**Daniel Van Sciver**

**How many pennies could you put on the Golden Gate Bridge without any of them overlapping? For this question, please write out each step in your thought process.**

The Golden Gate Bridge consists of five main features: the main cable, the deck, the anchor points, the support towers, and the stringers. To answer the above question accurately we would be theoretically gluing pennies along all five of these features, considering each part makes up the Golden Gate Bridge, and not just the deck portion. For simplicity sake, let’s consider the two different approaches there are to answering how many pennies could fit on just the deck of the bridge without overlapping.

The first approach is the position of the pennies laying face down. According to <http://www.goldengatebridge.org/research/factsGGBDesign.php> the total length of the bridge is 8,981 feet, and the width is 90 feet, and according to <http://www.usmint.gov/about_the_mint/index.cfm?action=coin_specifications> a penny is 0.750 inches in diameter. The area of the deck would be 808,290 square feet or 116,393,760 square inches and the area of the penny is .4418 square inches. Since pennies are circles, we reach a packing problem where there will be left over space in between each circle because there is no overlapping. To reduce this area not covered by pennies as much as possible, place the pennies in a hexagonal design much like a honeycomb. This way, we are covering as much of the bridge as possible without actually overlapping the pennies. Though there are still small spaces between the pennies the number of pennies would only be an estimation and not exact. By dividing the area of the bridges deck by the area of the penny, we can estimate the number of pennies that would fit on the Golden Gate Bridge would be about 263,454,508 pennies.  


Image via: <http://mathworld.wolfram.com/CirclePacking.html>

    However, another approach would allow even more pennies to stand across the bridge. Lets say you can glue the pennies together face to face and stack them standing up, this is assuming by overlapping we are assuming vertical overlap is illegal and not horizontal. Here we need the thickness of a penny, 1.55 mm, which is 0.061023622 inches. Because the diameter of the penny will limit how many rows we can have across the bridge we must use the width of the bridge, 90 feet, or 1080 inches and divide this by the diameter, .750 inches, to get 1440 rows of pennies standing across the bridge. The length of the bridge is 8,981 feet, or 107,772 inches. Dividing the length of the bridge by the thickness of the penny we have 1,766,070 pennies per row. Multiple this by the amount of rows and we get 2,543,141,080 pennies that can fit on the Golden Gate Bridge. This is about 25.4 million U.S. dollars in pennies.

**Our images have a ratio of 16:9, and our design layouts have 12 pixel wide increments (there are no limits on height). Give examples of three image sizes that would have the correct ratio and would fit the design layout**

192x108  
2304x1296  
27648x15552

These are all examples of images sizes that would have the correct ratio to fit the design layout.