Recommendation on Algorithm Processing

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SEII

SCHOOL EFFECTIVENESS &
INEQUALITY INITIATIVE

Who are we?

- Technical experts on school choice algorithm design

- We have provided BPS with *pro bono* technical assistance on their assignment plan since 2003

- Once policies are specified by policymakers, our agenda is to ensure that they are implemented in a transparent way

- We are here to raise a technical concern with the EAC recommendation, which requires getting into details on how the algorithm works

The Issue

• Using an innovative approach, BPS divides the slots at nearly every school into two halves

- 50% of the slots have walk-zone priority (Walk-half), and
- 50% of the slots do not have walk-zone priority (Open-half).

• Despite this innovative approach, the outcome of the BPS procedure is virtually identical to one which negates the walk-zone priority.
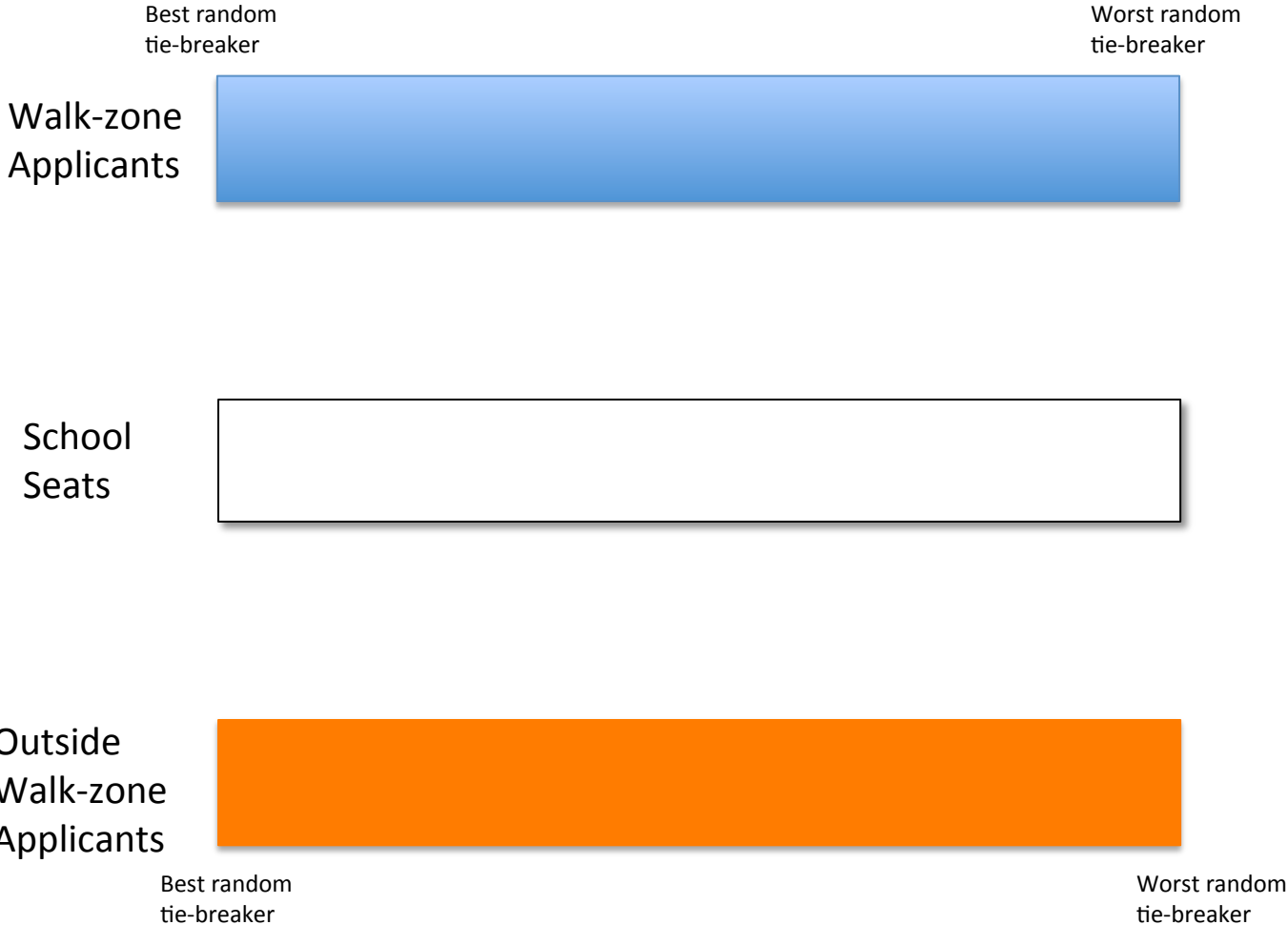
Grade K2, 2009-2012, Round 1
Fraction of Assigned Students Assigned to Walk Zone School
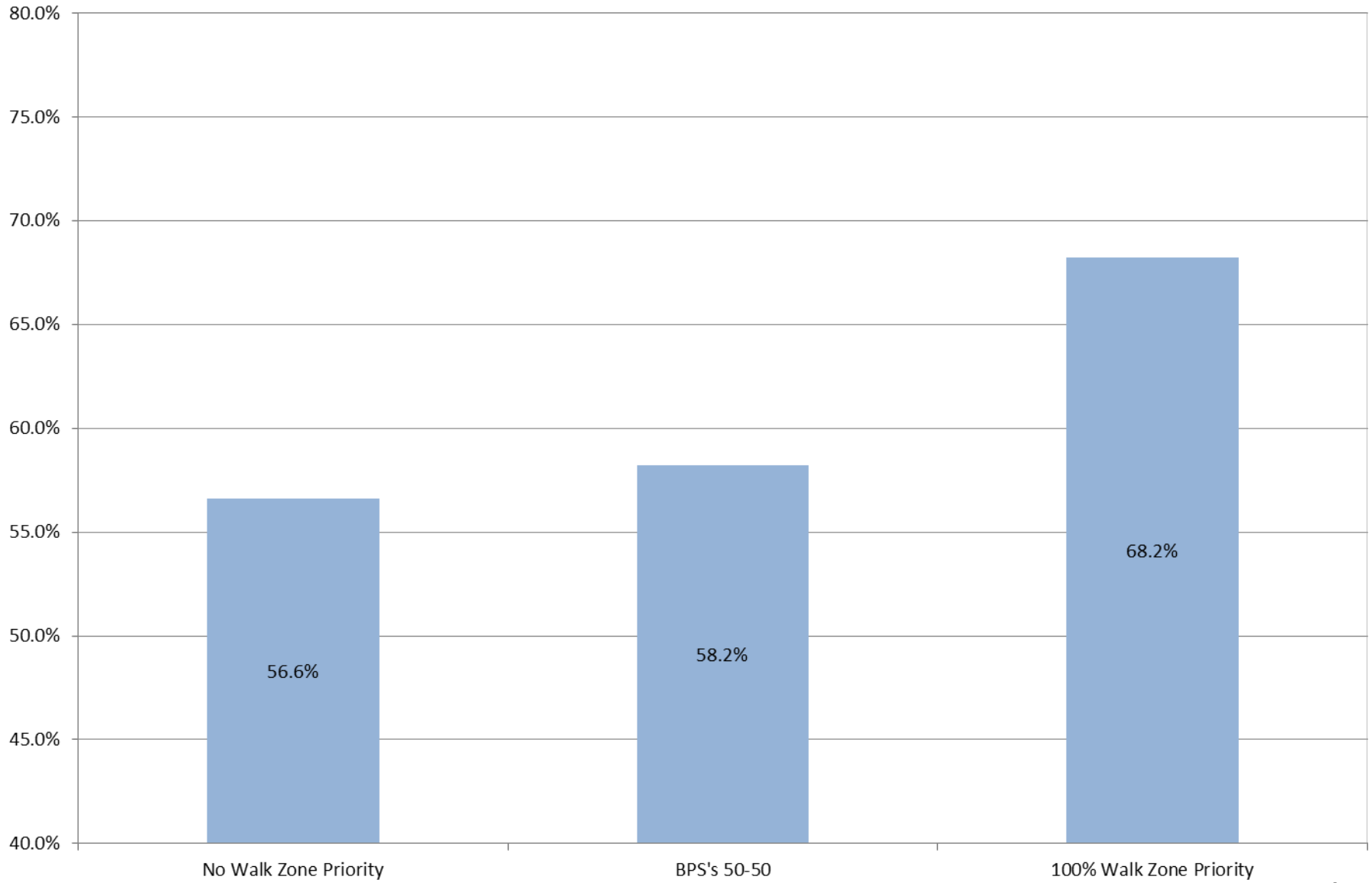
• In our view, it is a mistake to focus on these exact numbers for they fluctuate year to year, depend on the grade, how the unassigned are counted, and which choices applicants make

