Runway Capacity Model Homework

You are the Manager of the Skyport Airport. This is an old, downtown airfield that is experiencing increased demand, but has no real-estate for additional runways. There are two runways. For noise abatement reasons, one runway is designated as a departure-only runway. The other runway is designated an arrival-only runway. The installation of EMAS at the runway ends would allow the runways to be extended.

Two vendors have approached you with proposals to increase airport capacity on the designated arrival-only runway:

Vendor 1) Modify the approach procedure to increase approach speeds

Vendor 2) Install navigation equipment to allow capture of localizer and glideslope closer to the runway threshold

Assume: (1) runway occupancy times are not the constraining factor, (2) separation distance is the constraining factor. Assume Vendor 1 proposal multiples approach speeds by K, where K > 1. Assume Vendor 2 proposal divides the length of the approach path by the same constant K, where K > 1.

Use the MTC model for an arrival-only, single runway.

1) Does K increase capacity in both proposals? Explain using the equations for the MTC model and generate charts to support your analysis.
2) Which of the two proposals will yield higher MTC? Explain using the equations for the MTC model and generate charts to support your analysis.

SOLUTION:

Maximum Throughput Capacity (MTC) = 3600/E[Tij]

Where: E[Tij] = ∑i∑j (pij *(Tij))

Where: Tij = sij/vj for compression case, and Tij = ((r + sij)/vj) – r/ vi for separating case

<u>Proposal #1: Increase approach speed by K (assume K >1).</u>
For compression case, Tij = sij/(vj * K) = (1/K) * (sij/vj)
For separating case, Tij = ((r + sij)/(vj * K)) – r/ (vi * K) = (1/K) * (r + sij/vj) – r/ vi
So, E[Tij] = ∑i∑j (pij *(1/K) * (Tij))
As K increases, E[Tij] decreases.
As E[Tij] decreases, MTC Increases across all fleet mix.

<u>Proposal #2: Divide the length of the approach path by the same constant K (assume K > 1)</u>
For compression case, Tij = sij/(vj) => no benefit to compression case
For separating case, Tij = (((r/K) + sij)/vj) – (r/K)/vi => as K increases, (r/K) decreases => reduction in Tij
As K increases, E[Tij] decreases but only for the fleet mix with separating case.
As E[Tij] decreases, MTC Increases but only for the fleet mix with separating case.