

World Trade Center Evacuation and Means of Egress Design Implications

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Despite their presentation of much useful information on the WTC disaster, the NIST study and reports on occupant behavior and evacuation need to be augmented relative to two issues.

World Trade Center Evacuation and Means of Egress Design Implications

- **Activity of evacuees and others in the exit stairwells**
- **Extent to which exit stairwell remoteness played a role in 9/11**

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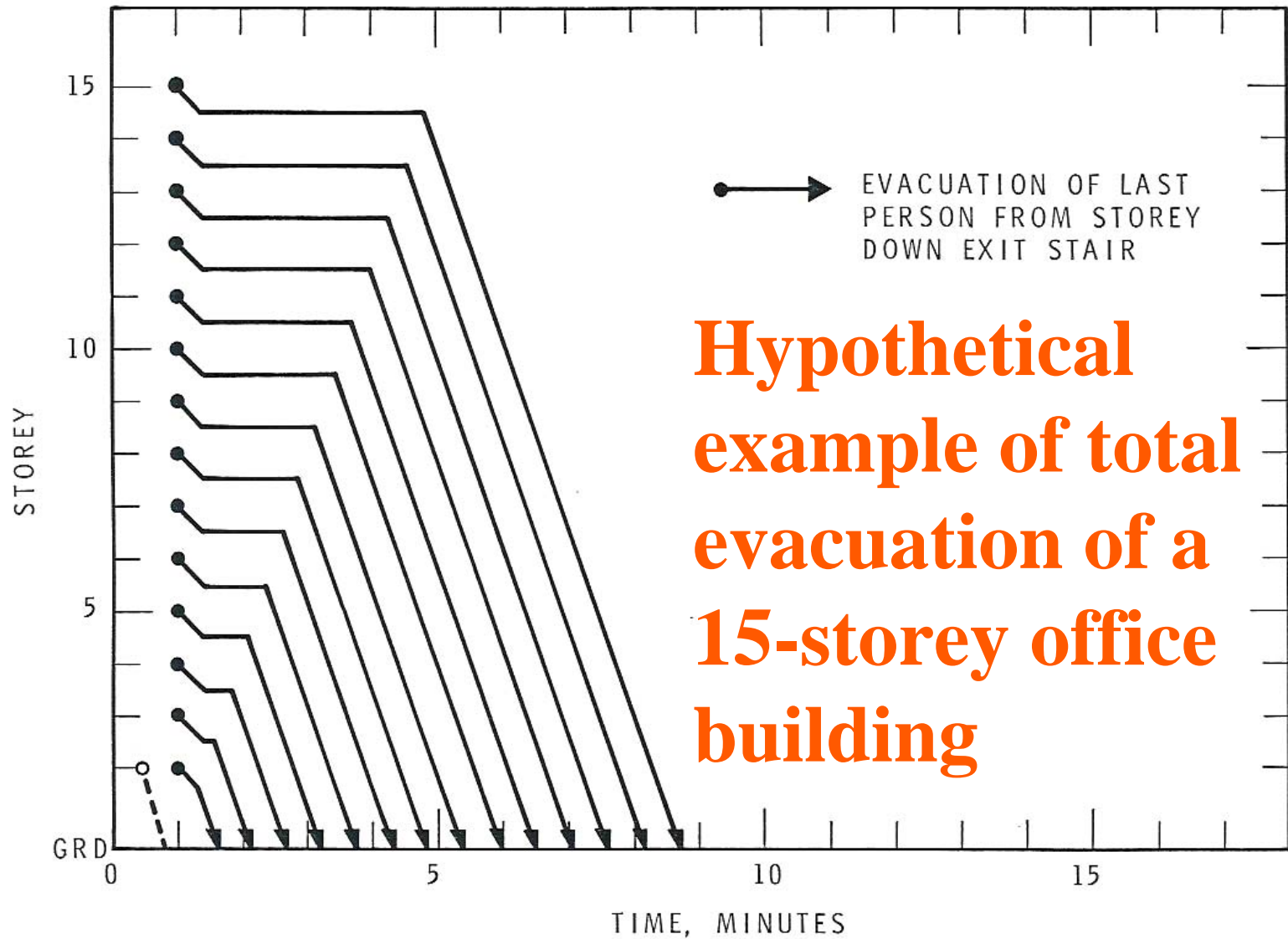
- **Activity of evacuees and others in the exit stairwells**

- **Activity of evacuees and others in the exit stairwells** got *relative short shrift* in the *NIST reports* — due to the *relative emphasis* by *NIST researchers* on *pre-evacuation behavior of occupants*.

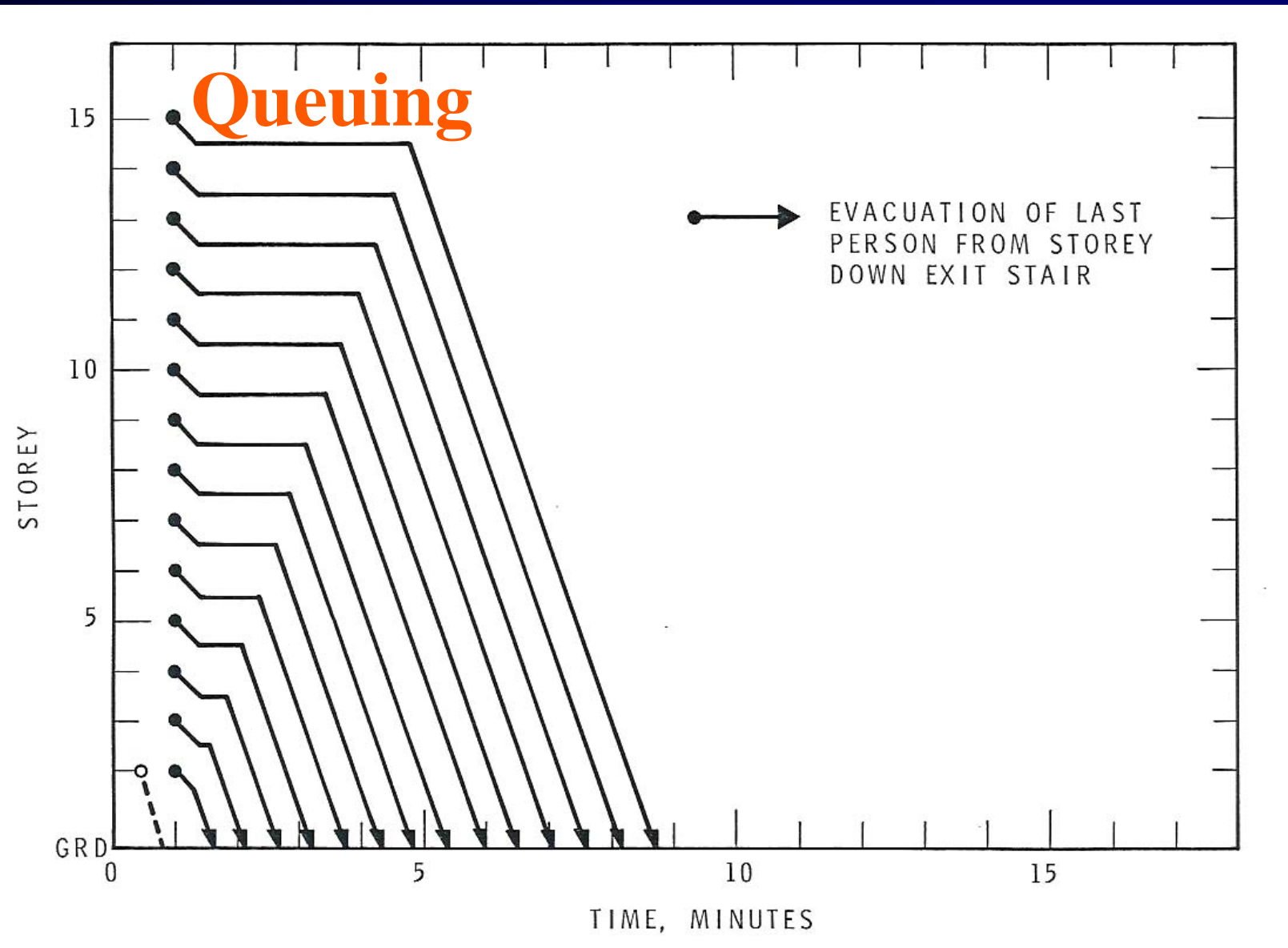
- **Augment NIST's treatment of exit use by employing analysis and presentation techniques developed 35 years ago in high-rise building evacuation studies at NRC Canada.**

