Google Maps Structure

The custom tilesets you create in TNTmips for use in Google Maps conform to all of Google's specifications for their native tileset structure. Google refers to these as "Tile Overlays". Each of these tilesets consists of a single hierarchical directory structure containing uniformly-sized tile files (256 by 256 pixels or 128 by 128 for cell phones). Every tile is aligned on a fixed global grid in the Spherical Web Mercator projection. Each tile represents the ground at a fixed, predetermined zoom level. Thus every pixel in every tile at any zoom level represents a single fixed ground location. Since the zoom levels are fixed, the number of levels and tiles and the tileset size depend upon the resolution of the imagery or map they represent.

Google uses this same conceptual structure in the imagery and maps it loads from its web sources, which accounts for its rapid response. This rigid pre-rendered pyramid of grid-aligned tiles ensures fast retrieval and display in Google Maps. Only a few tiles need to be located and read from a particular Google Maps zoom level directory for any particular view, regardless of the size of the tileset. Google Maps will display your small, untiled images and maps directly from a variety of file formats. However, your global, state, province, or city-wide images and maps of any size can be transformed into a Tile Overlay tileset by TNTmips using the Export Raster Tileset or Auto Mosaic processes. You can maintain a custom Tile Overlay on a local drive for private use or publish it on the Internet to it make publically available. In either case, Google Maps can quickly and efficiently load the tiles from your overlay for display with its native layers.

Zoom Levels

Google Maps uses a numbered sequence of zoom levels, and all of the tiles for each level are stored in a correspondingly-named subdirectory (see illustration to the left). The least-detailed zoom level in Google Maps is level 0, which represents the entire globe with a single tile centered at 0 degrees longitude and 0 degrees latitude. Each integer increase in zoom level doubles the number of tiles in both the north-south and east-west directions. Zoom level 1 covers the globe with a 2 x 2 grid of tiles, level 2 with a 4 x 4 grid, and so on (see illustrations on the reverse of this page). Because the tile size is fixed, each increase in zoom level also reduces the size of the area on the ground represented by one pixel in a tile by a factor of 2, providing increasing visual detail in the tileset at higher zoom levels (see table above and the Technical Guide entitled *Tilesets: Setting Zoom Levels*).
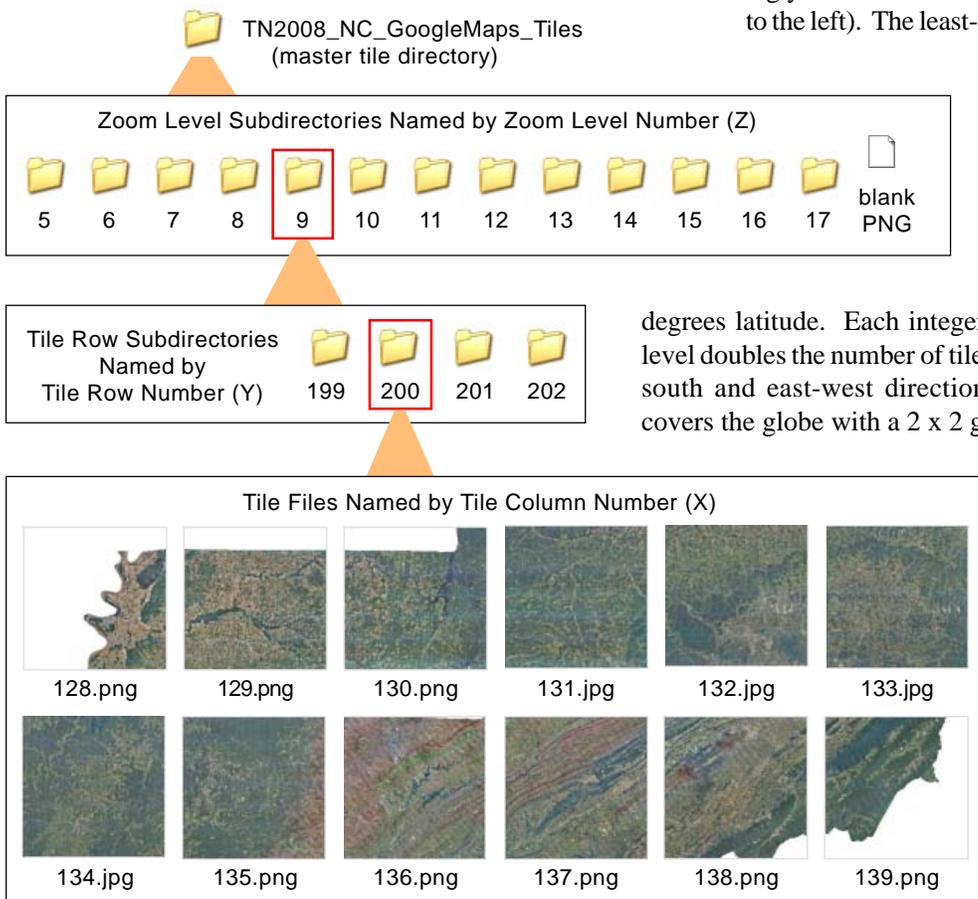
Tile Coordinates