• What is important about these numbers is that results of 0% walk and 50/50 are almost the **same**
  • That is, the implementation of the 50-50 slot split does **not** work as intended or commonly perceived.
  • While many believe that walk-zone priority plays an important role in BPS's assignment process, the fact that the outcome is nearly identical to a system without walk zone priority shows that it does not.

• This is a technical issue we became aware of about 9 months ago, we first notified BPS in June 2012, and we presented to the EAC in January 2013

•   We will illustrate the cause and remedy of this anomaly for an over-demanded school which has:
•   200 applicants, and
•   100 applicants from walk-zone and 100 from outside walk-zone.
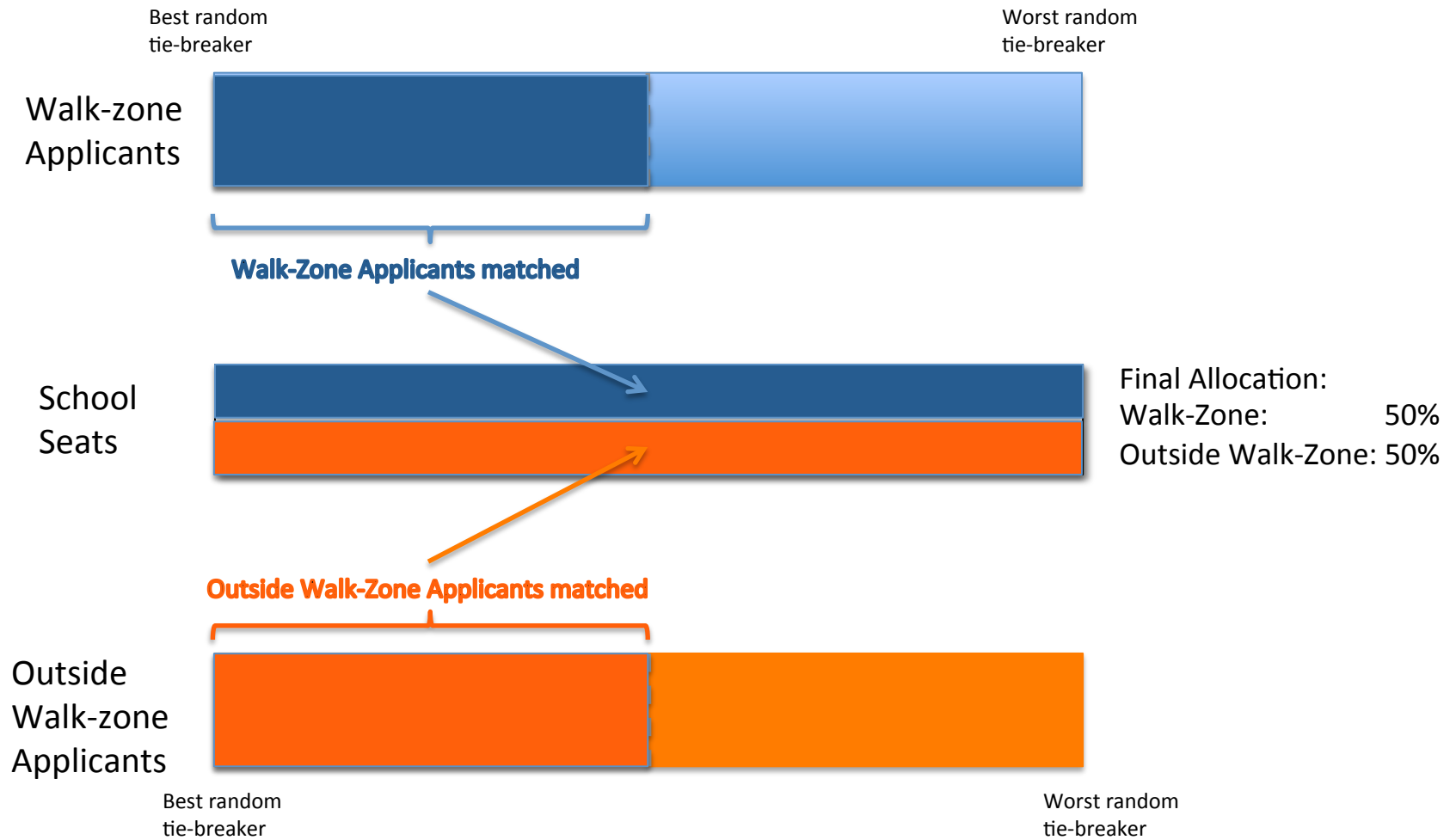
Scenario 1: All Slots are open (0% Walk-Zone Priority)