**Graphical Models
of
Evacuation
Strategies
and
Activity**

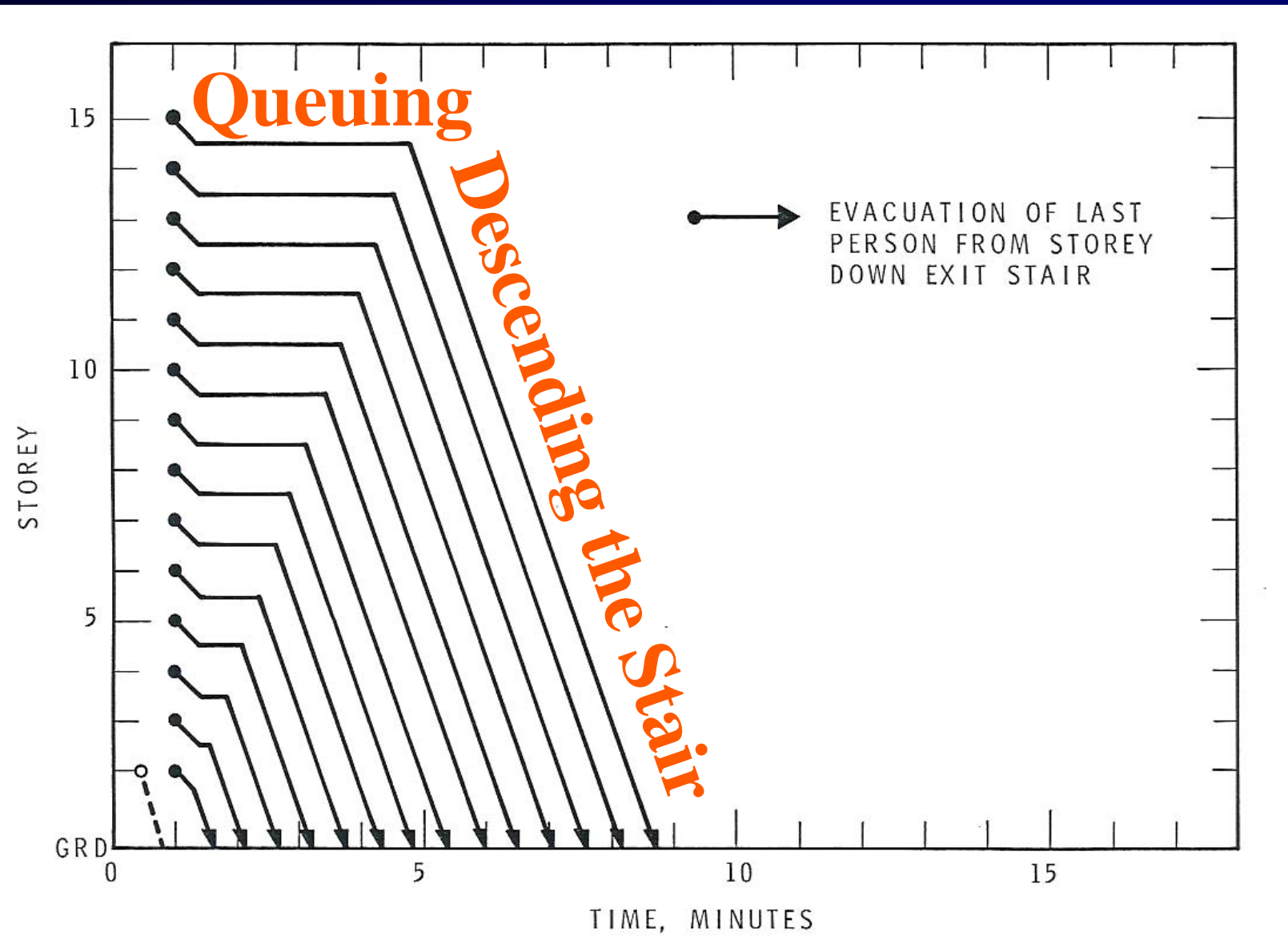
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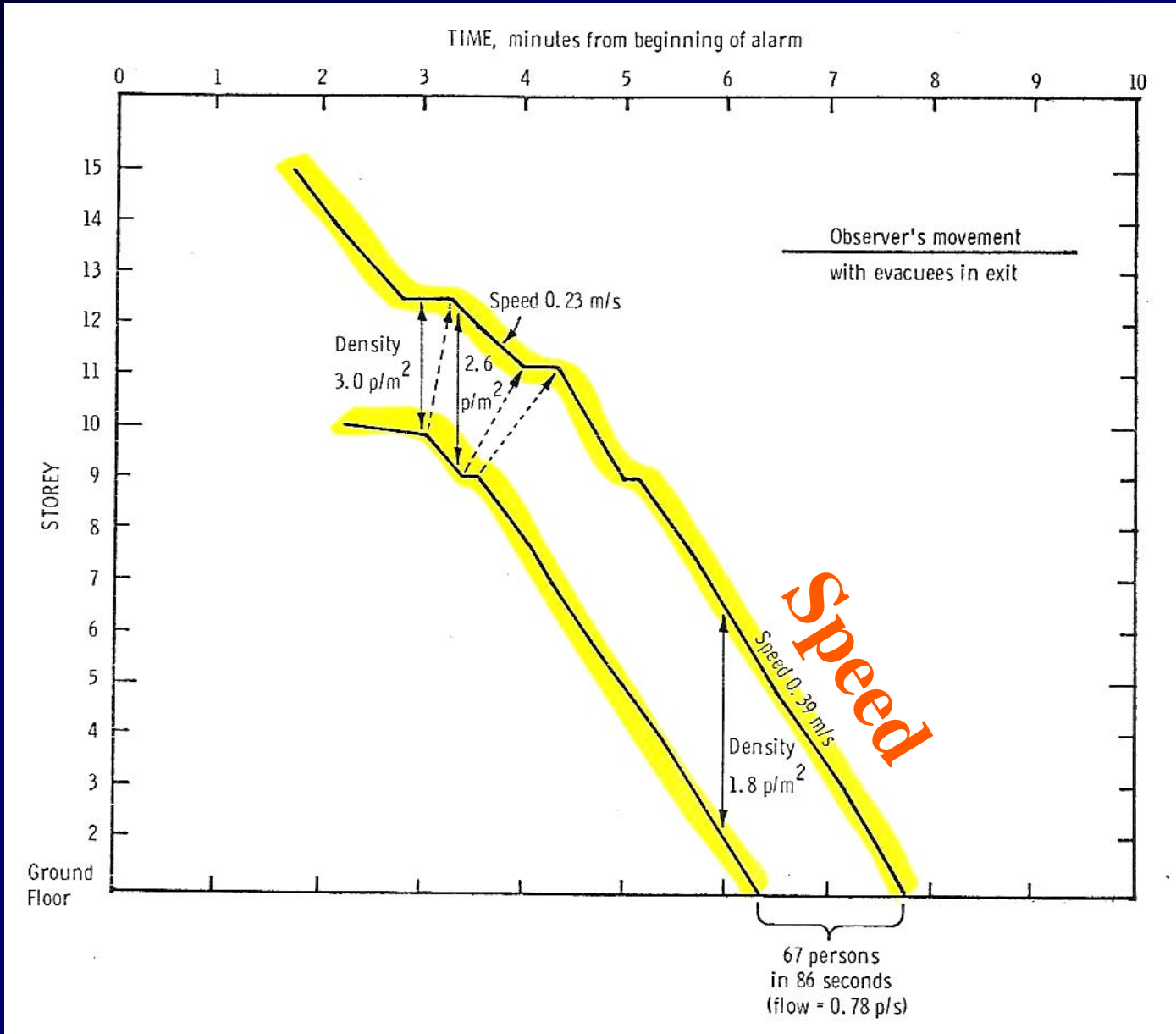
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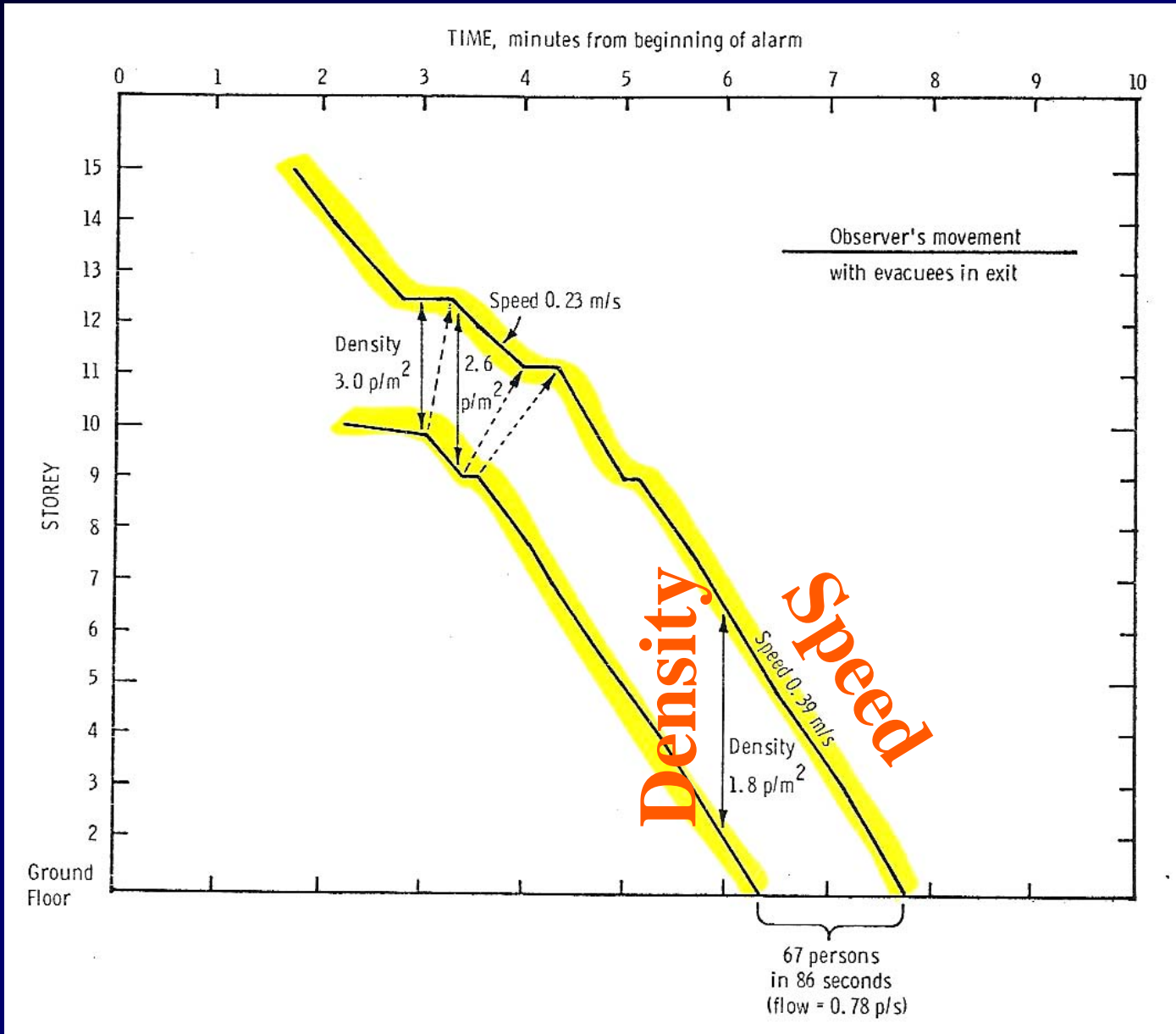
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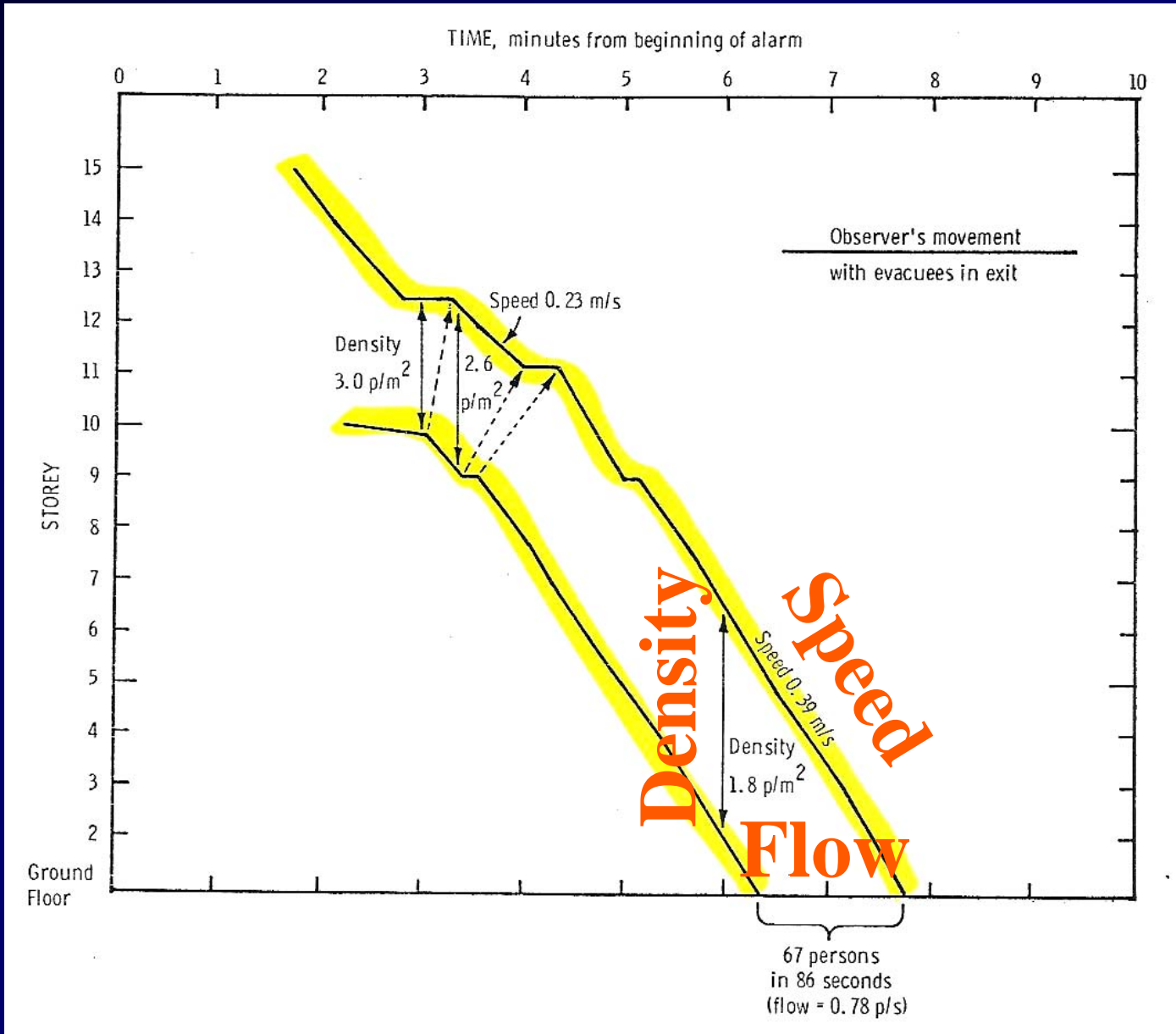
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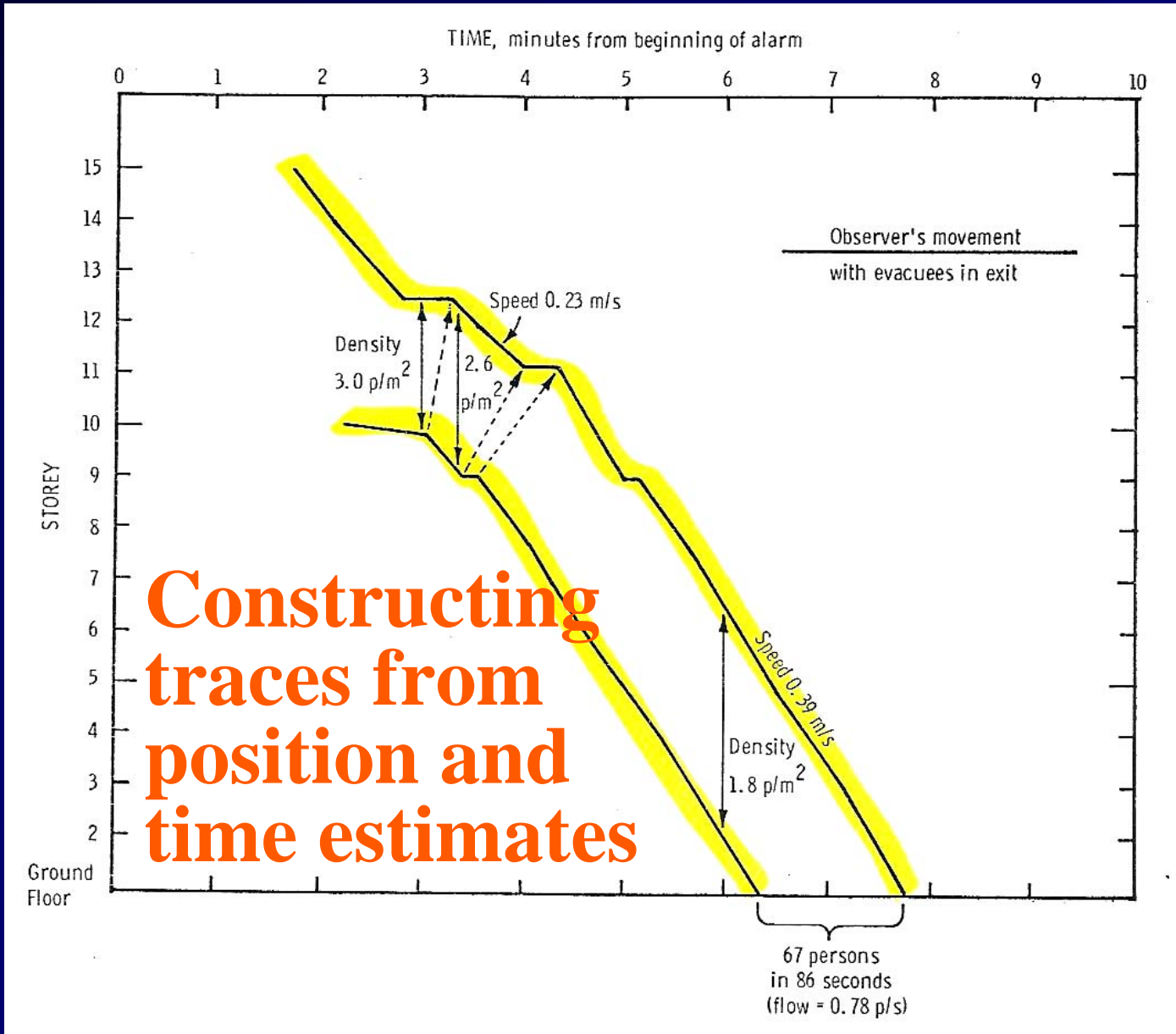
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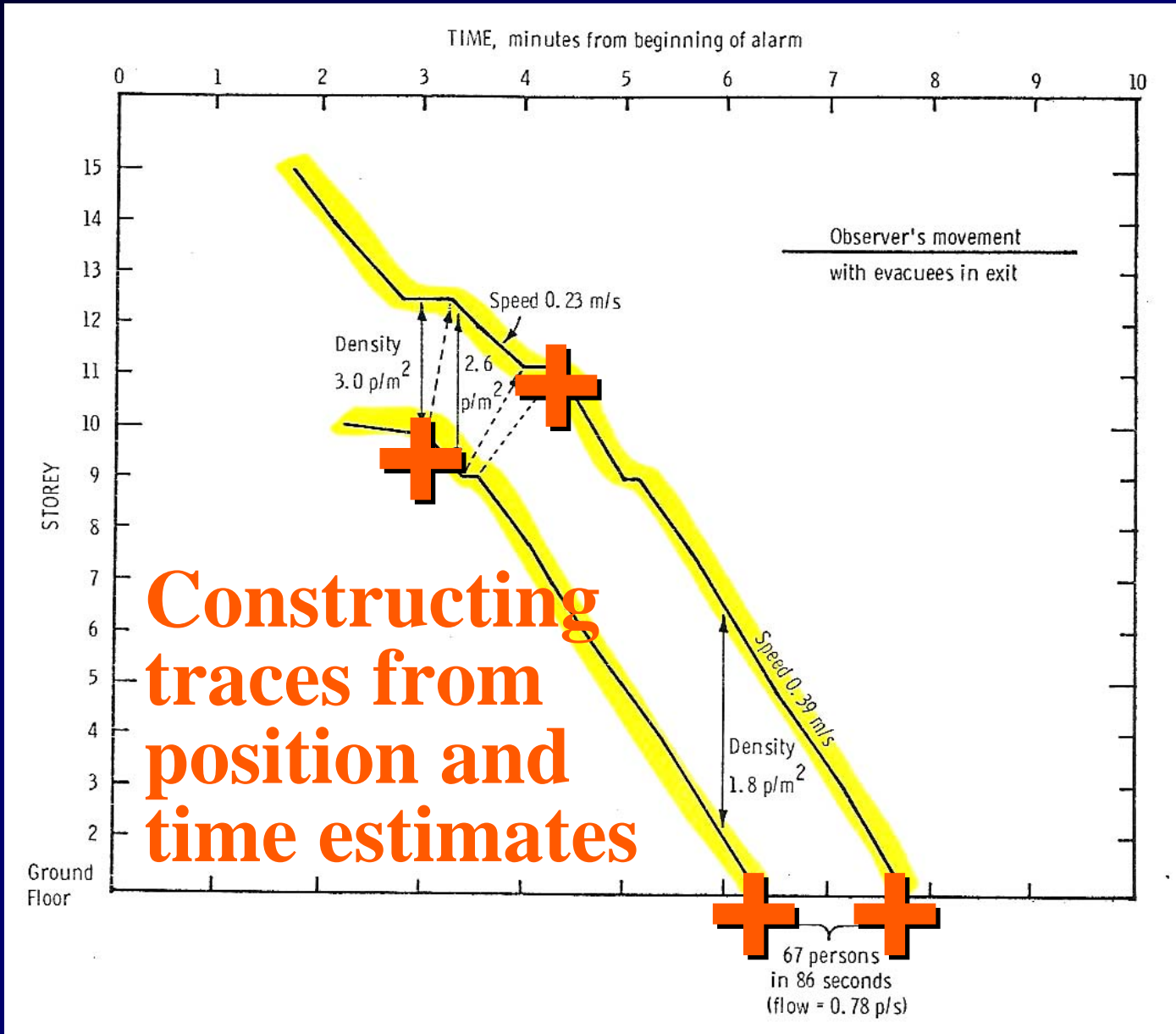


