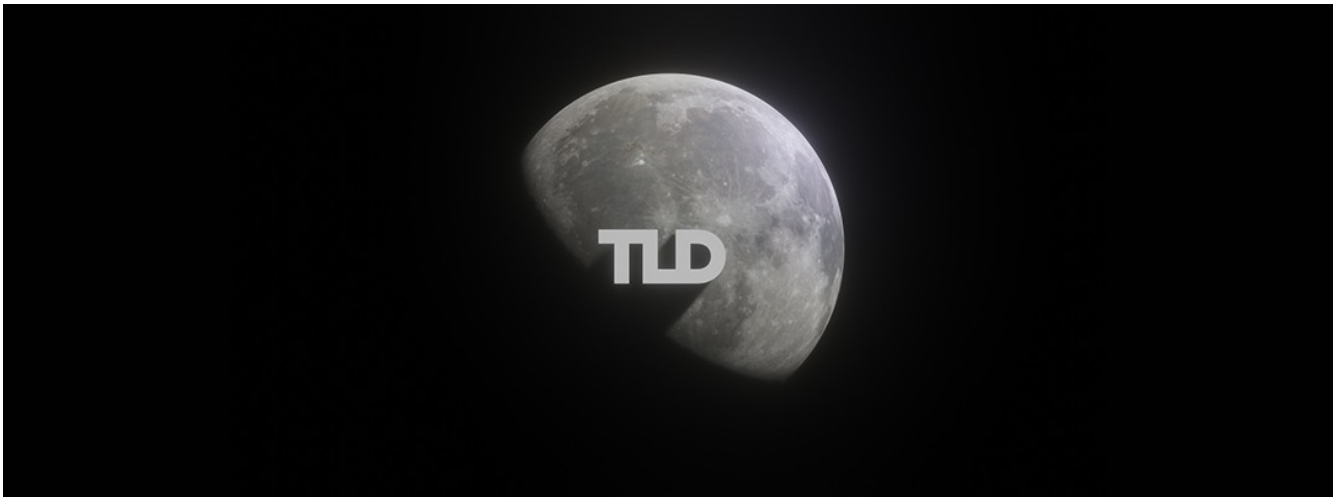
TLD LOD Generator



Official Documentation

Version: 1.0.0
Developer: The Last Dream Productions
Support: tldproductionbusiness@gmail.com
YouTube: https://www.youtube.com/@TheLastDreamProductions

🎯 Overview

The TLD LOD Generator is a professional Unity tool designed to automatically create Level of Detail (LOD) systems for your 3D models. This tool helps optimize game performance by reducing polygon counts at different viewing distances while maintaining visual quality.

What are LODs?

Level of Detail (LOD) is a technique that uses multiple versions of the same object with different polygon counts:

- LOD 0: High detail (close to camera)
- LOD 1: Medium detail (medium distance)
- LOD 2: Low detail (far from camera)
- LOD 3: Very low detail (very far away)

Why Use LODs?

- Performance: Dramatically improves frame rates

- Memory: Reduces GPU memory usage
- Scalability: Better performance on lower-end devices
- Professional: Industry standard optimization technique

📦 Installation

Requirements

- Unity 2019.4 or newer
- Windows, Mac, or Linux
- Objects with MeshRenderer and MeshFilter components

Installation Steps

1. Create Editor Folder
    - In your Unity project's Assets folder, create a folder named Editor
    - If an Editor folder already exists, use that one
2. Add the Script
    - Copy TLDLODGeneratorWindow.cs into your Editor folder
    - Unity will automatically compile the script
3. Verify Installation
    - Check Unity's menu bar for Tools > TLD Tools > LOD Generator
    - If you see this menu item, installation was successful

File Structure

```
YourProject/
├── Assets/
│   ├── Editor/
│   │   └── TLDLODGeneratorWindow.cs  ← Place script here
│   ├── Models/
│   ├── Scripts/
│   └── ...
```

