幼儿园采光顶

结

构

计

算

书

审核：

设计：

校对：

2025.10

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1. 设计依据

《工程结构通用规范》 （GB55001-2021）

《钢结构设计标准》 (GB50017-2017)

《钢结构通用规范》 （GB55006-2021）

《建筑结构荷载规范》 (GB50009-2012)

《建筑抗震设计规范》 (GB50011-2010)(2016年版)

《建筑与市政工程抗震通用规范》 （GB55002-2021）

《建筑地基基础设计规范》 (GB50007-2011)

《建筑结构可靠性设计统一标准》 (GB50068-2018)

《钢管混凝土结构技术规范》 (GB50936-2014)

《钢管混凝土结构设计规程》 (CECS 28:2012)

《矩形钢管混凝土结构技术规程》 (CECS159-2004)

《钢结构焊接规范》 (GB50661-2011)

《钢结构高强度螺栓连接技术规程》 (JGJ82-2011)

1. 软件信息

3D3S Design 2022.1（上海同磊土木工程技术有限公司）

1. 结构信息
   1. 总体信息

节点总数　　　　35

支座总数　　　　14

单元总数　　　　40

材料种类　　　　1

截面种类　　　　1

荷载工况　　　　4

* 1. 几何信息



节点编号图（整体）

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 节点信息表 | | | | | | | | | |
| 节点号 | x坐标(m) | y坐标(m) | z坐标(m) | 备注 | 节点号 | x坐标(m) | y坐标(m) | z坐标(m) | 备注 |
| 1 | -2.199 | -4.002 | 9.176 |  | 2 | -2.199 | -1.002 | 8.176 |  |
| 3 | -2.199 | -7.002 | 8.176 |  | 4 | -2.199 | -1.002 | 6.976 | 支座1 |
| 5 | 1.886 | -4.002 | 9.176 |  | 6 | 1.886 | -1.002 | 8.176 |  |
| 7 | 1.886 | -7.002 | 8.176 |  | 8 | 1.886 | -1.002 | 6.976 | 支座1 |
| 9 | 6.386 | -4.002 | 9.176 |  | 10 | 6.386 | -1.002 | 8.176 |  |
| 11 | 6.386 | -7.002 | 8.176 |  | 12 | 6.386 | -1.002 | 6.976 | 支座1 |
| 13 | 10.886 | -4.002 | 9.176 |  | 14 | 10.886 | -1.002 | 8.176 |  |
| 15 | 10.886 | -7.002 | 8.176 |  | 16 | 10.886 | -1.002 | 6.976 | 支座1 |
| 17 | 15.386 | -4.002 | 9.176 |  | 18 | 15.386 | -1.002 | 8.176 |  |
| 19 | 15.386 | -7.002 | 8.176 |  | 20 | 15.386 | -1.002 | 6.976 | 支座1 |
| 21 | 19.886 | -4.002 | 9.176 |  | 22 | 19.886 | -1.002 | 8.176 |  |
| 23 | 19.886 | -7.002 | 8.176 |  | 24 | 19.886 | -1.002 | 6.976 | 支座1 |
| 25 | 23.971 | -4.002 | 9.176 |  | 26 | 23.971 | -1.002 | 8.176 |  |
| 27 | 23.971 | -7.002 | 8.176 |  | 28 | 23.971 | -1.002 | 6.976 | 支座1 |
| 29 | -2.199 | -7.002 | 6.976 | 支座1 | 30 | 1.886 | -7.002 | 6.976 | 支座1 |
| 31 | 6.386 | -7.002 | 6.976 | 支座1 | 32 | 10.886 | -7.002 | 6.976 | 支座1 |
| 33 | 15.386 | -7.002 | 6.976 | 支座1 | 34 | 19.886 | -7.002 | 6.976 | 支座1 |
| 35 | 23.971 | -7.002 | 6.976 | 支座1 |  |  |  |  |  |



单元编号图（整体）

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 单元信息表（注：等肢角钢的2、3轴分别对应u、v轴） | | | | | | | | | | |
| 单元号 | 截面名称 | 材料名称 | 长度(m) | 面积(mm2) | 绕2轴惯性矩(×104mm4) | 绕3轴惯性矩(×104mm4) | 绕2轴计算长度系数 | 绕3轴计算长度系数 | i节点释放 | j节点释放 |
| 1 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 2 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 3 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.369 | 2.898 | --- | --- |
| 4 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 5 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 6 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.196 | 2.898 | --- | --- |
| 7 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 8 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 9 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.206 | 2.898 | --- | --- |
| 10 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 11 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 12 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.206 | 2.898 | --- | --- |
| 13 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 14 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 15 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.206 | 2.898 | --- | --- |
| 16 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 17 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 18 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.196 | 2.898 | --- | --- |
| 19 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 20 | 矩350x150x10x10 | Q235B | 3.162 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 21 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.369 | 2.898 | --- | --- |
| 22 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.369 | 2.898 | --- | --- |
| 23 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.196 | 2.898 | --- | --- |
| 24 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.206 | 2.898 | --- | --- |
| 25 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.206 | 2.898 | --- | --- |
| 26 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.206 | 2.898 | --- | --- |
| 27 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.196 | 2.898 | --- | --- |
| 28 | 矩350x150x10x10 | Q235B | 1.200 | 8600.00 | 3311.17 | 9968.67 | 2.369 | 2.898 | --- | --- |
| 29 | 矩350x150x10x10 | Q235B | 4.085 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 30 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 31 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 32 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 33 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 34 | 矩350x150x10x10 | Q235B | 4.085 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 35 | 矩350x150x10x10 | Q235B | 4.085 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 36 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 37 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 38 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 39 | 矩350x150x10x10 | Q235B | 4.500 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |
| 40 | 矩350x150x10x10 | Q235B | 4.085 | 8600.00 | 3311.17 | 9968.67 | 1.000 | 1.000 | --- | --- |



