Below are the steps of the possible approach:

1. Using the Minimum Spanning Tree approach, i.e. 2-approximate solution, discussed in the TSP document, we build the optimum (close to optimum in worst case) tour.
2. We decide an upper bound on the distance that each truck can travel.
3. Accordingly we divide the tour (call it ‘job’) in sub-tours (call it ‘task’) such that the total distance in any sub-tour doesn’t exceed the maximum distance that any truck can travel.
4. We further create the MSTs for each sub-tours using the original full tour MST that we created in step 1.

Note: We might have to create new optimum tours within the individual tours to further optimize each truck’s tour. We might need to do this also if we have to accommodate depots in each sub-tour. In such cases, a truck always start from the depot in its sub-tour and returns back to the same depot.

1. For each of the sub-tour we assign 1 truck. Thus the number of trucks would be equal to the number of sub-tours.

How it is targeting the Problem Statement?

With this approach we strive to satisfy both the optimization tasks discussed in the Problem Statement.

1. With the overall MST in step 1, we target the first objective of visiting all the nodes in optimum time.
2. We keep each sub-tour within the upper bound and further optimize the individual sub-tours to target the second objective that we have optimum number of trucks to complete the entire job and that each job is accomplished in an optimized manner.

Challenges:

1. The 2 upper bounds discussed in the Problem Statement, i.e. upper bound on visiting each node and an upper bound on the maximum distance any truck can travel, could possibly conflict with each other. In such cases we would have to either sacrifice on the minimum number trucks in order to use extra trucks to satisfy the upper bound on visiting each node or we would have to possibly accommodate the conflicting node in another sub-tour. If we accommodate the conflicting node in other sub-tours then we might conflict the upper bound on the distance for truck.
2. As we are assigning 1 truck per sub-tour, we might want to include a depot in each sub-tour. Satisfying this requirement along with the optimization goals could be challenging and could possibly conflict with providing an overall optimum solution.

Example:

Suppose the cost of MST built after step1 is 300 miles and we decide that the upper bound on the distance that a truck can travel is 100 miles, then we divide the entire tour into the sub-tours of 100 miles each.

We assign 1 truck per sub-tour.