Best random
tie-breaker

Worst random
tie-breaker

Walk-zone
Applicants

School
Seats

Outside
Walk-zone
Applicants

Best random
tie-breaker

Worst random
tie-breaker

Scenario 1: All Slots are open (0% Walk-Zone Priority)

Best random tie-breaker

Worst random tie-breaker

Walk-zone Applicants

Walk-Zone Applicants matched

School Seats

Final Allocation:
Walk-Zone: 50%
Outside Walk-Zone: 50%

Outside Walk-Zone Applicants matched

Outside Walk-zone Applicants
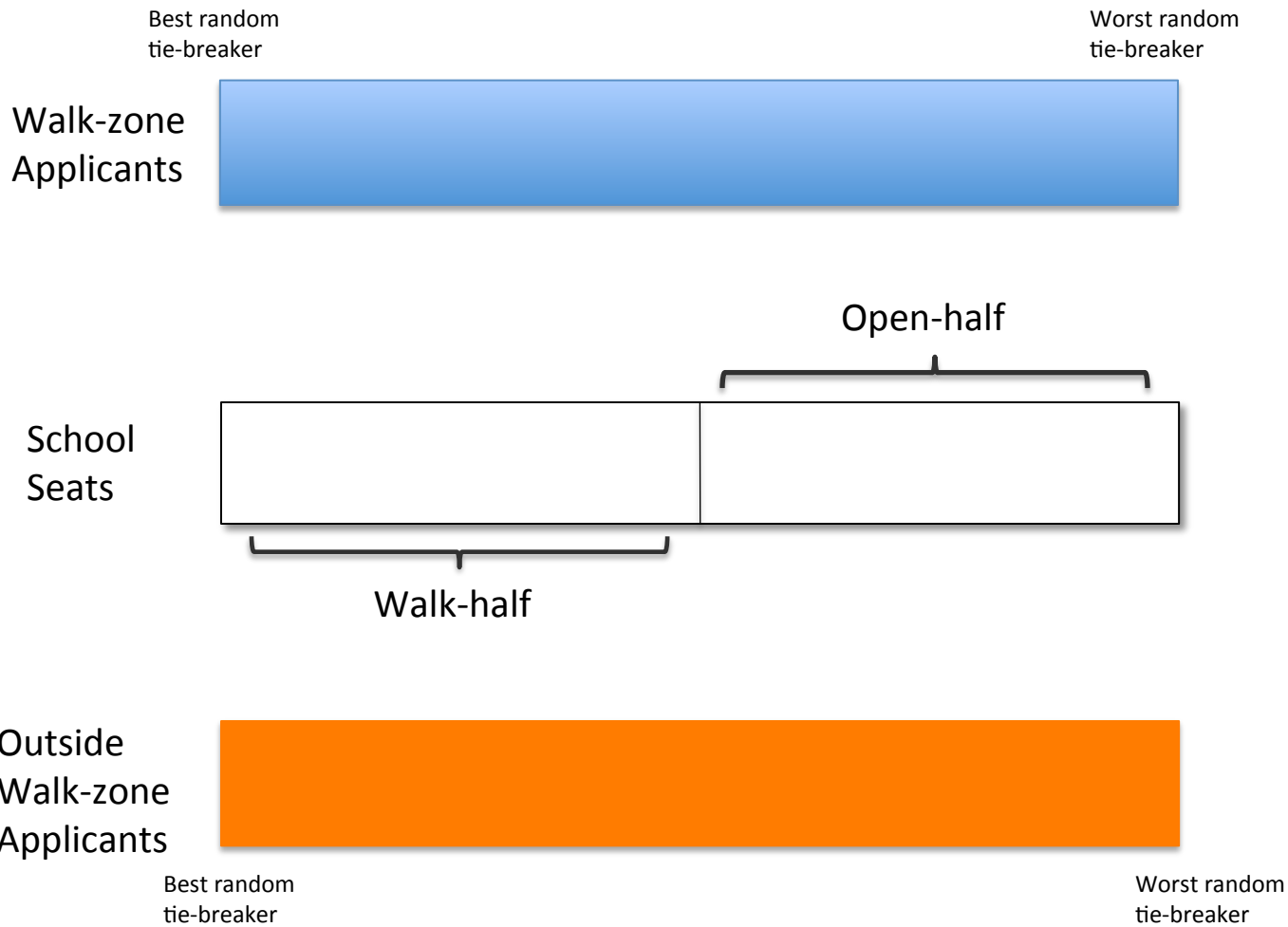
Best random tie-breaker