🚀 Quick Start

5-Minute Setup

1. Open the Tool
    - Go to Tools > TLD Tools > LOD Generator

    - The TLD LOD Generator window will open
2. Select Your Object
    - In your scene, select a GameObject with meshes
    - Or drag an object into the "Target Object" field
3. Check Validation
    - Look for the green checkmark "✅ All meshes passed validation"
    - If you see errors, fix them before continuing
4. Generate LODs
    - Click the blue "Generate LODs" button
    - Wait for the progress bar to complete
5. Test Results
    - Select your object in the scene
    - Look for the "LODGroup" component that was added
    - Move the camera closer/farther to see LOD switching

Quick Settings

The tool comes with optimal default settings:

- LOD 0: Original quality (100%)
- LOD 1: 90% quality
- LOD 2: 50% quality
- LOD 3: 10% quality

📋 Feature Guide

Main Interface

Target Object Section

- Target Object Field: Drag GameObjects here or select in scene
- Mesh Information: Shows vertex/triangle counts and memory usage
- Auto-Detection: Automatically finds all child objects with meshes

Mesh Validation System

Real-time checking for common mesh problems:

✅ Valid Meshes

- Proper vertex and triangle data
- No corrupted geometry

- Reasonable polygon counts

⚠ Warnings (Will still work)

- Missing normals or UVs
- High polygon counts
- Minor geometry issues

❌ Errors (Must fix first)

- Null or empty meshes
- Corrupted triangle data
- Invalid mesh structure

LOD Level Configuration

LOD 0 (Original)

- Always uses 100% quality
- No mesh modification
- Preserves all original data

LOD 1-3 (Simplified)

- Enable/Disable Toggle: Turn individual LODs on/off
- Screen Height: Distance where this LOD becomes active
    - Higher values = switches closer to camera
    - Lower values = switches farther from camera
- Quality Reduction: How much to simplify the mesh
    - Lower values = better quality, higher performance cost
    - Higher values = lower quality, better performance

Real-Time Feedback

- Triangle Count: Shows estimated triangles for each LOD
- Quality Percentage: Visual indicator of detail level
- Warning System: Alerts for extreme settings

Preview System

LOD Preview Panel

- Preview Dropdown: Select which LOD to view
- Force LOD Level: Lock object to specific LOD for testing
- Reset LOD: Return to automatic LOD switching

Testing Your LODs

1. Generate LODs first

2. Use "Force LOD Level" to switch between versions
3. Compare visual quality and polygon counts
4. Adjust settings if needed and regenerate

⚙️ Advanced Settings

Click "Advanced Settings" to access professional options:

Mesh Simplification Options

Preserve UV Seams

- ✅ Enabled (Recommended): Maintains texture coordinate boundaries
- ❌ Disabled: Allows UV vertices to merge (may cause texture distortion)

When to Disable: Simple objects without detailed textures

Preserve Boundaries

- ✅ Enabled (Recommended): Keeps mesh silhouette intact
- ❌ Disabled: Allows edge simplification (may change shape)

When to Disable: Background objects where silhouette changes are acceptable

Preserve Normals

- ✅ Enabled (Recommended): Maintains surface normal quality
- ❌ Disabled: Prioritizes triangle reduction over lighting quality

When to Disable: Hard-edge objects or when maximum performance is needed

Quality Bias (0.1 - 3.0)

- 1.0: Balanced quality vs performance (default)
- < 1.0: Prioritize performance (more aggressive simplification)
- > 1.0: Prioritize quality (more conservative simplification)

Reduction Curve

- Linear (Default): Even simplification across all LODs
- Custom Curve: Create non-linear patterns
    - Steep Early: Maintain high quality longer, then drop quickly
    - Gentle Early: Gradual quality reduction throughout

Generate Impostor LODs (Experimental)

Creates billboard/card representations for very distant objects.