Tile positions within each zoom level are indexed in Google Maps by tile column and tile row numbers. Tile columns are numbered from left to right and tile rows from top to bottom of the global map, each beginning with

(over)

Google Zoom Level	Pixel Size at Equator
0	157 km
1	78 km
2	39 km
3	19.6 km
4	9.8 km
5	4.9 km
6	2.4 km
7	1.2 km
8	611 m
9	306 m
10	153 m
11	76 m
12	39 m
13	19 m
14	10 m
15	5 m
16	2.4 m
17	1.2 m
18	60 cm
19	30 cm
20	15 cm
21	7.5 cm
22	3.7 cm
23	1.9 cm
24	9.3 mm

Table of possible pre-rendered, fixed zoom levels in a Google Maps tileset

Google Maps Tile Overlay Directory Structure

TN2008_NC_GoogleMaps_Tiles
(master tile directory)

Zoom Level Subdirectories Named by Zoom Level Number (Z)

5 6 7 8 9 10 11 12 13 14 15 16 17 blank PNG

Tile Row Subdirectories Named by Tile Row Number (Y)   199 200 201 202

Tile Files Named by Tile Column Number (X)

128.png 129.png 130.png 131.jpg 132.jpg 133.jpg

134.jpg 135.png 136.png 137.png 138.png 139.png

Directory structure for a Google Maps Tile Overlay created in TNTmips using the JPEG + PNG default option for Tile Format, which creates JPEG files for interior tiles and PNG files for edge tiles to provide transparency for non-image areas. This tile overlay includes zoom levels 5 through 17. Tiles are stored in nested subdirectories, first by zoom level number and then by tile row number. Individual tile files are named by tile column number.

0 as shown in the illustration to the right. Within each zoom level directory in the Google Maps Tile Overlay structure, the tiles for each tile row are stored in a separate subdirectly named by row number (see illustration on the front side of this page). The individual tile files are named by their corresponding tile column number. This hierarchical structure ensures that a tileset with a practical maximum spatial resolution will never exceed the maximum number of files or directories permitted by your computer's operating system.
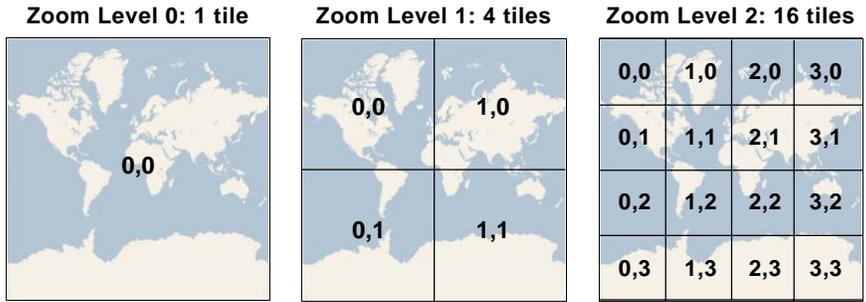
Global tile grids at the three lowest Google Maps zoom levels. Google Maps uses a Spherical Web Mercator projection representing the globe as a square shape. Tiles at each zoom level are indexed by tile row and tile column number (beginning with 0) from the upper left corner of the global map. The number pairs on each tile grid show the tile column and tile row (X,Y) for each tile.