截面编号图（整体）

|  |  |  |  |
| --- | --- | --- | --- |
| 截面信息表 | | | |
| 截面编号 | 截面类型 | 截面名称 | 构件总数 |
| 1 | 矩形管截面 | 矩350x150x10x10 | 40 |

* 1. 计算参数

(1)动力特性计算

计算振型数: 9

振型类型: 特征向量

(2)线性计算

梁单元属性: 考虑剪切效应（铁木辛哥梁）

梁抗扭惯性矩: 自由扭转惯性矩

考虑P - Δ / 二阶效应：否

* 1. 设计参数

结构重要性系数：1.000

支撑临界角：15.000°

|  |  |  |
| --- | --- | --- |
| 抗震等级 | | |
| 结构类型 | 抗震等级 | 构造措施的抗震等级 |
| 钢框架 | 三级 | 三级 |

注：此处为整体抗震等级，若部分构件单独定义了抗震等级请注意检查。

1. 计算简图



计算简图（整体）

注：蓝色单元为普通单元，绿色单元为连接单元，绿色实心圆为支座，黄色实心圆为主从节点的主节点

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 支座信息表（单位: 刚度：kN/mm kN\*mm/rad 位移：mm rad） | | | | | | |
| 支座类型 | 平动1 | 平动2 | 平动3 | 转动R1 | 转动R2 | 转动R3 |
| 1 | 刚性 | 刚性 | 刚性 | 无 | 无 | 无 |

1. 材料信息
   1. 材料特性

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 名称 | 材料 | 弹性模量(kN/mm2) | 泊松比 | 线膨胀系数 | 设计强度(MPa) | 质量密度(kg/mm3) |
| Q235B-1 | Q235 | 206.000 | 0.300 | 1.20e-05 | 按规范 | 7.85e-06 |

* 1. 材料统计

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 钢汇总表 | | | | | |
| 序号 | 截面 | 材性 | 数量 | 长度(m) | 重量(kg) |
| 1 | 矩350x150x10x10 | Q235B-1 | 40 | 113.412 | 8546 kg |
|  |  |  | 40 根 | 113.412 m | 8546 kg |

1. 荷载与组合
   1. 工况信息

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 序号 | 工况号 | 荷载类型 | 自重系数 | 荷载说明 |
| 1 | 0 | 恒 | 1 | 自重荷载 |
| 2 | 1 | 风 | 1 | 侧面风荷载 |
| 3 | 3 | 雪 | 1 | 雪荷载 |
| 4 | 2 | 风 | 1 | 顶面风荷载 |

* 1. 荷载信息

(1)杆件导荷载列表(力：kN；分布力：kN/m；弯矩：kN.m；分布弯矩：kN.m/m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 序号 | 荷载类型 | 工况 | 导荷方式 | 体型系数 | 面荷载值(基本风压) |
| 1 | 恒 | 0 | 双向杆件 |  | 0.700 |
| 2 | 风 | 1 | 双向杆件 | -2.000 | 0.350 |
| 3 | 风 | 2 | 双向杆件 | 2.000 | 0.350 |
| 4 | 雪 | 3 | 双向杆件 |  | 0.800 |

* + 1. **恒荷载**
       1. 恒荷载0

(1)恒荷载0杆件导荷载

|  |  |  |  |
| --- | --- | --- | --- |
| 杆件荷载表 | | | |
| 序号 | 导荷方式 | 面荷载值kN/m2 | 不均匀分布 |
| 1 | 双向杆件 | 0.700 | 否 |





恒荷载工况0杆件导荷载分布图（整体）

* + 1. **风荷载**
       1. 基本参数

基本风压：0.35(kN/m2)

地面粗糙度：B

风计算用规范：《建筑结构荷载规范》(GB50009-2012)

风荷载计算用阻尼比：0.02

参考点高度Z0（m）：0.00

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 风荷载参数 | | | | |
| 高度(m) | μz（修正前） | η | μz（修正后） | βz |
| 7.90 | 1.00 | 1.00 | 1.00 | 1.17 |

说明：μz为风压高度变化系数，η为风压高度变化修正系数，βz为风振系数，βgz为阵风系数（计算围护结构用）

* + - 1. 风荷载1

(1)风荷载1杆件导荷载

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 杆件荷载表 | | | | |
| 序号 | 导荷方式 | 基本风压(kN/m2) | 体型系数 | 风振系数 |
| 1 | 双向杆件 | 0.350 | -2.000 | 自动计算 |





风荷载工况1体型系数分布图（整体）

* + - 1. 风荷载2

(1)风荷载2杆件导荷载

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 杆件荷载表 | | | | |
| 序号 | 导荷方式 | 基本风压(kN/m2) | 体型系数 | 风振系数 |
| 1 | 双向杆件 | 0.350 | 2.000 | 自动计算 |





风荷载工况2体型系数分布图（整体）

* + 1. **地震作用**

计算依据：《建筑抗震设计规范》(GB50011-2010)(2016年版)