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Constructing traces from position and time estimates

World Trade Center Evacuation and Means of Egress Design Implications



World Trade Center Evacuation and Means of Egress Design Implications

FLOOR

TIME

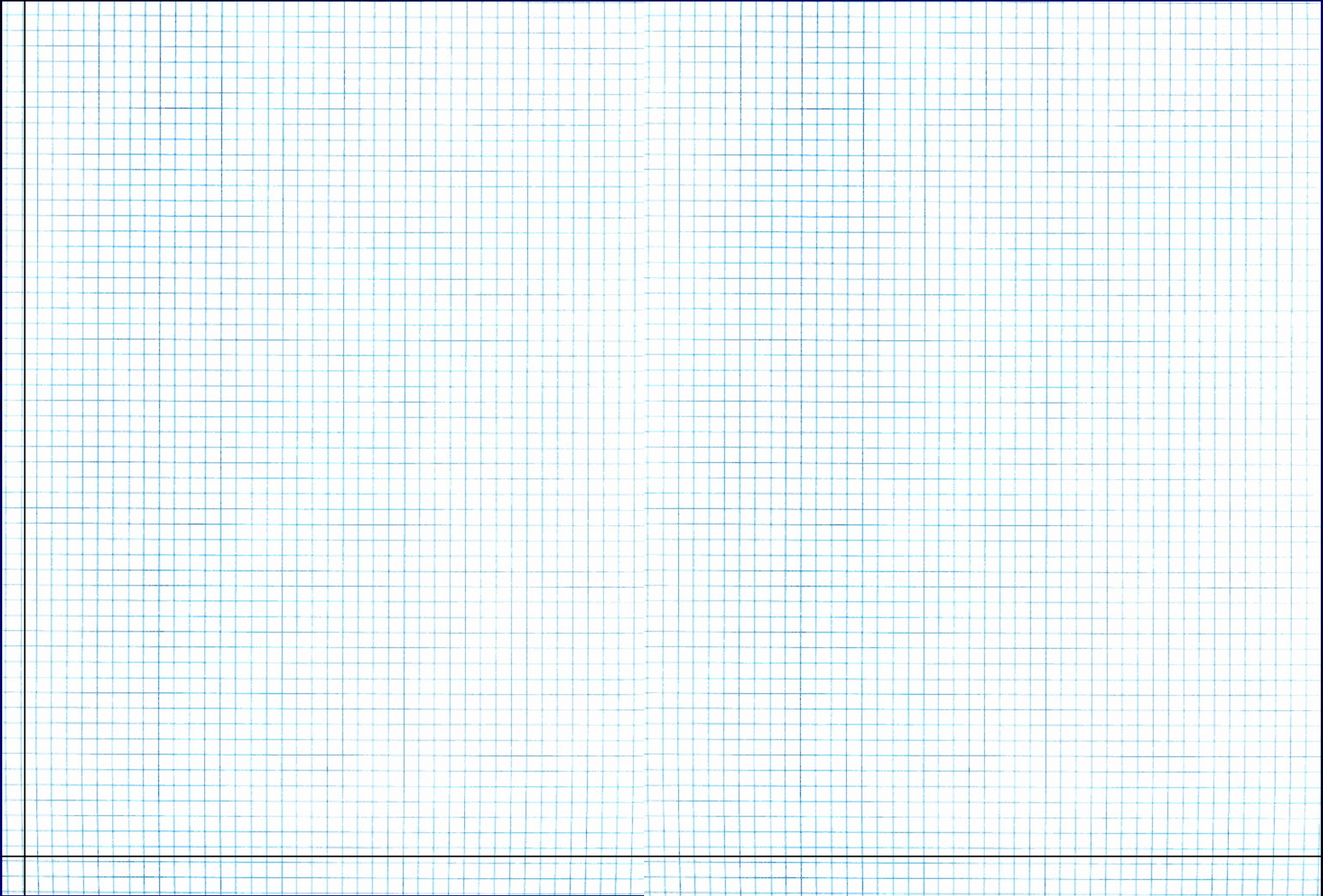


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FLOOR

TIME



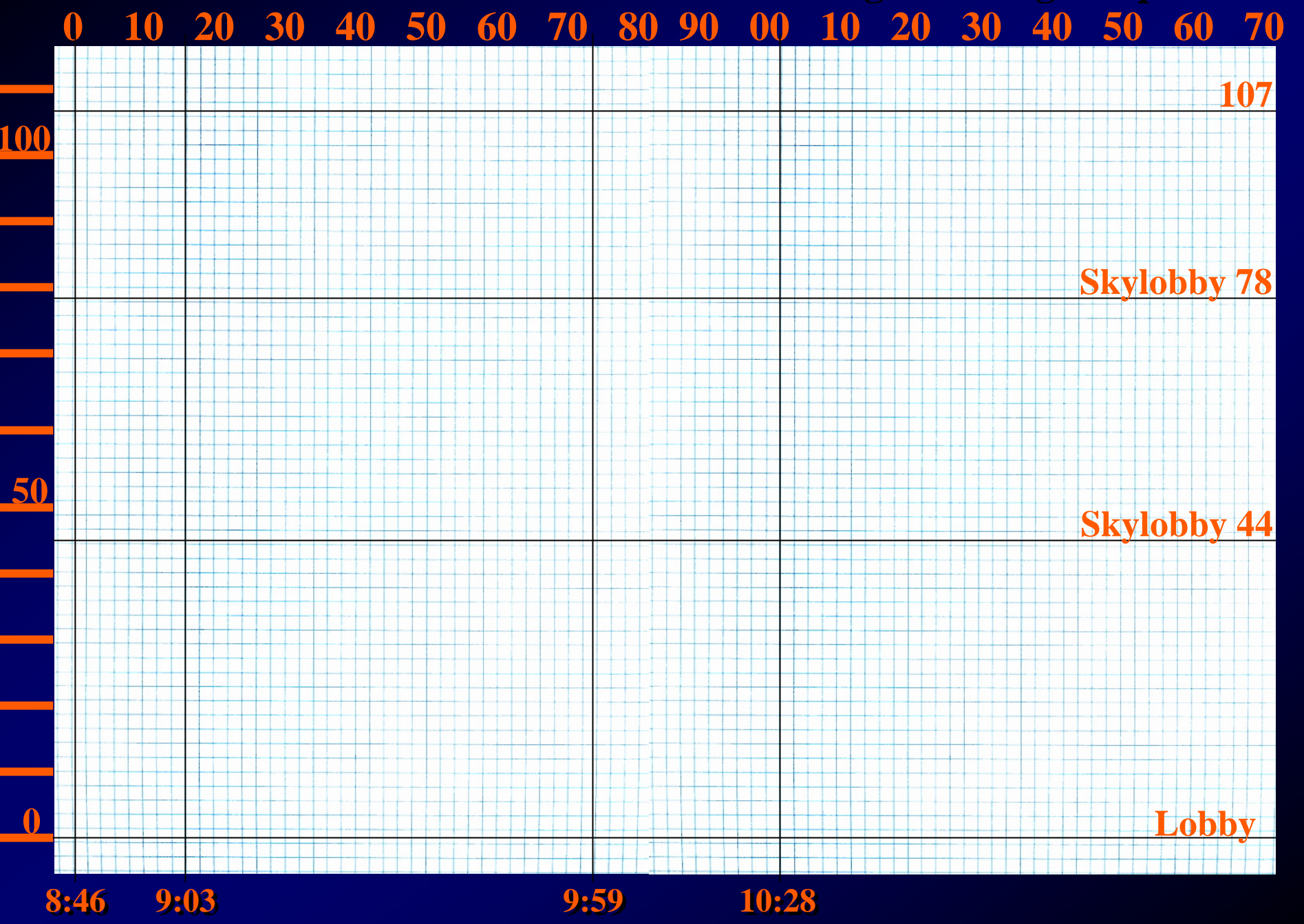
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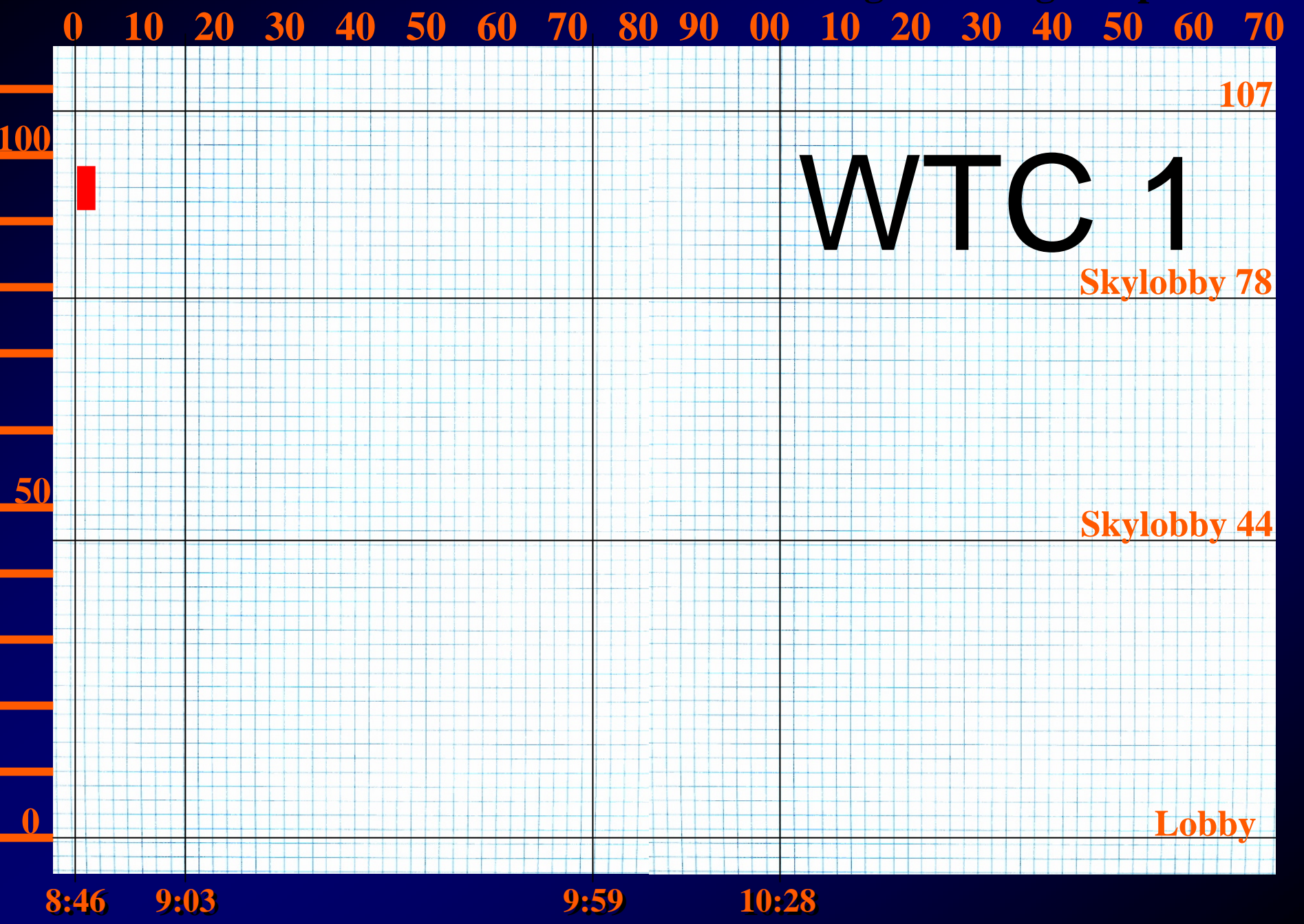