Worst random tie-breaker

For simplicity, this example assumes same number of walk-zone applicants and outside walk-zone applicants.

Scenario 2: 50-50 slot split (50% Walk-Zone Priority – 50% Open Priority),
Walk-half first – Open-half next, Same tie-breaker for both halves (Current BPS)

Walk-zone Applicants

Best random tie-breaker

Worst random tie-breaker

School Seats

Open-half

Walk-half

Outside Walk-zone Applicants

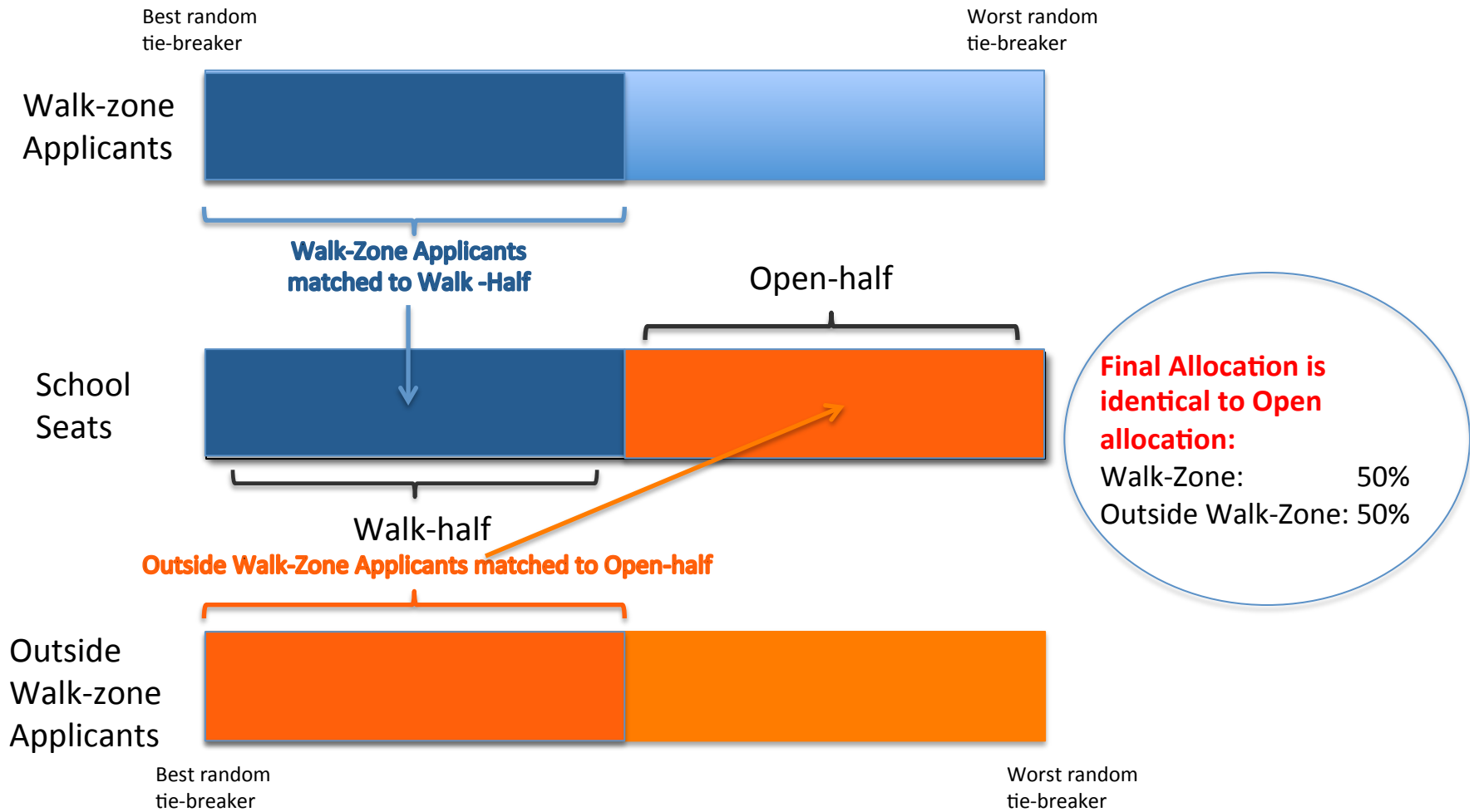Best random tie-breaker

Worst random tie-breaker

For simplicity, this example assumes same number of walk-zone applicants and outside walk-zone applicants.

Scenario 2: 50-50 slot split (50% Walk-Zone Priority – 50% Open Priority),
Walk-half first – Open-half next, Same tie-breaker for both halves (Current BPS)