地震烈度：8度0.20g

场地类别：Ⅰ1类

设计地震分组：第一组

特征周期值(s)：0.25

多遇水平地震影响系数最大值：0.08

罕遇水平地震影响系数最大值：0.5

计算振型数：9

结构阻尼比：0.04

周期折减系数：1

按双向地震作用考虑耦联：否

振型组合方法：CQC

计算竖向地震作用：否

质量源：

恒载(工况0) \* 1.00 + 雪(工况3)\_雪荷载 \* 0.50

* + 1. **雪荷载**
       1. 雪荷载3

(1)雪荷载3杆件导荷载

|  |  |  |  |
| --- | --- | --- | --- |
| 杆件荷载表 | | | |
| 序号 | 导荷方式 | 面荷载值kN/m2 | 不均匀分布 |
| 1 | 双向杆件 | 0.800 | 否 |





雪荷载工况3杆件导荷载分布图（整体）

* 1. 荷载组合

(1) 1.300 恒载 + 1.50风载1 + 1.50风载2 + 1.400 水平地震 + 1.50雪3

1. 周期与振型
   1. 周期与质量参与系数

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 振型 | 周期(s) | X向质量参与系数 | Y向质量参与系数 | Z向质量参与系数 |
| 1 | 0.136 | 63.000% | 0.000% | 0.000% |
| 2 | 0.126 | 2.000% | 0.000% | 0.000% |
| 3 | 0.124 | 0.000% | 0.000% | 0.000% |
| 4 | 0.121 | 0.896% | 0.000% | 0.000% |
| 5 | 0.117 | 0.000% | 0.000% | 0.000% |
| 6 | 0.114 | 0.082% | 0.000% | 0.000% |
| 7 | 0.113 | 0.000% | 0.000% | 0.000% |
| 8 | 0.099 | 0.000% | 74.809% | 0.000% |
| 9 | 0.095 | 0.000% | 0.000% | 0.000% |
| 合计 |  | 65.979% | 74.809% | 0.000% |