TIME

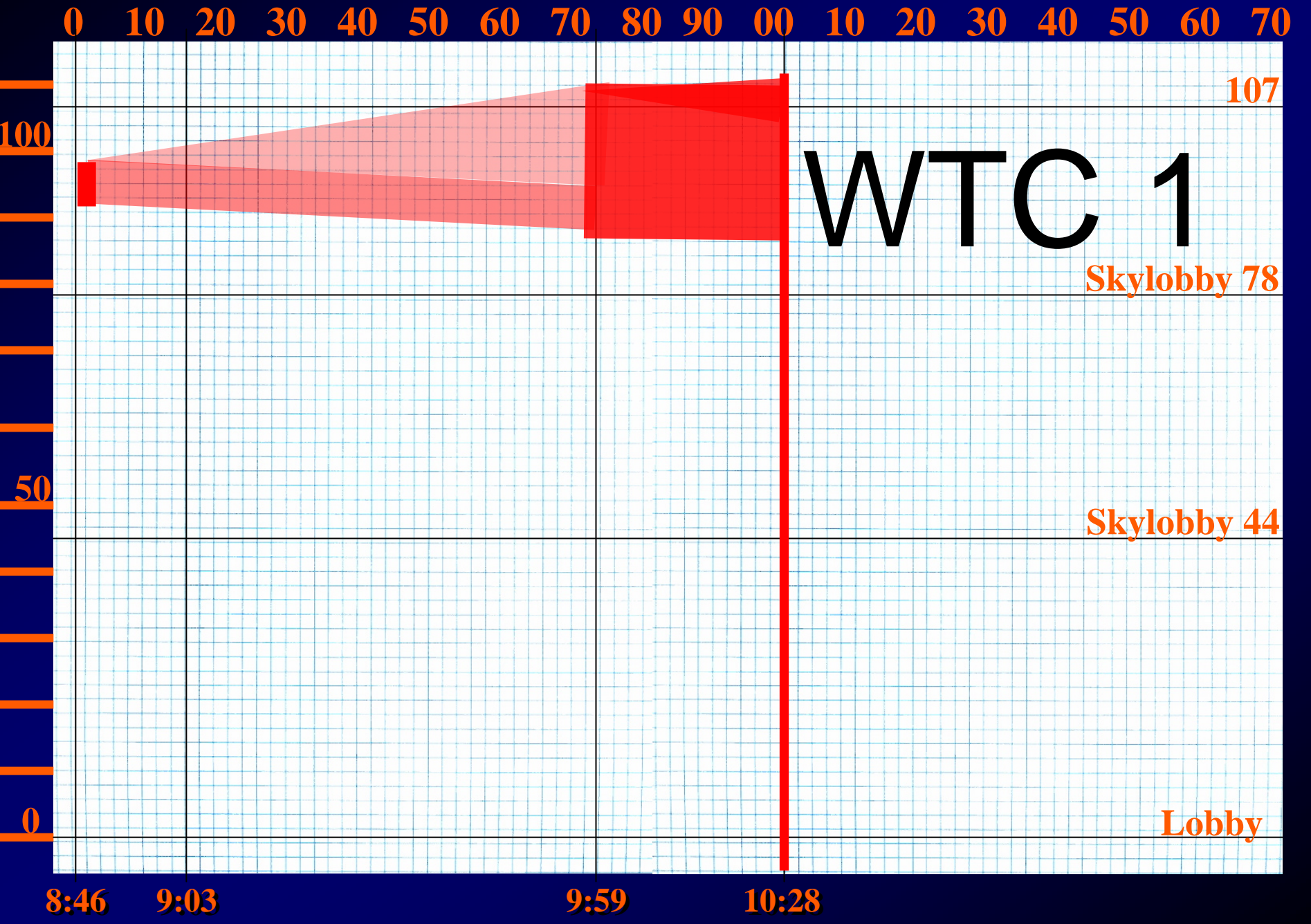
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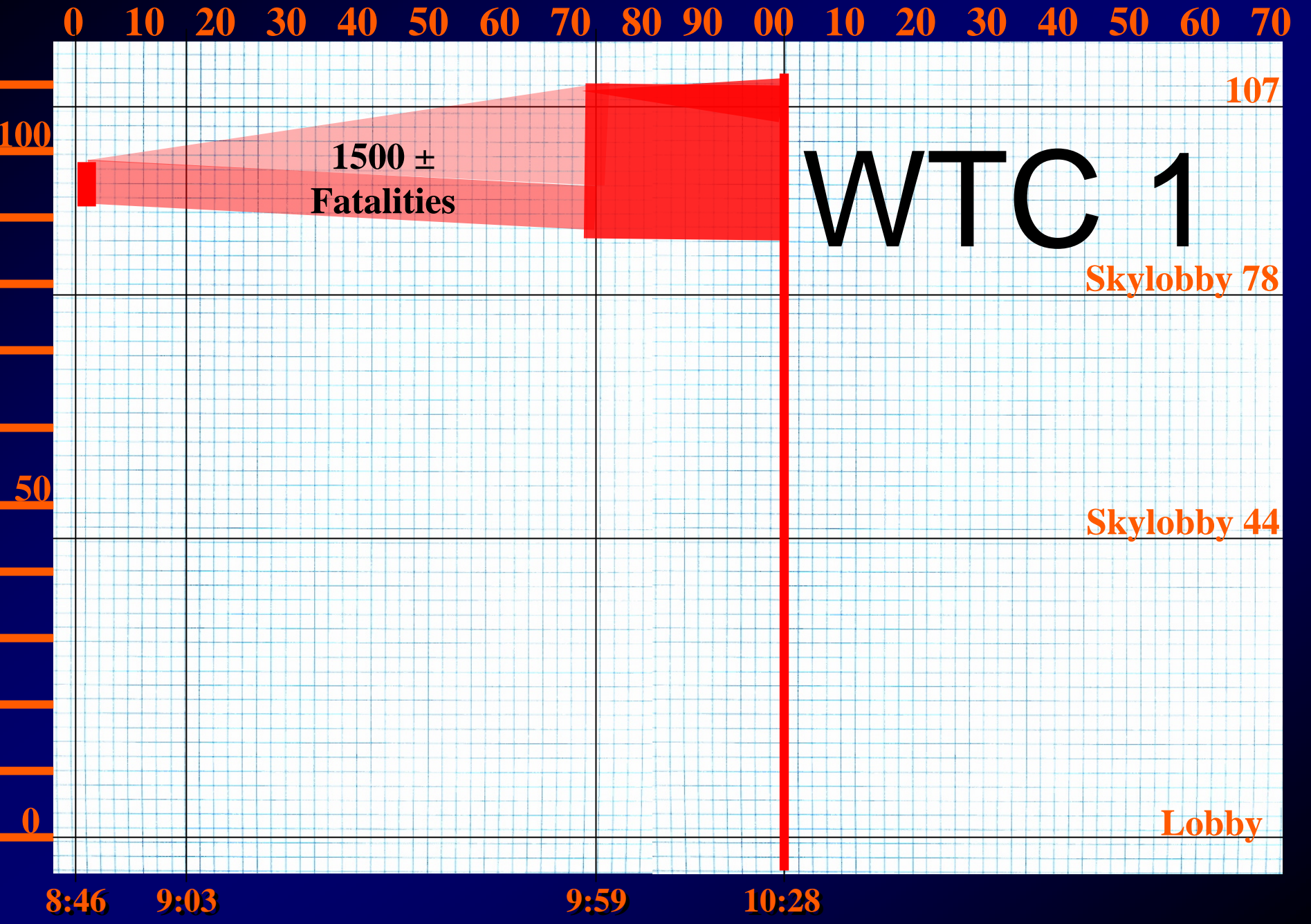
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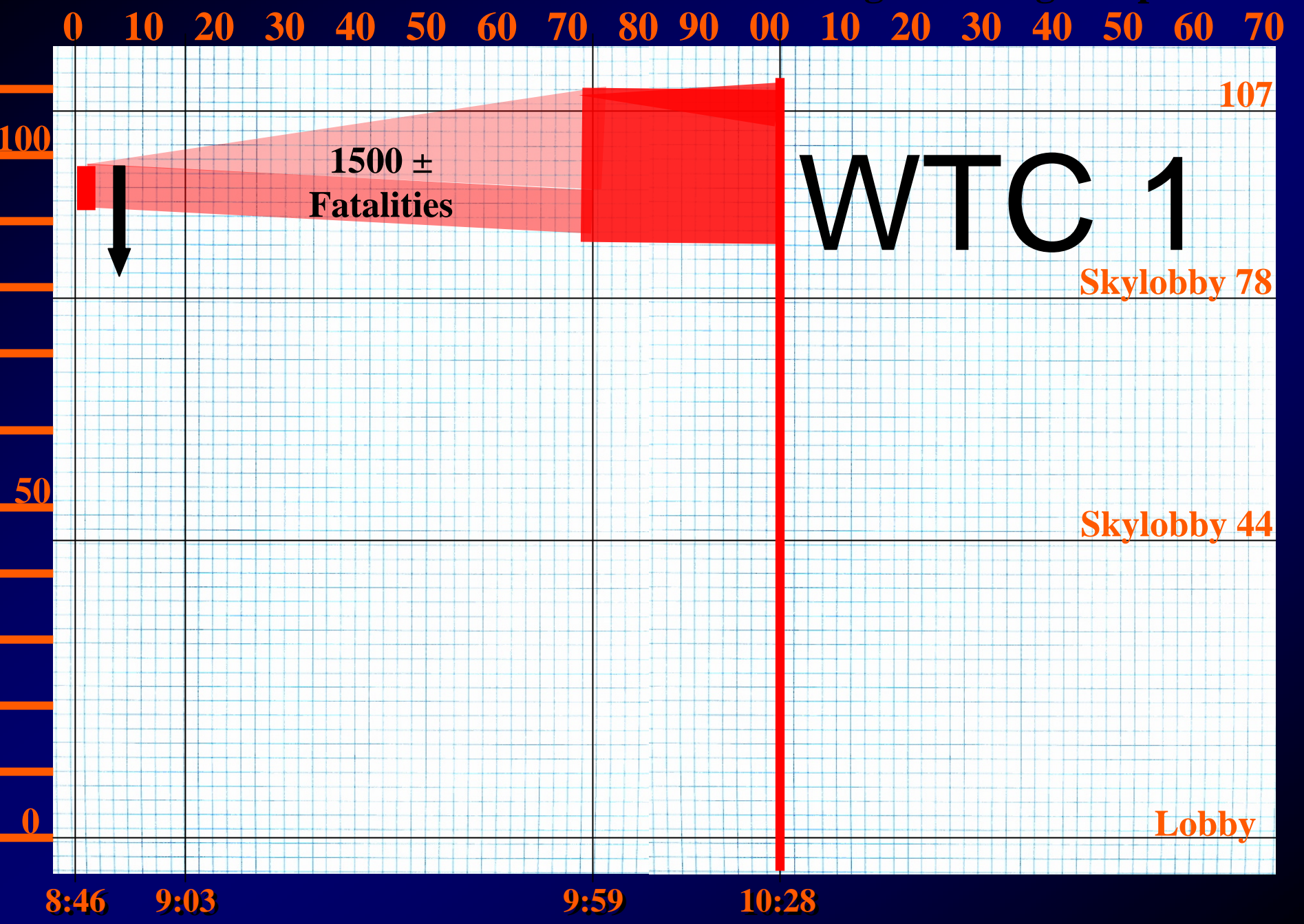
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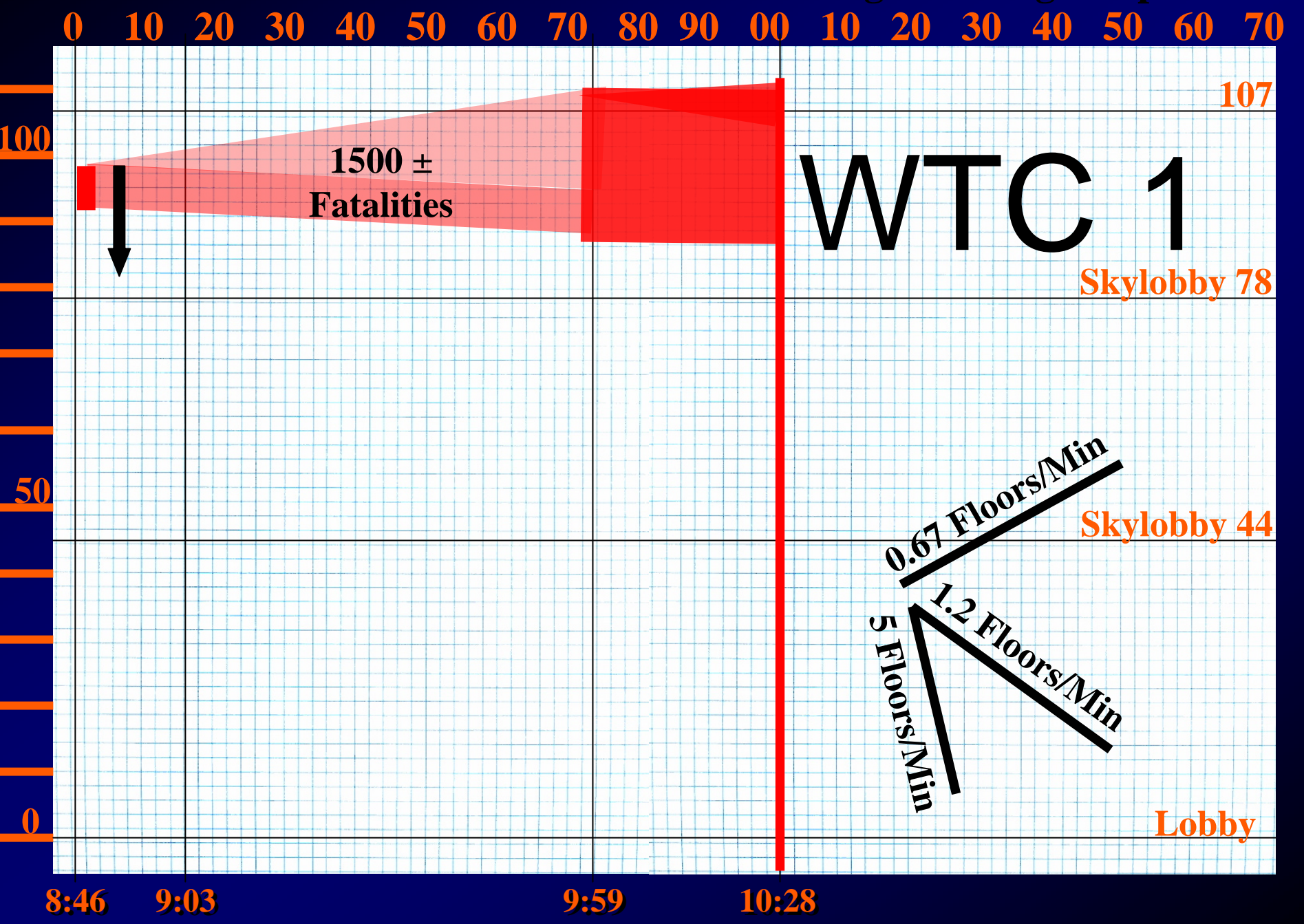
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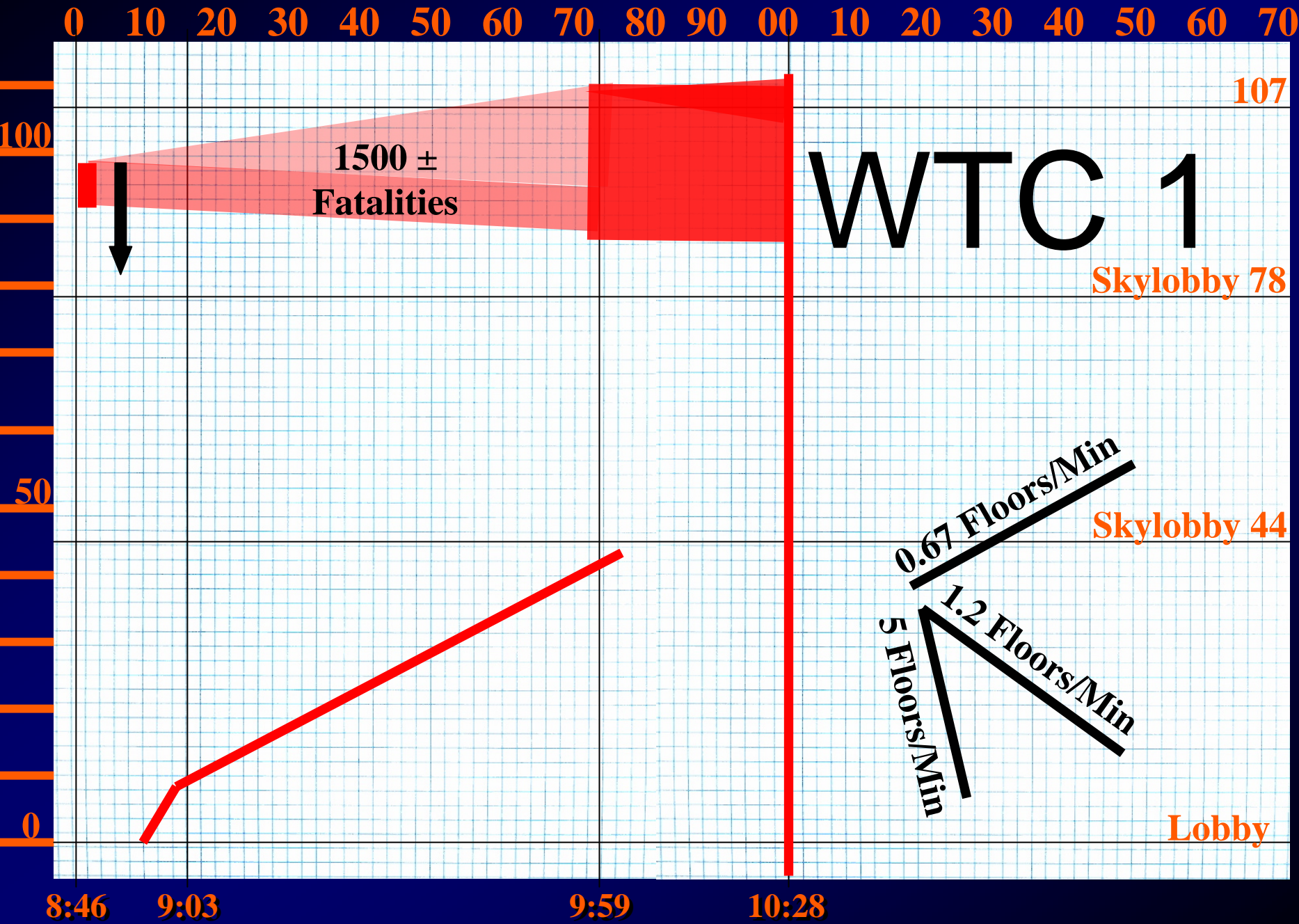