🎯 Best Practices

Optimal LOD Settings

Screen Heights (Distance Settings)

- LOD 0: 0.6 - 1.0 (objects close to camera)
- LOD 1: 0.3 - 0.6 (medium distance objects)
- LOD 2: 0.1 - 0.3 (far distance objects)
- LOD 3: 0.01 - 0.1 (very far or background objects)

Quality Reduction Recommendations

- LOD 1: 10-30% reduction (subtle changes)
- LOD 2: 40-70% reduction (noticeable but acceptable)
- LOD 3: 70-95% reduction (very simplified)

Object Type Guidelines

Characters & Important Objects

- Conservative quality reduction (10-50%)
- Enable all preservation options
- More LOD levels for smoother transitions

Environment & Props

- Moderate quality reduction (30-80%)
- Preserve UV seams for textured objects
- Focus on silhouette preservation

Background Objects

- Aggressive quality reduction (50-95%)
- Disable preservation options for maximum performance
- Fewer LOD levels needed

Performance Optimization Tips

1. Start Conservative: Begin with lower reduction percentages
2. Test in Movement: LODs should look good during gameplay, not just static
3. Batch Similar Objects: Process objects of similar complexity together
4. Monitor Performance: Use Unity Profiler to verify improvements
5. Platform Specific: Mobile may need more aggressive LODs

Batch Processing

Processing Multiple Objects

1. Select Multiple Objects in hierarchy (Hold Ctrl/Cmd and click)
2. Configure your desired settings in the LOD Generator
3. Click "Batch Process Selected Objects"
4. Wait for processing to complete

Batch Results Window

- Processed: Number of successfully generated LODs
- Errors: Number of failed objects
- Error Details: Specific information about failures

Batch Processing Tips

- Group by Complexity: Process similar objects together
- Save First: Always save your scene before batch processing
- Small Batches: Process 10-20 objects at a time to avoid memory issues
- Consistent Settings: Use similar settings for objects of the same type

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Safety Features

Automatic Backup System

- Pre-Generation Backup: Automatically saves state before LOD generation
- Manual Backup: "Create Backup" button for manual saves
- Restore Function: "Restore Backup" if something goes wrong

Error Prevention

- Real-Time Validation: Continuous checking for problems
- Safe Defaults: Settings that work well for most objects
- Graceful Failure: Tool won't crash Unity if errors occur
- Clear Error Messages: Specific information about what went wrong

Undo Support

- Full Unity Undo system integration
- Use Ctrl+Z to undo LOD generation

- All operations are reversible

🐛 Troubleshooting

Common Issues & Solutions

"Can't add script" Error

Problem: Trying to add script as component to GameObject
Solution:

- Place script in Editor folder only
- Access via Tools > TLD Tools > LOD Generator menu
- Never drag script onto GameObjects

"No valid meshes found"

Problem: Selected object has no meshes or invalid meshes
Solutions:

- Ensure object has MeshRenderer and MeshFilter components
- Check that mesh asset isn't corrupted
- Try selecting a parent object that contains mesh children
- Reimport the mesh with different settings

"Mesh validation failed"

Problem: Mesh data is corrupted or has errors
Solutions:

- Check mesh in 3D modeling software for problems
- Try Unity's "Generate Lightmap UVs" option
- Use Unity's Mesh Combiner to fix simple issues
- Reduce polygon count in modeling software

"LOD generation failed"

Problem: Simplification process encountered errors
Solutions:

- Reduce quality reduction percentage (try 50% instead of 90%)
- Enable all preservation options in Advanced Settings
- Check available memory (close other applications)
- Try processing one object at a time

Textures Look Wrong on LODs

Problem: UV mapping gets distorted during simplification
Solutions:

- Enable "Preserve UV Seams" in Advanced Settings
- Reduce quality reduction percentage
- Check original mesh has proper UV mapping
- Consider manual UV optimization in modeling software

Performance Issues

Generation is Very Slow

Solutions:

- Process fewer objects at once
- Close other Unity windows during generation
- Reduce target triangle counts
- Use lower quality settings temporarily

High Memory Usage

Solutions:

- Process smaller batches (5-10 objects)
- Close unnecessary applications
- Use Unity's Mesh Compression after LOD generation
- Restart Unity if memory usage gets too high

Quality Issues

LODs Look Too Different from Original

Solutions:

- Reduce quality reduction percentages
- Increase Quality Bias in Advanced Settings
- Enable more preservation options
- Add more LOD levels for smoother transitions