1. 线性计算结果
   1. 线性反力



支座节点编号图（整体）

* + 1. **最不利反力**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 线性组合最不利反力表(标准值)(单位：kN、kN.m) | | | | | | | | | |
| 节点号 | 控制 | 组合号 | 组合序号 | N1 | N2 | N3 | M1 | M2 | M3 |
| 35 | N1最大 | 1 | 2 | -3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 35 | N2最大 | 1 | 4 | -4.331 | 13.278 | 37.163 | 0.000 | 0.000 | 0.000 |
| 35 | N3最大 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | M1最大 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | M2最大 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | M3最大 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | 合力最大 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | N1最小 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | N2最小 | 1 | 3 | -4.331 | 12.943 | 36.942 | 0.000 | 0.000 | 0.000 |
| 35 | N3最小 | 1 | 2 | -3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 35 | M1最小 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | M2最小 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 35 | M3最小 | 1 | 1 | -5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 34 | N1最大 | 1 | 2 | 1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 34 | N2最大 | 1 | 4 | 0.003 | 19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 34 | N3最大 | 1 | 4 | 0.003 | 19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 34 | M1最大 | 1 | 1 | -1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 34 | M2最大 | 1 | 1 | -1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 34 | M3最大 | 1 | 1 | -1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 34 | 合力最大 | 1 | 4 | 0.003 | 19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 34 | N1最小 | 1 | 1 | -1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 34 | N2最小 | 1 | 3 | 0.004 | 17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 34 | N3最小 | 1 | 3 | 0.004 | 17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 34 | M1最小 | 1 | 1 | -1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 34 | M2最小 | 1 | 1 | -1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 34 | M3最小 | 1 | 1 | -1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 33 | N1最大 | 1 | 2 | 1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 33 | N2最大 | 1 | 4 | -0.017 | 21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 33 | N3最大 | 1 | 4 | -0.017 | 21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 33 | M1最大 | 1 | 1 | -1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 33 | M2最大 | 1 | 1 | -1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 33 | M3最大 | 1 | 1 | -1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 33 | 合力最大 | 1 | 4 | -0.017 | 21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 33 | N1最小 | 1 | 1 | -1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 33 | N2最小 | 1 | 3 | -0.018 | 17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 33 | N3最小 | 1 | 3 | -0.018 | 17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 33 | M1最小 | 1 | 1 | -1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 33 | M2最小 | 1 | 1 | -1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 33 | M3最小 | 1 | 1 | -1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 32 | N1最大 | 1 | 2 | 1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 32 | N2最大 | 1 | 4 | 0.000 | 21.636 | 65.313 | 0.000 | 0.000 | 0.000 |
| 32 | N3最大 | 1 | 4 | 0.000 | 21.636 | 65.313 | 0.000 | 0.000 | 0.000 |
| 32 | M1最大 | 1 | 1 | -1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 32 | M2最大 | 1 | 1 | -1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 32 | M3最大 | 1 | 1 | -1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 32 | 合力最大 | 1 | 4 | 0.000 | 21.636 | 65.313 | 0.000 | 0.000 | 0.000 |
| 32 | N1最小 | 1 | 1 | -1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 32 | N2最小 | 1 | 3 | 0.000 | 16.473 | 62.932 | 0.000 | 0.000 | 0.000 |
| 32 | N3最小 | 1 | 3 | 0.000 | 16.473 | 62.932 | 0.000 | 0.000 | 0.000 |
| 32 | M1最小 | 1 | 1 | -1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 32 | M2最小 | 1 | 1 | -1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 32 | M3最小 | 1 | 1 | -1.233 | 19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 31 | N1最大 | 1 | 2 | 1.210 | 19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 31 | N2最大 | 1 | 4 | 0.017 | 21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 31 | N3最大 | 1 | 4 | 0.017 | 21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 31 | M1最大 | 1 | 1 | -1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 31 | M2最大 | 1 | 1 | -1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 31 | M3最大 | 1 | 1 | -1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 31 | 合力最大 | 1 | 4 | 0.017 | 21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 31 | N1最小 | 1 | 1 | -1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 31 | N2最小 | 1 | 3 | 0.018 | 17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 31 | N3最小 | 1 | 3 | 0.018 | 17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 31 | M1最小 | 1 | 1 | -1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 31 | M2最小 | 1 | 1 | -1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 31 | M3最小 | 1 | 1 | -1.175 | 19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 30 | N1最大 | 1 | 2 | 1.348 | 17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 30 | N2最大 | 1 | 4 | -0.003 | 19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 30 | N3最大 | 1 | 4 | -0.003 | 19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 30 | M1最大 | 1 | 1 | -1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 30 | M2最大 | 1 | 1 | -1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 30 | M3最大 | 1 | 1 | -1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 30 | 合力最大 | 1 | 4 | -0.003 | 19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 30 | N1最小 | 1 | 1 | -1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 30 | N2最小 | 1 | 3 | -0.004 | 17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 30 | N3最小 | 1 | 3 | -0.004 | 17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 30 | M1最小 | 1 | 1 | -1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 30 | M2最小 | 1 | 1 | -1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 30 | M3最小 | 1 | 1 | -1.354 | 18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 29 | N1最大 | 1 | 2 | 5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 29 | N2最大 | 1 | 4 | 4.331 | 13.278 | 37.163 | 0.000 | 0.000 | 0.000 |
| 29 | N3最大 | 1 | 2 | 5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 29 | M1最大 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 29 | M2最大 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 29 | M3最大 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 29 | 合力最大 | 1 | 2 | 5.172 | 13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 29 | N1最小 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 29 | N2最小 | 1 | 3 | 4.331 | 12.943 | 36.942 | 0.000 | 0.000 | 0.000 |
| 29 | N3最小 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 29 | M1最小 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 29 | M2最小 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 29 | M3最小 | 1 | 1 | 3.490 | 13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 28 | N1最大 | 1 | 2 | -3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 28 | N2最大 | 1 | 4 | -4.331 | -12.943 | 36.942 | 0.000 | 0.000 | 0.000 |
| 28 | N3最大 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | M1最大 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | M2最大 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | M3最大 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | 合力最大 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | N1最小 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | N2最小 | 1 | 3 | -4.331 | -13.278 | 37.163 | 0.000 | 0.000 | 0.000 |
| 28 | N3最小 | 1 | 2 | -3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 28 | M1最小 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | M2最小 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 28 | M3最小 | 1 | 1 | -5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 24 | N1最大 | 1 | 2 | 1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 24 | N2最大 | 1 | 4 | 0.004 | -17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 24 | N3最大 | 1 | 3 | 0.003 | -19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 24 | M1最大 | 1 | 1 | -1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 24 | M2最大 | 1 | 1 | -1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 24 | M3最大 | 1 | 1 | -1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 24 | 合力最大 | 1 | 3 | 0.003 | -19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 24 | N1最小 | 1 | 1 | -1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 24 | N2最小 | 1 | 3 | 0.003 | -19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 24 | N3最小 | 1 | 4 | 0.004 | -17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 24 | M1最小 | 1 | 1 | -1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 24 | M2最小 | 1 | 1 | -1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 24 | M3最小 | 1 | 1 | -1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 20 | N1最大 | 1 | 2 | 1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 20 | N2最大 | 1 | 4 | -0.018 | -17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 20 | N3最大 | 1 | 3 | -0.017 | -21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 20 | M1最大 | 1 | 1 | -1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 20 | M2最大 | 1 | 1 | -1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 20 | M3最大 | 1 | 1 | -1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 20 | 合力最大 | 1 | 3 | -0.017 | -21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 20 | N1最小 | 1 | 1 | -1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 20 | N2最小 | 1 | 3 | -0.017 | -21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 20 | N3最小 | 1 | 4 | -0.018 | -17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 20 | M1最小 | 1 | 1 | -1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 20 | M2最小 | 1 | 1 | -1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 20 | M3最小 | 1 | 1 | -1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 16 | N1最大 | 1 | 2 | 1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 16 | N2最大 | 1 | 4 | 0.000 | -16.473 | 62.932 | 0.000 | 0.000 | 0.000 |
| 16 | N3最大 | 1 | 3 | 0.000 | -21.636 | 65.313 | 0.000 | 0.000 | 0.000 |
| 16 | M1最大 | 1 | 1 | -1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 16 | M2最大 | 1 | 1 | -1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 16 | M3最大 | 1 | 1 | -1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 16 | 合力最大 | 1 | 3 | 0.000 | -21.636 | 65.313 | 0.000 | 0.000 | 0.000 |
| 16 | N1最小 | 1 | 1 | -1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 16 | N2最小 | 1 | 3 | 0.000 | -21.636 | 65.313 | 0.000 | 0.000 | 0.000 |
| 16 | N3最小 | 1 | 4 | 0.000 | -16.473 | 62.932 | 0.000 | 0.000 | 0.000 |
| 16 | M1最小 | 1 | 1 | -1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 16 | M2最小 | 1 | 1 | -1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 16 | M3最小 | 1 | 1 | -1.233 | -19.055 | 64.123 | 0.000 | 0.000 | 0.000 |
| 12 | N1最大 | 1 | 2 | 1.210 | -19.170 | 64.164 | 0.000 | 0.000 | 0.000 |
| 12 | N2最大 | 1 | 4 | 0.018 | -17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 12 | N3最大 | 1 | 3 | 0.017 | -21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 12 | M1最大 | 1 | 1 | -1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 12 | M2最大 | 1 | 1 | -1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 12 | M3最大 | 1 | 1 | -1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 12 | 合力最大 | 1 | 3 | 0.017 | -21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 12 | N1最小 | 1 | 1 | -1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 12 | N2最小 | 1 | 3 | 0.017 | -21.284 | 65.093 | 0.000 | 0.000 | 0.000 |
| 12 | N3最小 | 1 | 4 | 0.018 | -17.011 | 63.116 | 0.000 | 0.000 | 0.000 |
| 12 | M1最小 | 1 | 1 | -1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 12 | M2最小 | 1 | 1 | -1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 12 | M3最小 | 1 | 1 | -1.175 | -19.125 | 64.045 | 0.000 | 0.000 | 0.000 |
| 8 | N1最大 | 1 | 2 | 1.348 | -17.987 | 63.365 | 0.000 | 0.000 | 0.000 |
| 8 | N2最大 | 1 | 4 | -0.004 | -17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 8 | N3最大 | 1 | 3 | -0.003 | -19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 8 | M1最大 | 1 | 1 | -1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 8 | M2最大 | 1 | 1 | -1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 8 | M3最大 | 1 | 1 | -1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 8 | 合力最大 | 1 | 3 | -0.003 | -19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 8 | N1最小 | 1 | 1 | -1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 8 | N2最小 | 1 | 3 | -0.003 | -19.042 | 64.123 | 0.000 | 0.000 | 0.000 |
| 8 | N3最小 | 1 | 4 | -0.004 | -17.021 | 63.163 | 0.000 | 0.000 | 0.000 |
| 8 | M1最小 | 1 | 1 | -1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 8 | M2最小 | 1 | 1 | -1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 8 | M3最小 | 1 | 1 | -1.354 | -18.076 | 63.921 | 0.000 | 0.000 | 0.000 |
| 4 | N1最大 | 1 | 2 | 5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 4 | N2最大 | 1 | 4 | 4.331 | -12.943 | 36.942 | 0.000 | 0.000 | 0.000 |
| 4 | N3最大 | 1 | 2 | 5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 4 | M1最大 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 4 | M2最大 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 4 | M3最大 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 4 | 合力最大 | 1 | 2 | 5.172 | -13.203 | 37.755 | 0.000 | 0.000 | 0.000 |
| 4 | N1最小 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 4 | N2最小 | 1 | 3 | 4.331 | -13.278 | 37.163 | 0.000 | 0.000 | 0.000 |
| 4 | N3最小 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 4 | M1最小 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 4 | M2最小 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |
| 4 | M3最小 | 1 | 1 | 3.490 | -13.018 | 36.350 | 0.000 | 0.000 | 0.000 |