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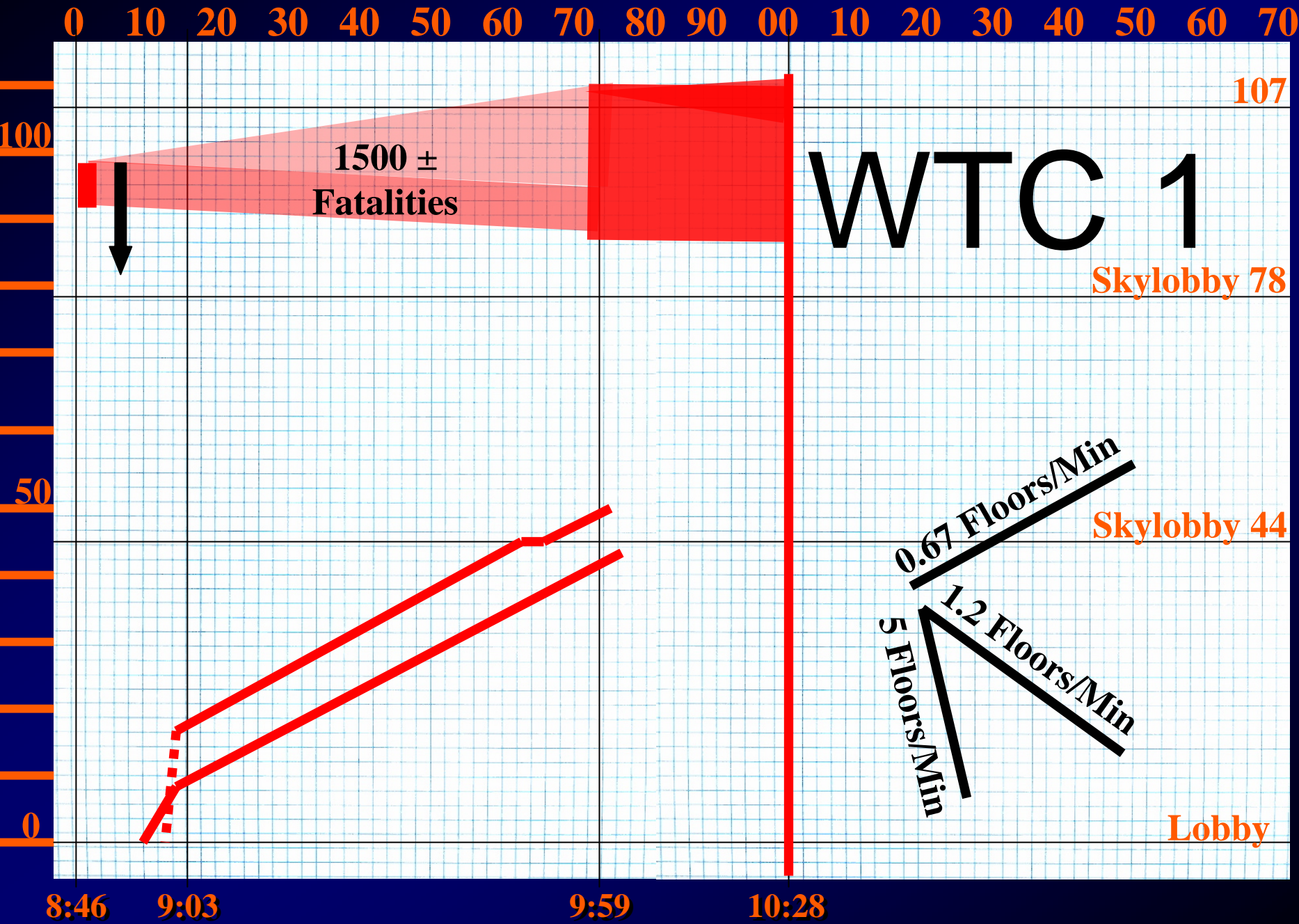
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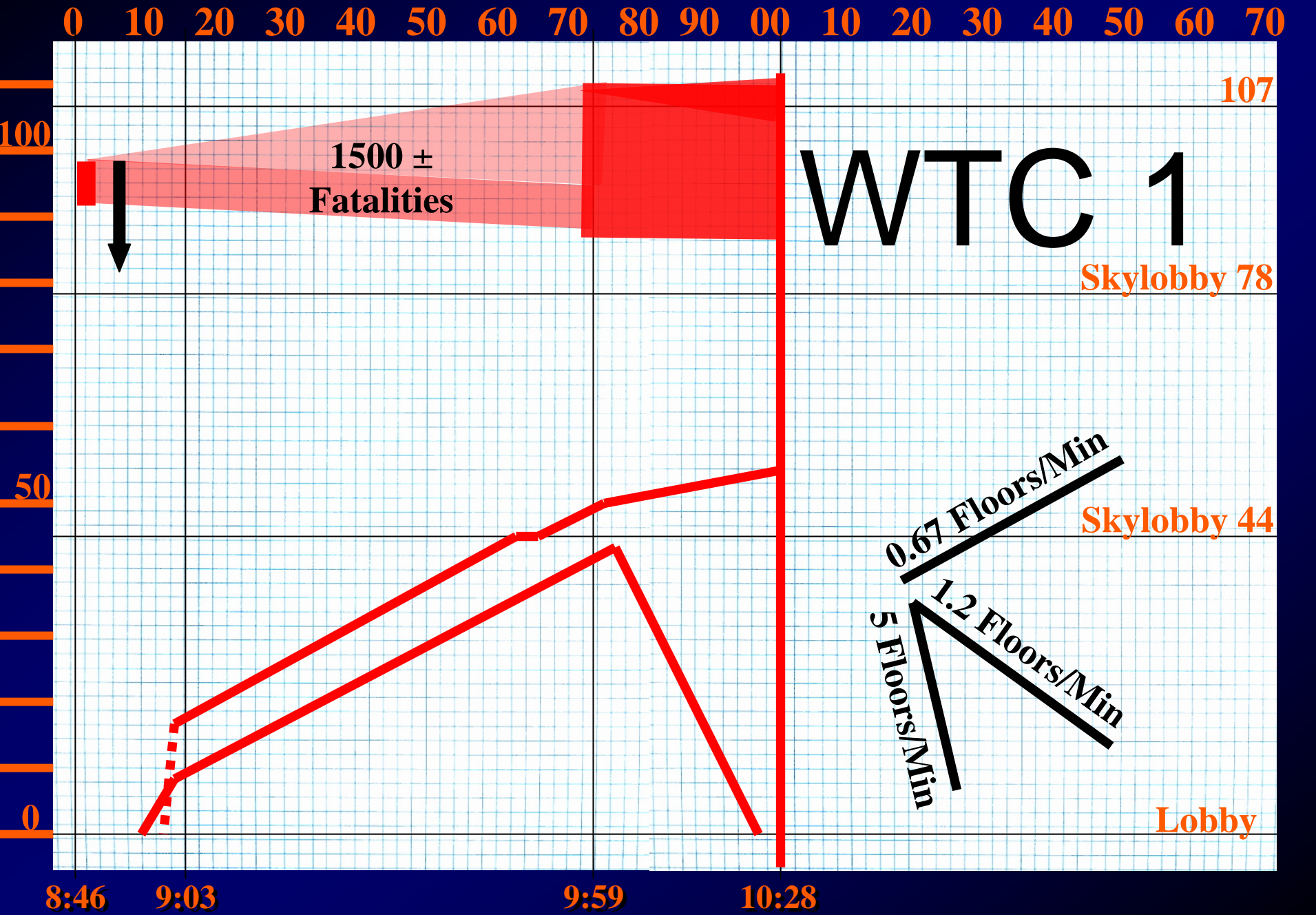
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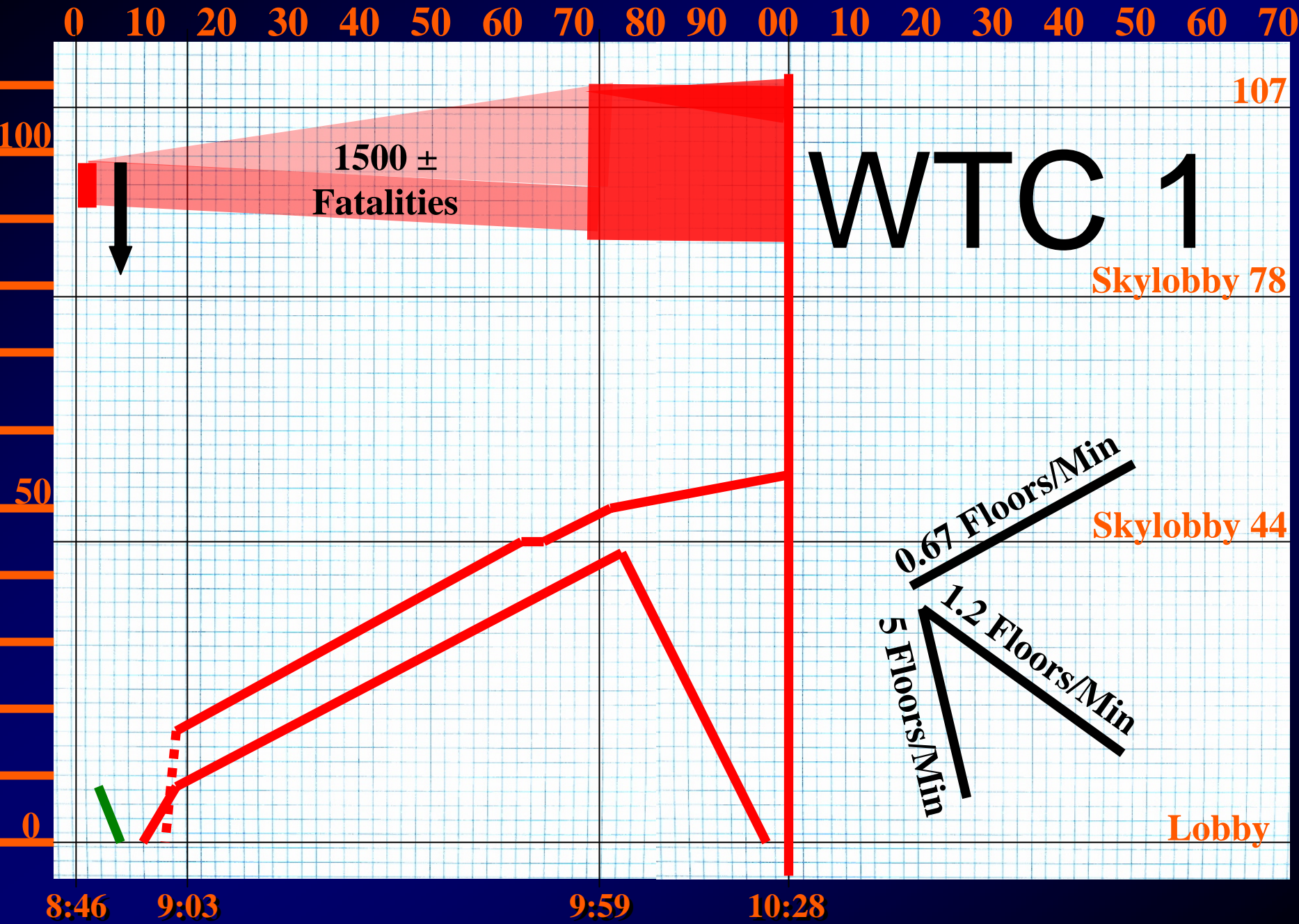
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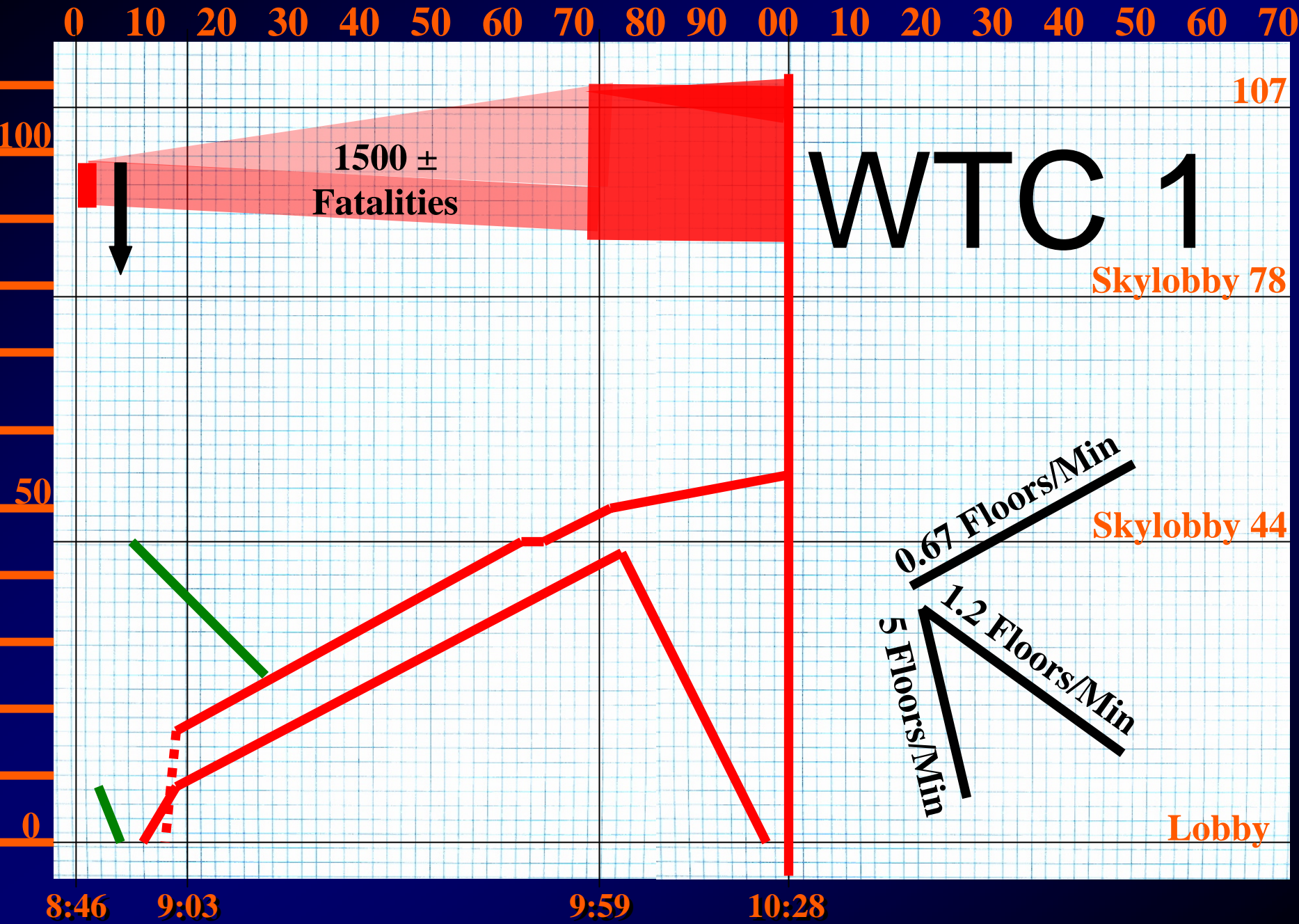
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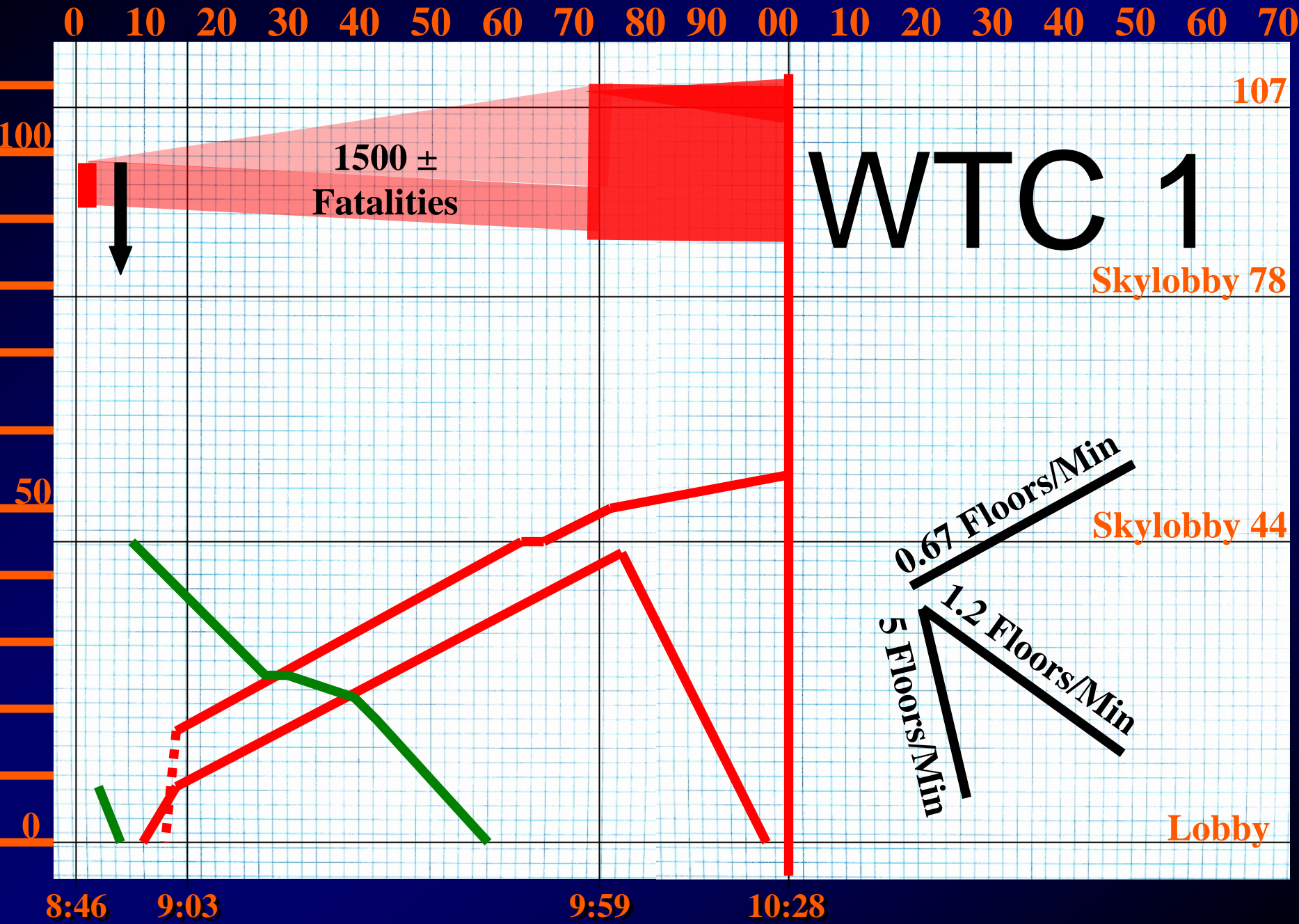
