement for foundation and low cost.

OFFSHORE AREA (WEAK ACID OR ALKALINE SOIL)
近海地区（弱酸性或碱性土质）

近海地区土壤中带有弱腐蚀性，采用波形钢板涵时适当加厚管壁、安装后增涂防腐材料进行第二次防腐可使波形钢板涵管达到设计寿命。

The soil in offshore area has weak corrosivity. If the corrugated steel plate culvert is used, the pipe wall should be thickened properly, and the anticorrosive material should be added for the second anticorrosion after installation, which can make the corrugated steel plate culvert reach the design life.



PERMAFROST AREA WITH HIGH COLD
高寒常年冻土地区

波纹钢板涵施工工期短(一般一道涵洞的施工时间在1至10个工作日)，减少了多年冻土的裸露时间，冻融量小，波形钢板涵的机械性能优越，能有效解决反复冻胀引起的各种缺陷，适用于多年冻土区。

The construction period of corrugated steel plate culvert is short (generally, the construction time of a culvert is 1 to 10 working days), which reduces the exposure time of permafrost, and the amount of freezing and thawing is small. The mechanical performance of corrugated steel plate culvert is superior, which can effectively solve various defects caused by repeated frost heaving, and is suitable for permafrost area.

CULVERT QUICK REPAIR WORKS
涵洞快修工程

波纹钢板涵采用标准化设计、生产，设计简单，生产不受环境影响，进行集中工厂化生产，生产周期短，适用于质量要求高、工期紧的工程项目。

Corrugated steel culvert adopts standardized design and production, which is simple in design and free from environmental impact. It can be produced in a centralized factory with short production cycle. It is suitable for engineering projects with high quality requirements and tight construction period.

临时便道/Temporary access road

工程中遇到跨河、跨渠路段，采用波形钢板涵。

When crossing river or canal, corrugated steel plate culvert is used.

特殊构造/Special structure

可根据工程需要制作各种形式的管节。

Make all kinds of pipe joints according to the needs of the project.

傍山险路/Near mountain road

可半幅进行施工，安装速度快，施工工期短。

Half construction, fast and short construction period.

煤矿采空区/Goaf of coal mine

整体性好，可解决煤矿采空区地基沉陷导致涵洞破坏问题。

Solving the problem of foundation subsidence and culvert damage.

箱涵通道/Box culvert

装配式波纹管(板)

assembled bellows plates