* 1. 线性内力
     1. **线性组合包络**





线性组合轴力N最大包络云图:kN（整体）

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 轴力N最大的前10个单元的内力（单位：m, kN, kN.m） | | | | | | | | | | |
| 序号 | 单元号 | 组合号 | 组合序号 | 位置 | 轴力N | 剪力Q2 | 剪力Q3 | 扭矩M | 弯矩M2 | 弯矩M3 |
| 1 | 35 | 1 | 2 | 0.000 | 1.441 | 19.278 | -0.554 | 0.056 | 4.690 | 11.192 |
| 2 | 29 | 1 | 2 | 0.000 | 1.441 | 19.278 | 0.554 | -0.056 | -4.690 | 11.192 |
| 3 | 34 | 1 | 1 | 0.000 | 1.441 | 22.838 | -3.438 | 0.056 | 3.485 | 18.459 |
| 4 | 40 | 1 | 1 | 0.000 | 1.441 | 22.838 | 3.438 | -0.056 | -3.485 | 18.459 |
| 5 | 33 | 1 | 2 | 0.000 | 1.302 | 23.765 | -1.096 | 0.005 | 0.650 | 21.497 |
| 6 | 36 | 1 | 1 | 0.000 | 1.302 | 22.630 | 2.080 | 0.005 | -2.885 | 18.941 |
| 7 | 30 | 1 | 1 | 0.000 | 1.302 | 22.630 | -2.080 | -0.005 | 2.885 | 18.941 |
| 8 | 39 | 1 | 2 | 0.000 | 1.302 | 23.765 | 1.096 | -0.005 | -0.650 | 21.497 |
| 9 | 32 | 1 | 3 | 0.000 | 1.227 | 23.194 | -1.670 | -0.050 | 1.651 | 20.123 |
| 10 | 31 | 1 | 3 | 0.000 | 1.227 | 23.200 | -1.507 | 0.050 | 1.283 | 20.137 |