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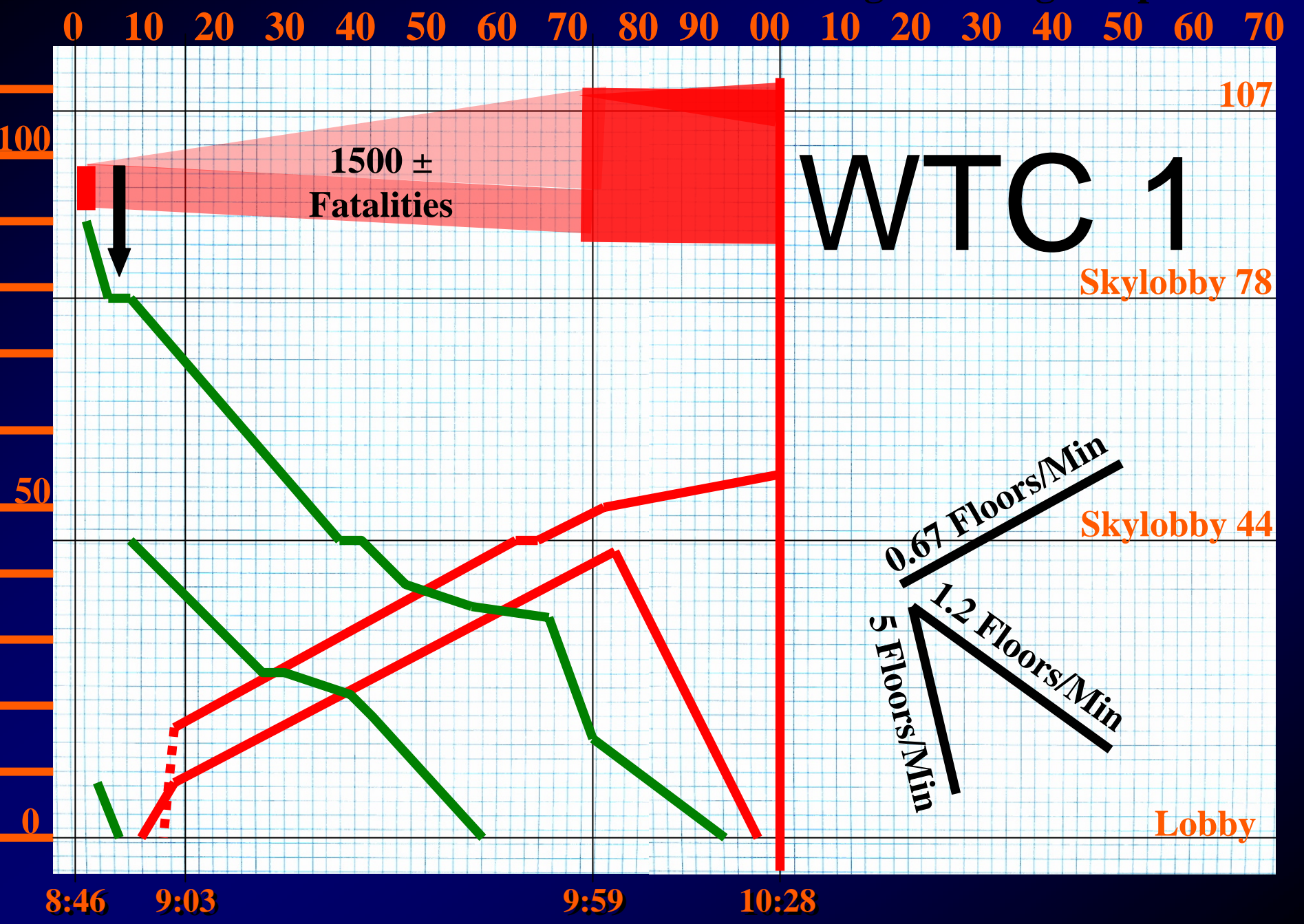
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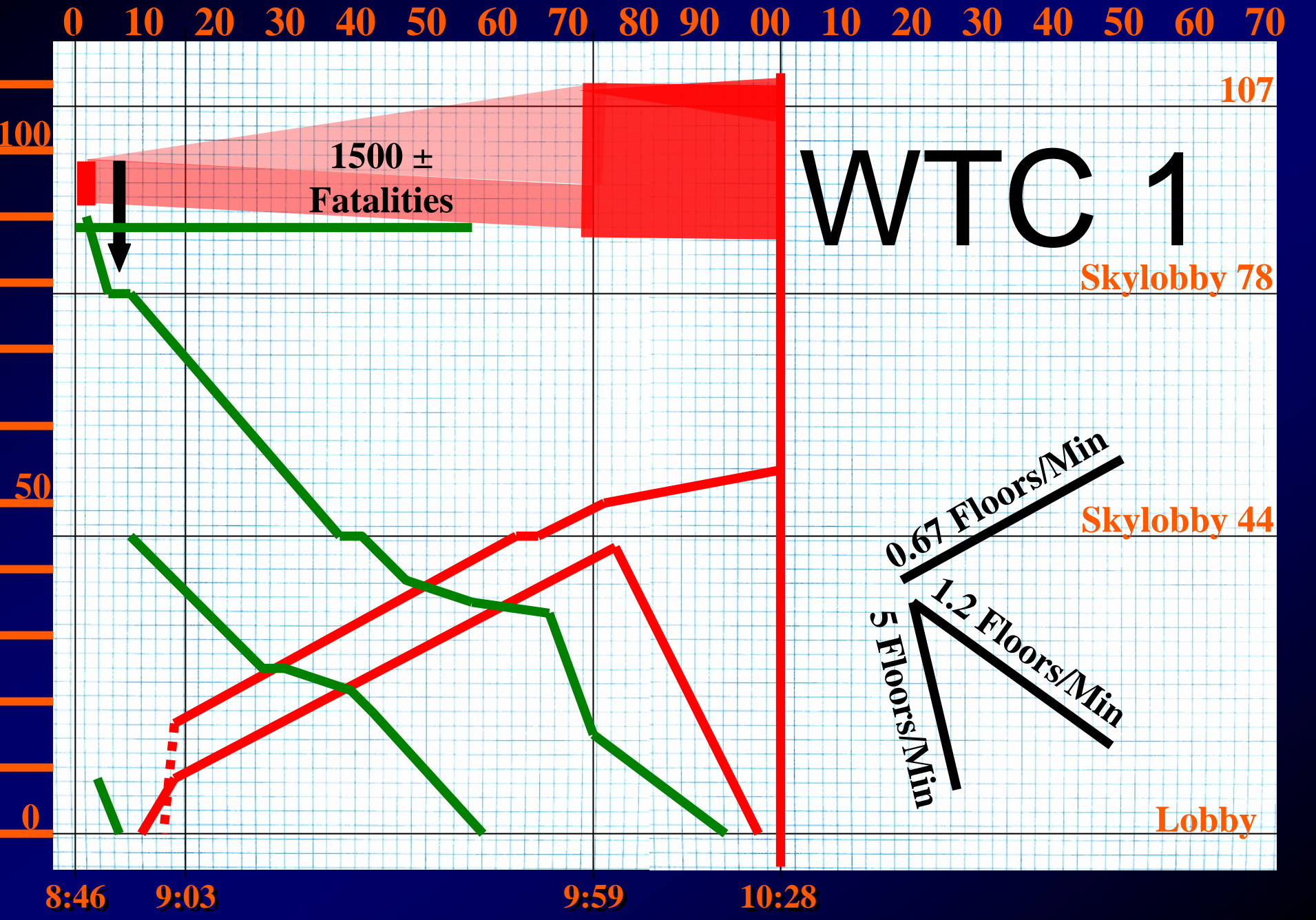
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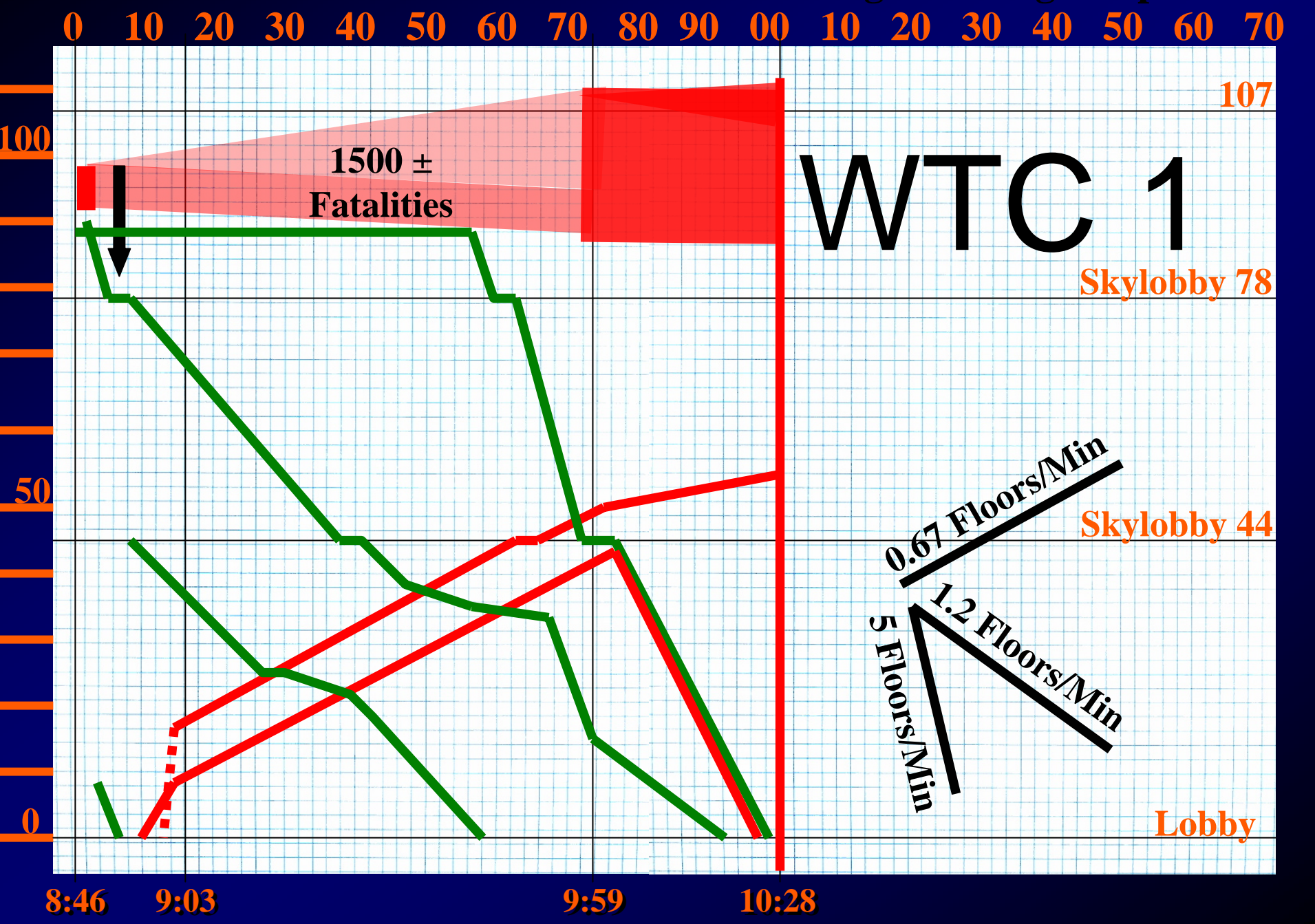
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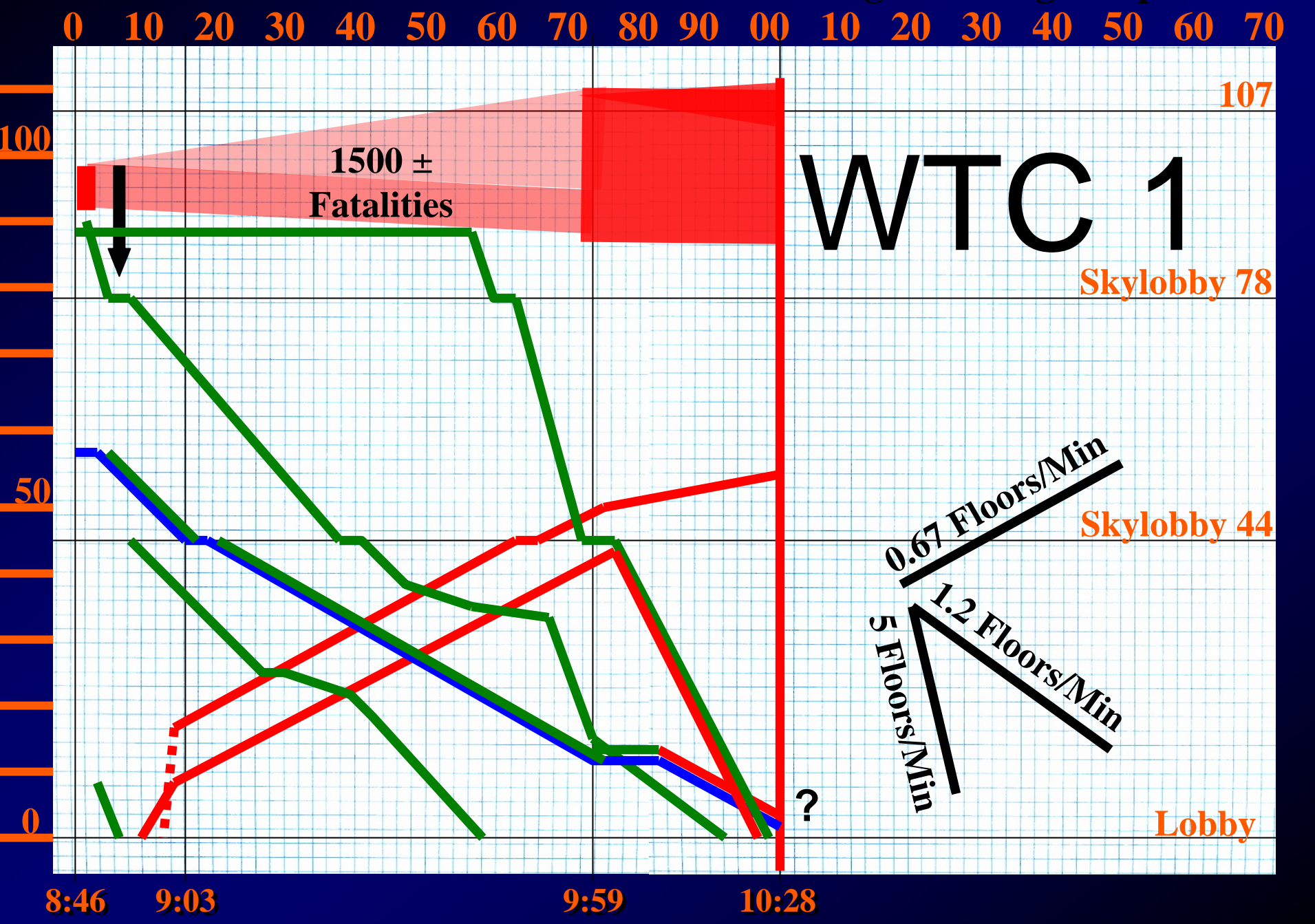