Final Allocation is identical to Open allocation:
Walk-Zone: 50%
Outside Walk-Zone: 50%

There are two reasons:

1. PROCESSING ORDER BIAS: The earlier the walk-zone slots are processed, the fewer the number of Walk-zone applicants are to compete for open slots.

Walk-zone applicants
competing for open slots

Outside walk-zone applicants
competing for open slots

When the walk-half is processed before the open-half, twice as many outside applicants as walk-zone applicants compete for the open slots.

Had all applicants been given an even shot for open slots, a third of open slots would be assigned to walk-zone applicants and two-thirds to outside-walk zone applicants.
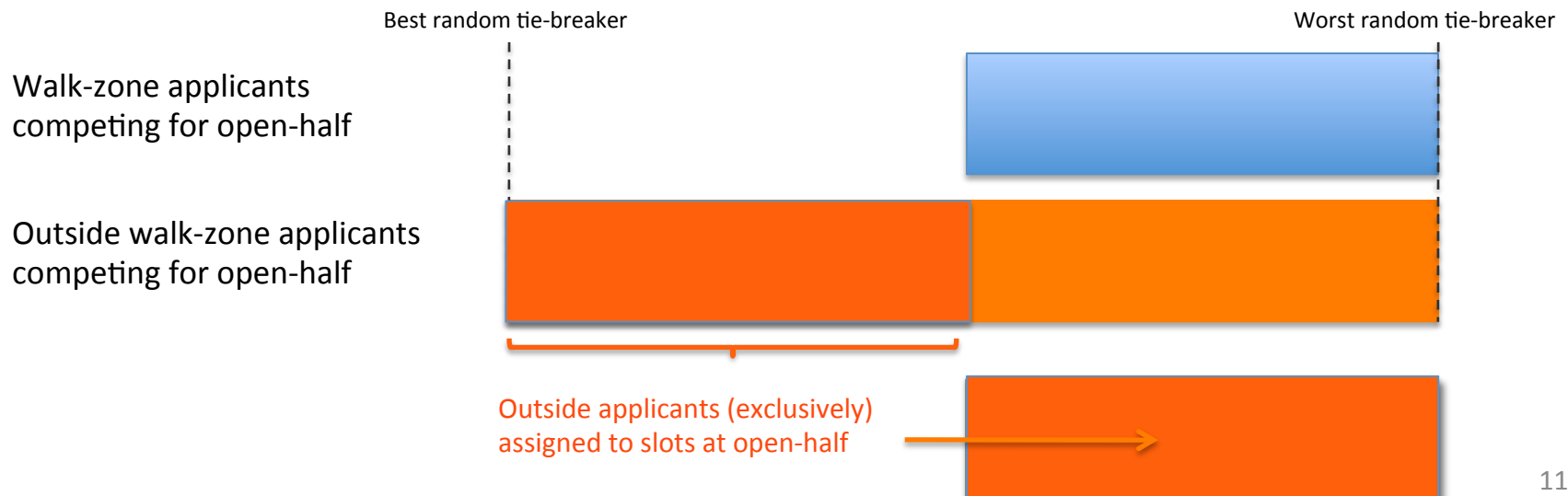
Elimination of the potential "second-bite" role of the Open–half