线性组合轴力N最小包络云图:kN（整体）

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 轴力N最小的前10个单元的内力（单位：m, kN, kN.m） | | | | | | | | | | |
| 序号 | 单元号 | 组合号 | 组合序号 | 位置 | 轴力N | 剪力Q2 | 剪力Q3 | 扭矩M | 弯矩M2 | 弯矩M3 |
| 1 | 12 | 1 | 3 | 1.200 | -93.926 | 31.235 | -0.000 | 0.000 | -0.000 | -0.000 |
| 2 | 25 | 1 | 4 | 1.200 | -93.926 | -31.235 | -0.000 | -0.000 | -0.000 | 0.000 |
| 3 | 24 | 1 | 4 | 1.200 | -93.622 | -30.750 | -0.029 | -0.000 | -0.000 | 0.000 |
| 4 | 9 | 1 | 3 | 1.200 | -93.622 | 30.750 | -0.029 | 0.000 | -0.000 | -0.000 |
| 5 | 15 | 1 | 3 | 1.200 | -93.622 | 30.750 | 0.029 | -0.000 | 0.000 | -0.000 |
| 6 | 26 | 1 | 4 | 1.200 | -93.622 | -30.750 | 0.029 | 0.000 | 0.000 | 0.000 |
| 7 | 18 | 1 | 3 | 1.200 | -92.224 | 27.534 | 0.016 | 0.000 | 0.000 | -0.000 |
| 8 | 6 | 1 | 3 | 1.200 | -92.224 | 27.534 | -0.016 | -0.000 | -0.000 | -0.000 |
| 9 | 27 | 1 | 4 | 1.200 | -92.224 | -27.534 | 0.016 | -0.000 | 0.000 | 0.000 |
| 10 | 23 | 1 | 4 | 1.200 | -92.224 | -27.534 | -0.016 | 0.000 | -0.000 | 0.000 |





线性组合弯矩M2最大包络云图:kN.m（整体）

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 弯矩M2最大的前10个单元的内力（单位：m, kN, kN.m） | | | | | | | | | | |
| 序号 | 单元号 | 组合号 | 组合序号 | 位置 | 轴力N | 剪力Q2 | 剪力Q3 | 扭矩M | 弯矩M2 | 弯矩M3 |
| 1 | 3 | 1 | 2 | 0.000 | -46.898 | 17.318 | -5.386 | 0.000 | 7.679 | 21.426 |
| 2 | 22 | 1 | 2 | 0.000 | -46.898 | -17.318 | -5.386 | -0.000 | 7.679 | -21.426 |
| 3 | 1 | 1 | 2 | 0.000 | -18.794 | 6.253 | -0.858 | -1.866 | 5.598 | -8.351 |
| 4 | 2 | 1 | 2 | 0.000 | -18.794 | -6.253 | -0.858 | 1.866 | 5.598 | 8.351 |
| 5 | 20 | 1 | 1 | 3.162 | -24.627 | 20.902 | 6.201 | -1.866 | 5.565 | -21.370 |
| 6 | 19 | 1 | 1 | 3.162 | -24.627 | -20.902 | 6.201 | 1.866 | 5.565 | 21.370 |
| 7 | 35 | 1 | 2 | 0.000 | 1.441 | 19.278 | -0.554 | 0.056 | 4.690 | 11.192 |
| 8 | 40 | 1 | 1 | 4.085 | 1.441 | -19.278 | 0.554 | -0.056 | 4.690 | 11.192 |
| 9 | 29 | 1 | 2 | 4.085 | 1.441 | -22.838 | 3.438 | -0.056 | 3.485 | 18.459 |
| 10 | 34 | 1 | 1 | 0.000 | 1.441 | 22.838 | -3.438 | 0.056 | 3.485 | 18.459 |





线性组合弯矩M2最小包络云图:kN.m（整体）

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 弯矩M2最小的前10个单元的内力（单位：m, kN, kN.m） | | | | | | | | | | |
| 序号 | 单元号 | 组合号 | 组合序号 | 位置 | 轴力N | 剪力Q2 | 剪力Q3 | 扭矩M | 弯矩M2 | 弯矩M3 |
| 1 | 21 | 1 | 1 | 0.000 | -46.898 | 17.318 | 5.386 | -0.000 | -7.679 | 21.426 |
| 2 | 28 | 1 | 1 | 0.000 | -46.898 | -17.318 | 5.386 | 0.000 | -7.679 | -21.426 |
| 3 | 20 | 1 | 1 | 0.000 | -18.794 | -6.253 | 0.858 | -1.866 | -5.598 | 8.351 |
| 4 | 19 | 1 | 1 | 0.000 | -18.794 | 6.253 | 0.858 | 1.866 | -5.598 | -8.351 |
| 5 | 2 | 1 | 2 | 3.162 | -24.627 | 20.902 | -6.201 | 1.866 | -5.565 | -21.370 |
| 6 | 1 | 1 | 2 | 3.162 | -24.627 | -20.902 | -6.201 | -1.866 | -5.565 | 21.370 |
| 7 | 29 | 1 | 2 | 0.000 | 1.441 | 19.278 | 0.554 | -0.056 | -4.690 | 11.192 |
| 8 | 34 | 1 | 1 | 4.085 | 1.441 | -19.278 | -0.554 | 0.056 | -4.690 | 11.192 |
| 9 | 40 | 1 | 1 | 0.000 | 1.441 | 22.838 | 3.438 | -0.056 | -3.485 | 18.459 |
| 10 | 35 | 1 | 2 | 4.085 | 1.441 | -22.838 | -3.438 | 0.056 | -3.485 | 18.459 |