Illustrated to the left is a single 256 by 256-pixel tile from zoom level 17 of the orthoimage tileset whose structure is illustrated on the front side of this page. The ground extent of a single pixel at level 17 at this latitude is 0.996 meter. The Google Maps tile coordinates for this tile are: tile row or Y = 51,209, tile column or X = 37,767. The Javascript code in the sample HTML file created with this tileset constructs the URL to this tile file (shown below) using the numeric zoom level directory name, tile column directory name, and tile file name.

[path to tileset] \ TN2008_NC_GoogleMaps_Tiles \ 17 \ 51209 \ 33767.jpg
(see the Technical Guide entitled Tilesets: Components of the TMS File)

33767.jpg

How the Structure is Loaded in Google Maps

The entire Google Maps tileset structure is stored in a subdirectory whose name consists of the name of your tileset with "_Tiles" appended. The directory/file path to any tile file in the structure thus consists of: tiles directory/ zoom level number/tile row number/tile column number (see the illustration above). As Google Maps renders your overlay and requests each tile by zoom level and tile column and row, the JavaScript in the sample HTML file created with your tileset directly constructs the required filepath to the tile using the supplied values (see the TechGuide entitled *Geomedia Publishing: Publishing Custom Google Maps on Your Web Site*).

A Google Maps Tile Overlay can contain JPEG and/or PNG tile files (see the TechGuide entitled *Tilesets: Tile Image Formats*). Each tile row subdirectory contains all tiles for that row regardless of file format. PNG and JPEG tiles are loaded separately as different layers by the Javascript in the sample HTML file.

Accompanying the zoom level subdirectories in the Tiles directory is a single PNG file named "blank.png". This tile file contains the "no data" text you selected when you created your tile overlay. The JavaScript in the sample HTML file loads this tile as the first layer for every tile position in your overlay. The "no data" message is thus visible in Google Maps at every tile position where no JPEG or PNG file is available in your tile overlay.

Size of Google Maps Tile Overlay Structures

The table to the right shows the number of tiles and stored size by zoom level for a Google Maps tileset created in TNTmips from statewide, 1-meter color orthoimage coverage of the state of Tennessee. As each higher zoom level requires up to 4 times the number of fixed-size tiles than the previous level, high-resolution Google Maps tilesets can include millions of tile files and require tens of gigabytes of drive space (see the TechGuide entitled *Tilesets: Understanding Sizes*). You should take these factors into account as you plan your processing activities.

**Folders, Tiles, and File Size by Zoom Level
for a Sample Google Maps Tile Overlay
(1-m Orthoimage Mosaic of a US State)**

(see Technical Guide entitled
Tilesets: Understanding Sizes)

Source image size: **352 GB** (uncompressed)

Image area: 109,185 square kilometers

Tile Size: 256 x 256 Pixels (required)

Tile Formats: JPEG + PNG for edge tiles

Coordinate Reference System:
WGS84 / Spherical Web Mercator (required)

Zoom Level	Number of Folders	Number of Tiles	Size on Disk
5*	1	2	32 KB
6	2	5	92 KB
7	2	7	308 KB
8	3	18	0.98 MB
9	4	43	2.86 MB
10	7	143	6.96 MB
11	13	516	17.1 MB
12	25	1,871	58.8 MB
13	49	7,236	201 MB
14	96	28,388	750 MB
15	192	112,485	2.88 GB
16	382	447,836	10.6 GB
17†	762	1,786,429	40.5 GB

* minimum zoom level: lowest level requiring more than one tile to cover the image area

† maximum zoom level: pixel size equal to or less than the spatial resolution of the input image

Total Number of Folders: **1,551**

Total Number of Tiles: **2,384,979**

Total Size on Disk: **55.1 GB**