LOD Switching is Too Obvious

Solutions:

- Adjust Screen Height values for smoother transitions
- Use more conservative quality reduction
- Test switching distances during actual gameplay

- Consider the object's importance in your scene

📊 Performance Guidelines

Target Performance Improvements

- LOD 1: 10-30% performance gain
- LOD 2: 40-70% performance gain
- LOD 3: 70-90% performance gain

Measuring Success

1. Before LODs: Note FPS and GPU usage
2. After LODs: Compare performance in same scene
3. Target Metrics: Aim for 20-50% overall improvement

Platform Considerations

PC/Console

- More conservative LODs (better quality)
- Can handle higher polygon counts
- Focus on maintaining visual fidelity

Mobile

- More aggressive LODs needed
- Lower triangle count targets
- Prioritize performance over quality

VR

- Very aggressive LODs required
- Performance is critical for comfort
- Test at 90+ FPS target

🎮 Integration with Unity

Unity LODGroup Component

The tool automatically creates Unity's built-in LODGroup component:

- Automatic Setup: No manual configuration needed

- Unity Integration: Works with all rendering pipelines
- Performance Benefits: Uses Unity's optimized LOD system

Rendering Pipeline Compatibility

- Built-in Render Pipeline: Full support ✅
- Universal Render Pipeline (URP): Full support ✅
- High Definition Render Pipeline (HDRP): Full support ✅
- Custom Pipelines: Should work with standard LODGroup ✅

Other Unity Systems

- Occlusion Culling: Works perfectly with LODs
- Static Batching: Can batch LOD objects
- GPU Instancing: Compatible with LOD system
- Lightmapping: LODs maintain lightmap UVs

🔗 Advanced Workflows

Asset Pipeline Integration

Model Import Workflow

1. Import high-quality models from 3D software
2. Apply materials and textures
3. Generate LODs with TLD LOD Generator
4. Test performance and quality
5. Save as prefabs for reuse

Team Workflow

1. Artist: Creates high-quality base models
2. Technical Artist: Generates LODs with consistent settings
3. Programmer: Integrates LOD objects into game systems
4. QA: Tests performance across different platforms

Version Control Best Practices

- Keep LOD settings documented for each object type
- Save LOD prefabs separately from source models
- Use consistent naming conventions
- Regular team reviews of LOD quality standards

📞 Support

Getting Help

Email Support

📧 tldproductionbusiness@gmail.com

- Technical questions
- Bug reports
- Feature requests
- General assistance

YouTube Channel

🎥 https://www.youtube.com/@TheLastDreamProductions

- Video tutorials
- Best practice guides
- Advanced techniques
- Community discussions

When Contacting Support

Please include:

1. Unity Version: Which version you're using
2. Platform: Windows, Mac, or Linux
3. Error Messages: Copy exact error text
4. Steps to Reproduce: What you were doing when the problem occurred
5. Screenshots: Visual examples of the issue

Response Times

- Email: 24-48 hours
- YouTube Comments: Usually same day
- Bug Reports: Priority handling

📈 Updates & Roadmap

Current Version: 1.0.0

- Professional LOD generation
- Batch processing
- Advanced mesh simplification

- Complete Unity integration

Planned Features

- Animation-Aware LODs: LODs that consider bone weights
- Material LODs: Automatic material simplification
- Terrain LODs: Special handling for terrain objects
- LOD Chains: Automatic LOD generation from single models

Stay Updated

- Subscribe to our YouTube channel for update notifications
- Follow development progress and tutorials
- Get early access to beta features

🏆 Credits

Tool Developer: The Last Dream Productions
Unity Version: 2019.4+
Documentation: v1.0.0

Special Thanks

- Unity Technologies for the amazing engine
- The Unity community for feedback and suggestions
- All beta testers and early adopters

📜 License

This tool is provided as-is for use in Unity projects.

Usage Rights

- ✅ Use in commercial and personal projects
- ✅ Modify for your specific needs
- ✅ Share with team members
- ❌ Redistribute as a separate product
- ❌ Reverse engineer or copy source code

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Making game development easier, one tool at a time.