线性组合弯矩M3最大包络云图:kN.m（整体）

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 弯矩M3最大的前10个单元的内力（单位：m, kN, kN.m） | | | | | | | | | | |
| 序号 | 单元号 | 组合号 | 组合序号 | 位置 | 轴力N | 剪力Q2 | 剪力Q3 | 扭矩M | 弯矩M2 | 弯矩M3 |
| 1 | 12 | 1 | 3 | 0.000 | -86.862 | 27.683 | -0.000 | 0.000 | 0.000 | 34.640 |
| 2 | 10 | 1 | 3 | 3.162 | -39.484 | -29.492 | 0.000 | -0.000 | 0.000 | 34.540 |
| 3 | 9 | 1 | 3 | 0.000 | -86.558 | 27.199 | -0.029 | 0.000 | 0.035 | 34.059 |
| 4 | 15 | 1 | 3 | 0.000 | -86.558 | 27.199 | 0.029 | -0.000 | -0.035 | 34.059 |
| 5 | 7 | 1 | 3 | 3.162 | -38.956 | -29.369 | -0.042 | -0.005 | -0.054 | 33.987 |
| 6 | 13 | 1 | 3 | 3.162 | -38.956 | -29.369 | 0.042 | 0.005 | 0.054 | 33.987 |
| 7 | 4 | 1 | 3 | 3.162 | -38.596 | -27.446 | -0.054 | 0.154 | -0.554 | 30.404 |
| 8 | 16 | 1 | 3 | 3.162 | -38.596 | -27.446 | 0.054 | -0.154 | 0.554 | 30.404 |
| 9 | 6 | 1 | 3 | 0.000 | -85.273 | 24.146 | -0.016 | -0.000 | 0.020 | 30.330 |
| 10 | 18 | 1 | 3 | 0.000 | -85.273 | 24.146 | 0.016 | 0.000 | -0.020 | 30.330 |





线性组合弯矩M3最小包络云图:kN.m（整体）

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 弯矩M3最小的前10个单元的内力（单位：m, kN, kN.m） | | | | | | | | | | |
| 序号 | 单元号 | 组合号 | 组合序号 | 位置 | 轴力N | 剪力Q2 | 剪力Q3 | 扭矩M | 弯矩M2 | 弯矩M3 |
| 1 | 25 | 1 | 4 | 0.000 | -86.862 | -27.683 | -0.000 | -0.000 | 0.000 | -34.640 |
| 2 | 11 | 1 | 4 | 3.162 | -39.484 | 29.492 | -0.000 | -0.000 | 0.000 | -34.540 |
| 3 | 24 | 1 | 4 | 0.000 | -86.558 | -27.199 | -0.029 | -0.000 | 0.035 | -34.059 |
| 4 | 26 | 1 | 4 | 0.000 | -86.558 | -27.199 | 0.029 | 0.000 | -0.035 | -34.059 |
| 5 | 8 | 1 | 4 | 3.162 | -38.956 | 29.369 | -0.042 | 0.005 | -0.054 | -33.987 |
| 6 | 14 | 1 | 4 | 3.162 | -38.956 | 29.369 | 0.042 | -0.005 | 0.054 | -33.987 |
| 7 | 5 | 1 | 4 | 3.162 | -38.596 | 27.446 | -0.054 | -0.154 | -0.554 | -30.404 |
| 8 | 17 | 1 | 4 | 3.162 | -38.596 | 27.446 | 0.054 | 0.154 | 0.554 | -30.404 |
| 9 | 23 | 1 | 4 | 0.000 | -85.273 | -24.146 | -0.016 | 0.000 | 0.020 | -30.330 |
| 10 | 27 | 1 | 4 | 0.000 | -85.273 | -24.146 | 0.016 | -0.000 | -0.020 | -30.330 |

* 1. 线性位移
     1. **线性最大位移**





最大正位移 组合1-情况1 (恒0+风1+雪3) Uz:mm





最大负位移 组合1-情况2 (恒0+风1+雪3) Uz:mm

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 线性组合最大最小位移表 | | | | | | |
| 最不利项 | 节点 | 组合名 | Ux | Uy | Uz | Uxyz |
| X方向位移最大 | 25 | 组合1-情况1 (恒0+风1+雪3) | 2.088 | 0.000 | -0.998 | 2.314 |
| Y方向位移最大 | 14 | 组合1-情况3 (恒0+风1+雪3) | -0.000 | 0.694 | -0.041 | 0.695 |
| Z方向位移最大 | 4 | 组合1-情况1 (恒0+风1+雪3) | 0.000 | 0.000 | 0.000 | 0.000 |
| 空间位移最大 | 1 | 组合1-情况2 (恒0+风1+雪3) | -2.088 | -0.000 | -1.015 | 2.322 |
| X方向位移最小 | 1 | 组合1-情况2 (恒0+风1+雪3) | -2.088 | -0.000 | -1.015 | 2.322 |
| Y方向位移最小 | 15 | 组合1-情况4 (恒0+风1+雪3) | -0.000 | -0.694 | -0.042 | 0.695 |
| Z方向位移最小 | 17 | 组合1-情况2 (恒0+风1+雪3) | -0.597 | -0.000 | -1.468 | 1.585 |