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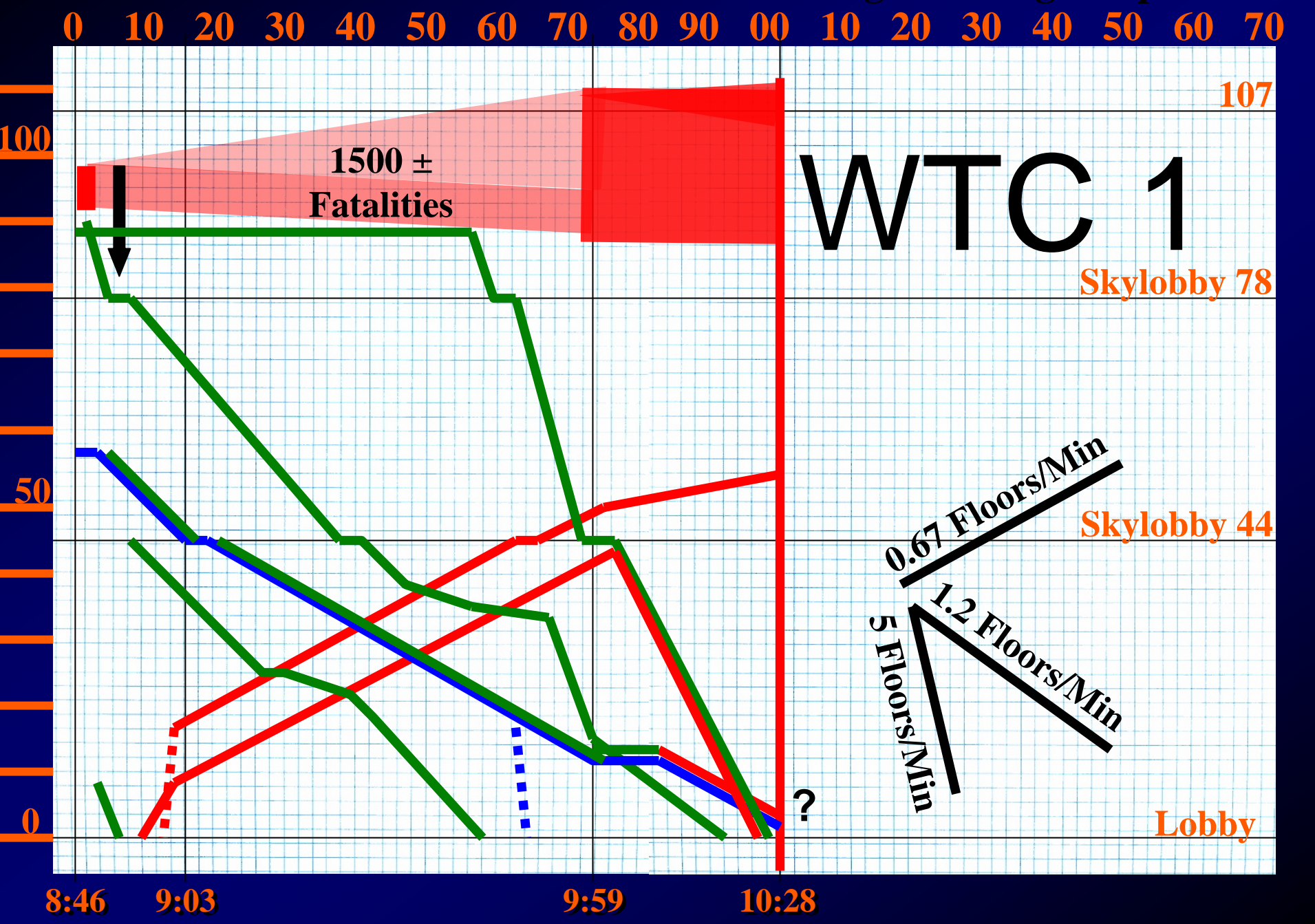
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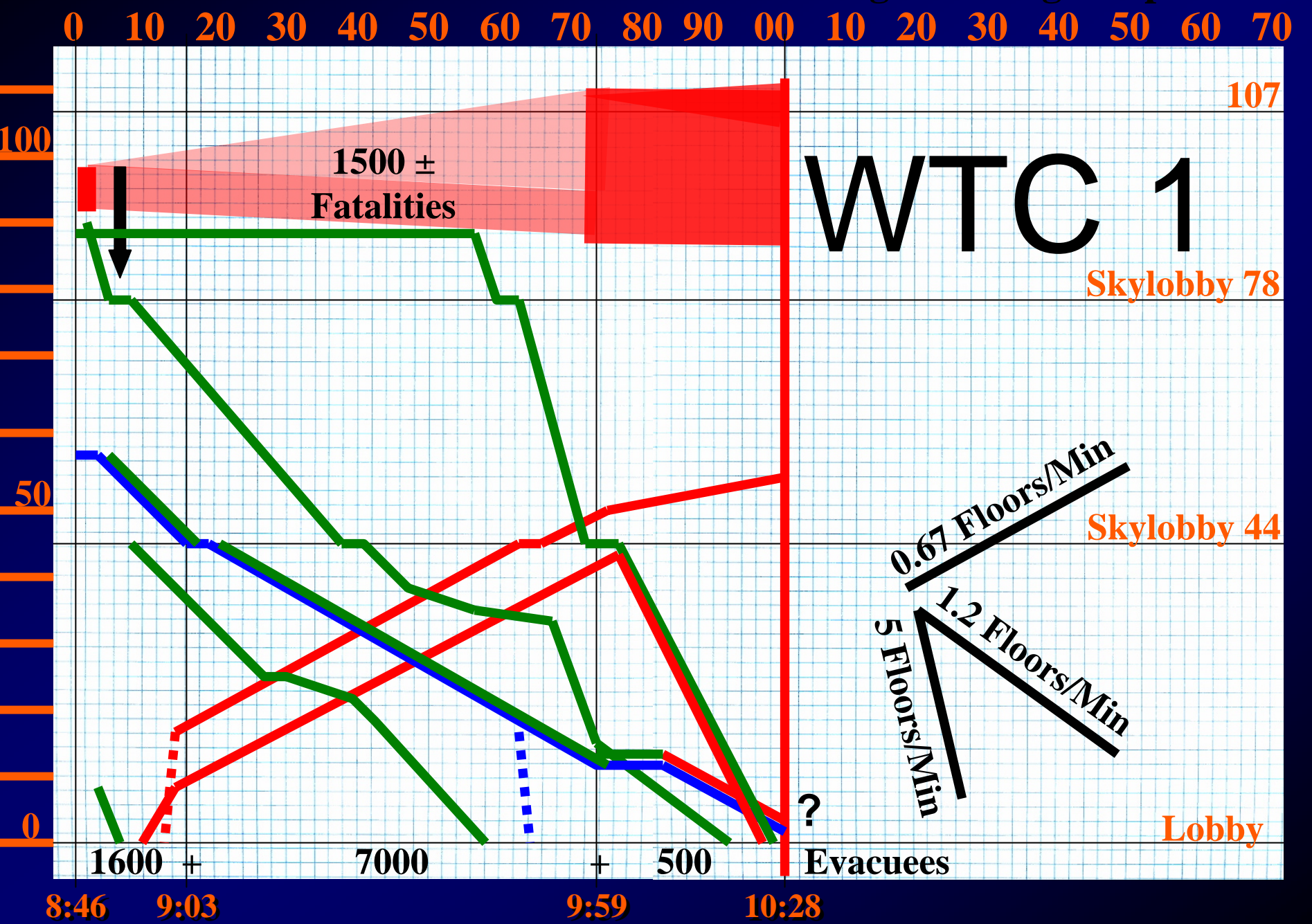
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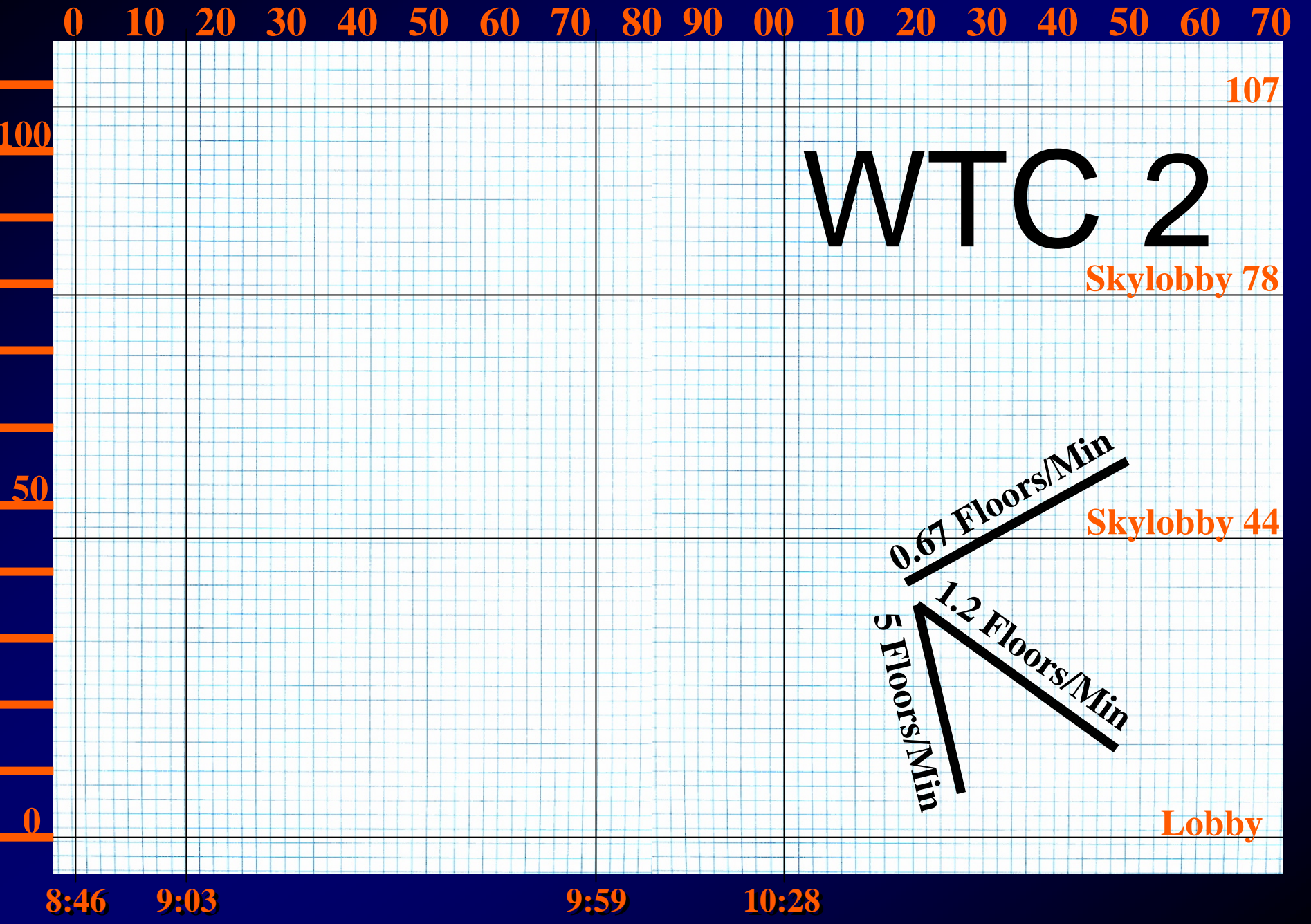
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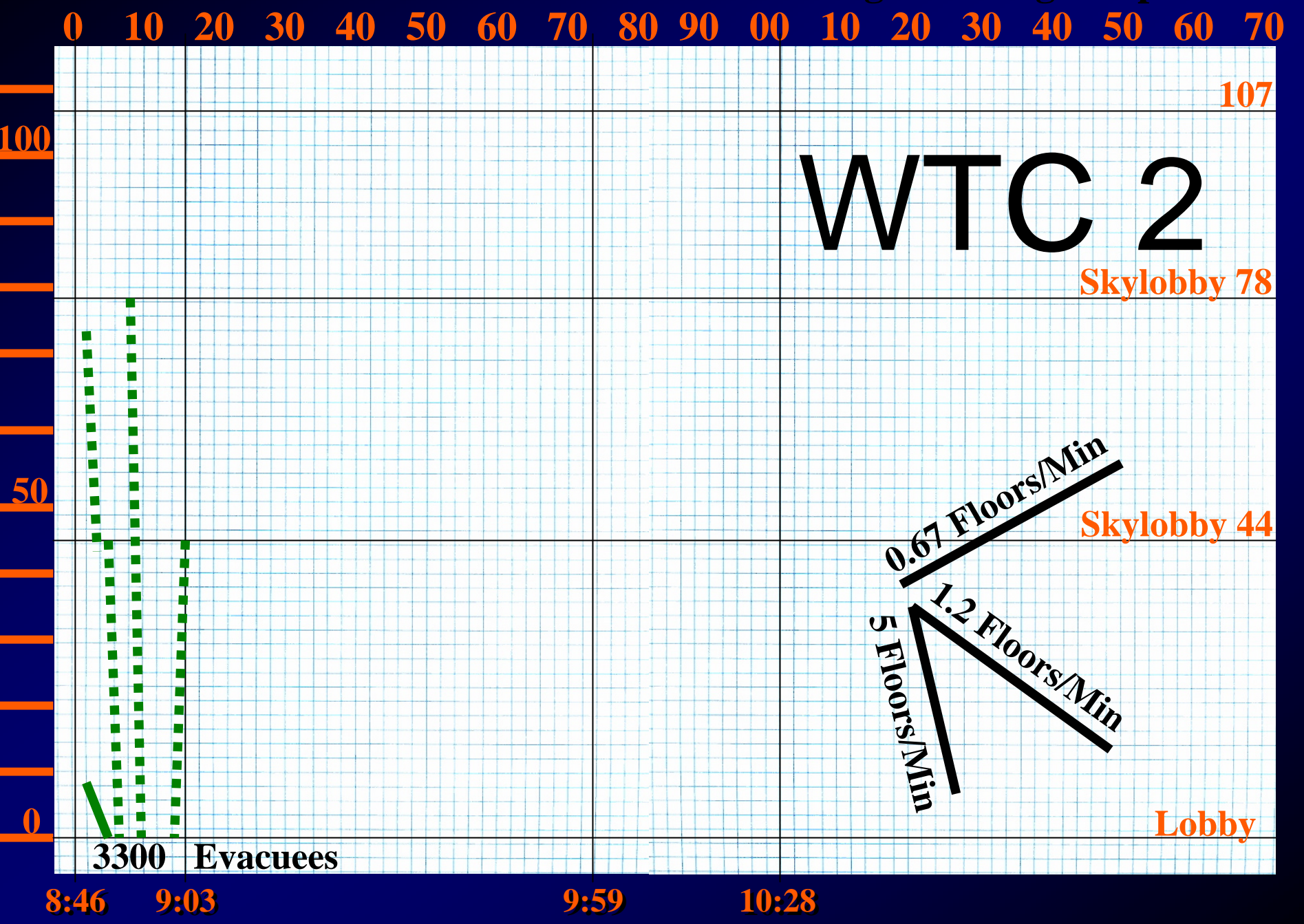
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WTC 2