This is, however, not what happens under current BPS policy and the EAC recommendation. Despite the intended "second-bite" at a school, none of the open slots are assigned to walk zone students!

The more troublesome problem is the following:

2. RANDOMIZATION BIAS: There is an important unintended implication of using the same random tie-breaker for both halves. Since BPS first processes slots in the walk-half, those who remain all have unfavorable lottery numbers.

In this example, walk-zone students have no shot for the open half!

Best random tie-breaker   Worst random tie-breaker

Walk-zone applicants
competing for open-half

Outside walk-zone applicants
competing for open-half

Outside applicants (exclusively)
assigned to slots at open-half

- Many believe that at 50% of slots, walk zone applicants have an edge…

 …. but as we've seen, at the other 50% of open slots, they are systematically disadvantaged

- As a result, current implementation of 50/50 is as if there is no walk zone priority.

- In our view, this misconception creates unneeded confusion among the public, and compromises the transparency of the assignment system

Is there a fully transparent procedure which eliminates both types of biases in allocation of open slots?

Yes. The following unbiased treatment removes both sources of bias.

1. Rather than processing all slots in the walk-half before all slots in the open half, rotate between the two types of slots.

School Slots

O W O W O W O W O W O W O W O W O W O W
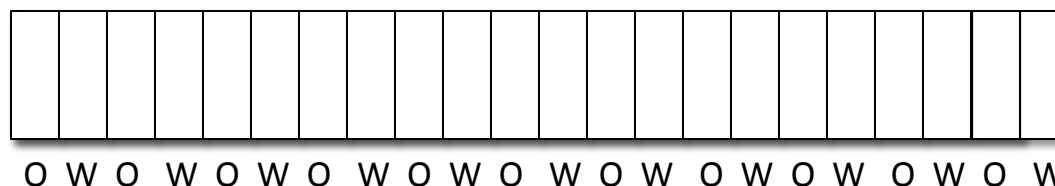
2. To avoid the major disadvantage to walk-zone applicants at open slots, use a second lottery number for these slots. This will give walk-zone applicants a fair shot for open slots.