线性组合最大最小位移图（整体）

1. 验算结果
   1. 杆件应力比限值分布图

|  |  |  |
| --- | --- | --- |
| 应力比限值表 | | |
| 序号 | 应力比下限 | 应力比上限 |
| 1 | 0 | 1 |





应力比限值分布图（整体）

* 1. 杆件应力比分布图
  2. 杆件验算结果云图
     1. **强度应力比**





按“强度应力比”显示构件颜色（整体）

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| “强度应力比”最大的前 10 个单元的验算结果（所在组合号／情况号） | | | | | | | | | |
| 序号 | 单元号 | 强度 | 绕2轴稳定 | 绕3轴稳定 | 沿2轴抗剪 | 沿3轴抗剪 | 沿2轴长细比 | 沿3轴长细比 | 验算结果 |
| 1 | 25 | 0.208(1/4) | 0.181 | 0.226 | 0.039 | 0.004 | 43 | 32 | 满足 |
| 2 | 12 | 0.208(1/3) | 0.181 | 0.226 | 0.039 | 0.004 | 43 | 32 | 满足 |
| 3 | 24 | 0.206(1/4) | 0.179 | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 4 | 9 | 0.206(1/3) | 0.179 | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 5 | 15 | 0.206(1/3) | 0.179 | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 6 | 26 | 0.206(1/4) | 0.179 | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 7 | 27 | 0.195(1/2) | 0.168 | 0.202 | 0.034 | 0.004 | 42 | 32 | 满足 |
| 8 | 18 | 0.195(1/2) | 0.168 | 0.202 | 0.034 | 0.004 | 42 | 32 | 满足 |
| 9 | 6 | 0.195(1/1) | 0.168 | 0.202 | 0.034 | 0.004 | 42 | 32 | 满足 |
| 10 | 23 | 0.195(1/1) | 0.168 | 0.202 | 0.034 | 0.004 | 42 | 32 | 满足 |

* + 1. **绕2轴稳定应力比**





按“绕2轴稳定应力比”显示构件颜色（整体）

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| “绕2轴稳定应力比”最大的前 10 个单元的验算结果（所在组合号／情况号） | | | | | | | | | |
| 序号 | 单元号 | 强度 | 绕2轴稳定 | 绕3轴稳定 | 沿2轴抗剪 | 沿3轴抗剪 | 沿2轴长细比 | 沿3轴长细比 | 验算结果 |
| 1 | 25 | 0.208 | 0.181(1/4) | 0.226 | 0.039 | 0.004 | 43 | 32 | 满足 |
| 2 | 12 | 0.208 | 0.181(1/3) | 0.226 | 0.039 | 0.004 | 43 | 32 | 满足 |
| 3 | 24 | 0.206 | 0.179(1/4) | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 4 | 15 | 0.206 | 0.179(1/3) | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 5 | 9 | 0.206 | 0.179(1/3) | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 6 | 26 | 0.206 | 0.179(1/4) | 0.223 | 0.038 | 0.004 | 43 | 32 | 满足 |
| 7 | 21 | 0.184 | 0.171(1/1) | 0.182 | 0.024 | 0.017 | 46 | 32 | 满足 |
| 8 | 3 | 0.184 | 0.171(1/2) | 0.182 | 0.024 | 0.017 | 46 | 32 | 满足 |
| 9 | 28 | 0.184 | 0.171(1/1) | 0.182 | 0.024 | 0.017 | 46 | 32 | 满足 |
| 10 | 22 | 0.184 | 0.171(1/2) | 0.182 | 0.024 | 0.017 | 46 | 32 | 满足 |

* + 1. **绕3轴稳定应力比**





按“绕3轴稳定应力比”显示构件颜色（整体）

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| “绕3轴稳定应力比”最大的前 10 个单元的验算结果（所在组合号／情况号） | | | | | | | | | |
| 序号 | 单元号 | 强度 | 绕2轴稳定 | 绕3轴稳定 | 沿2轴抗剪 | 沿3轴抗剪 | 沿2轴长细比 | 沿3轴长细比 | 验算结果 |
| 1 | 25 | 0.208 | 0.181 | 0.226(1/4) | 0.039 | 0.004 | 43 | 32 | 满足 |
| 2 | 12 | 0.208 | 0.181 | 0.226(1/3) | 0.039 | 0.004 | 43 | 32 | 满足 |
| 3 | 24 | 0.206 | 0.179 | 0.223(1/4) | 0.038 | 0.004 | 43 | 32 | 满足 |
| 4 | 9 | 0.206 | 0.179 | 0.223(1/3) | 0.038 | 0.004 | 43 | 32 | 满足 |
| 5 | 15 | 0.206 | 0.179 | 0.223(1/3) | 0.038 | 0.004 | 43 | 32 | 满足 |
| 6 | 26 | 0.206 | 0.179 | 0.223(1/4) | 0.038 | 0.004 | 43 | 32 | 满足 |
| 7 | 23 | 0.195 | 0.168 | 0.202(1/4) | 0.034 | 0.004 | 42 | 32 | 满足 |
| 8 | 6 | 0.195 | 0.168 | 0.202(1/3) | 0.034 | 0.004 | 42 | 32 | 满足 |
| 9 | 18 | 0.195 | 0.168 | 0.202(1/3) | 0.034 | 0.004 | 42 | 32 | 满足 |
| 10 | 27 | 0.195 | 0.168 | 0.202(1/4) | 0.034 | 0.004 | 42 | 32 | 满足 |