Demystifying the number of splices during $m$ TwC operations:

We are counting heavy solid edges (call that number $HS$) created ($HSc$) and destroyed ($HSd$) during those operations. Each TwC operation involves execution of a PwC operation and an expose. During the execution of expose, there are at most $\log n$ splices that convert a light dashed edge to (light) heavy edge and therefore are not accounted for by heavy solid edges. Every other splice in that execution creates a heavy solid edge that will be counted. We have, so far, $(m \cdot \log n + HSc)$ splices.

We have to count also $HSd$, as that number represents “destroyed evidence” of a splice. Each splice that converts a light dashed edge to light solid potentially destroys a heavy solid edge (by converting it to dashed) – there are $m \cdot \log n$ of those. Additionally, each execution of cut lowers the size of solid edges on the path to the root; at most $\log n$ of those can become light. Since there are at most $m/2$ cuts, this contributes at most $m/2 \cdot \log n$ to $HSd$. Each link may convert light edges on the path to the root (at most $\log n$ of those) to heavy, contributing $m \cdot \log n$ to $HSd$, for the total of $3/2m \cdot \log n$.

In total we have at most: $m \cdot \log n$ splices unaccounted for by heavy solid edges + $n$ splices represented by heavy solid edges present after $m$ TwC operations $+ 3/2m \cdot \log n$ splices represented by heavy solid edges destroyed.

Hence Theorem 5.1 follows.