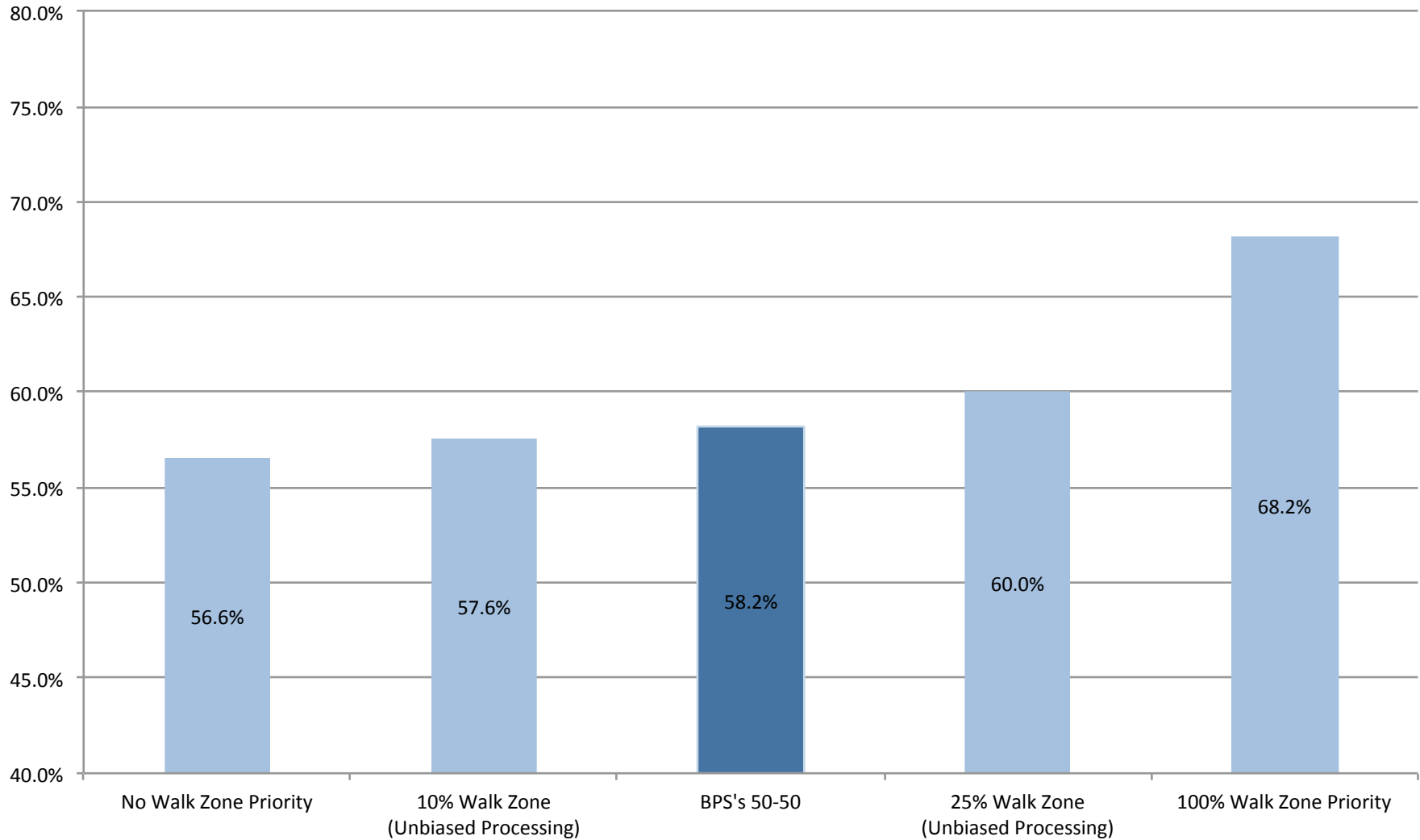
While removing both biases is ideal, correction of the second one is key to have a transparent system.

Otherwise, the 50-50 slot split appears cosmetic and may unintentionally mislead the community.

Note: Fully unbiased procedure can be calibrated to adjust the slot breakdown (ex. 25% walk – 75% open) as the school committee wishes.

- In our view, this is the preferred way to alter the fraction of walk-zone students at schools (if that is your goal) since it is transparent.

- In contrast, the current system secretly reduces the fraction of walk-zone students at a school, while giving the impression of a walk advantage.

Grade K2, 2009-2012, Round 1
Fraction of Assigned Students Assigned to Walk Zone School

No Walk Zone Priority	10% Walk Zone (Unbiased Processing)	BPS's 50-50	25% Walk Zone (Unbiased Processing)	100% Walk Zone Priority
56.6%	57.6%	58.2%	60.0%	68.2%

- We are not proposing 50/50 or 25/75 or something else: this is up to you. We are proposing to remove the unintended consequence of improper implementation of the school split in the algorithm.

- While the EAC recommended revisiting the walk zone processing issue in the future, for the sake of transparency, we urge the school committee to adopt the unbiased treatment now (with their preferred slot split).

- Once this issue is resolved, the walk zone percentage slot breakdown should be examined either now or in the future (as the EAC recommends), but using the ideal unbiased treatment.

Reference

Dur, Kominers, Pathak, Sönmez (2012). "Priorities vs. Precedence in School Choice: Theory and Evidence from Boston," Manuscript.