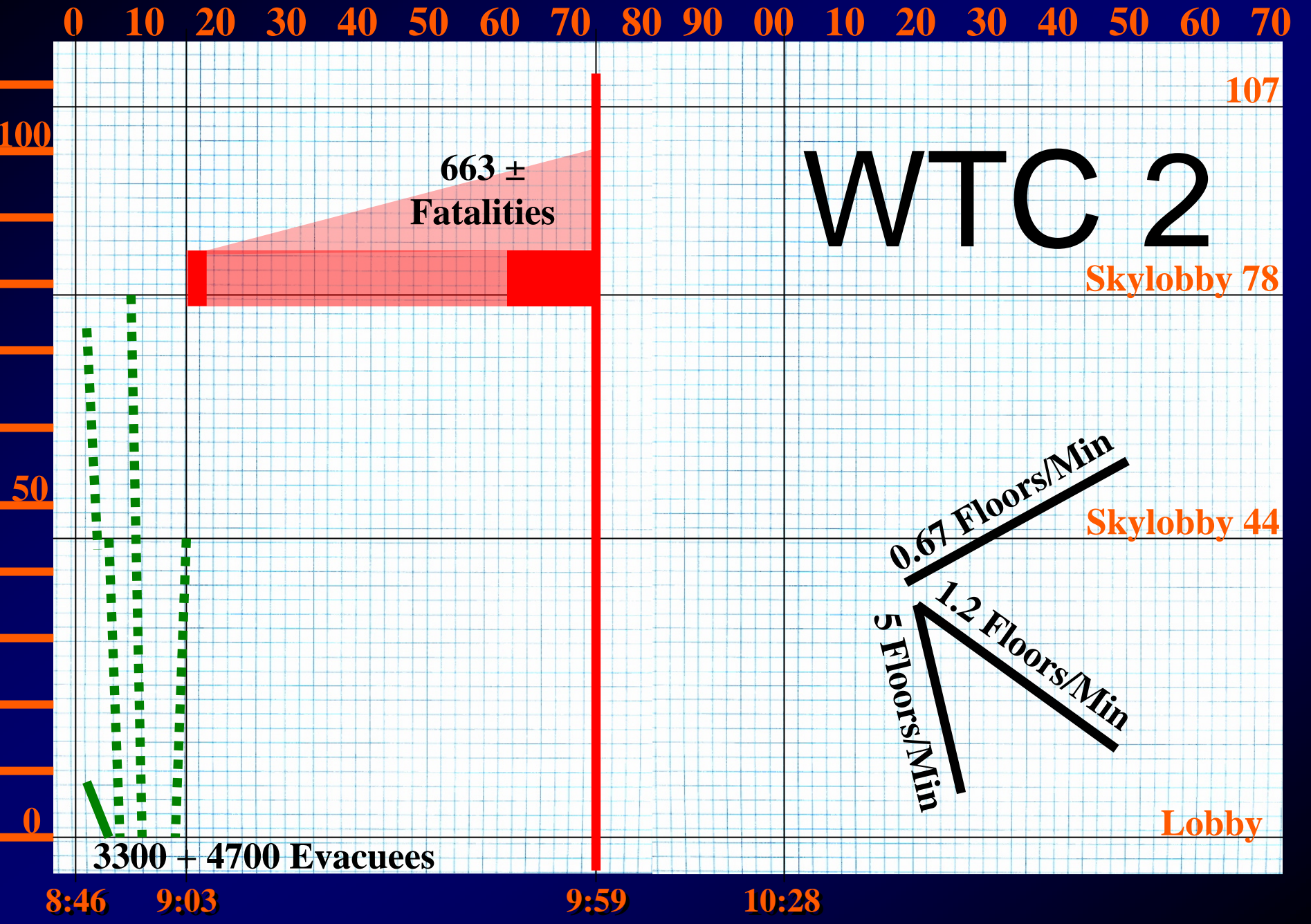
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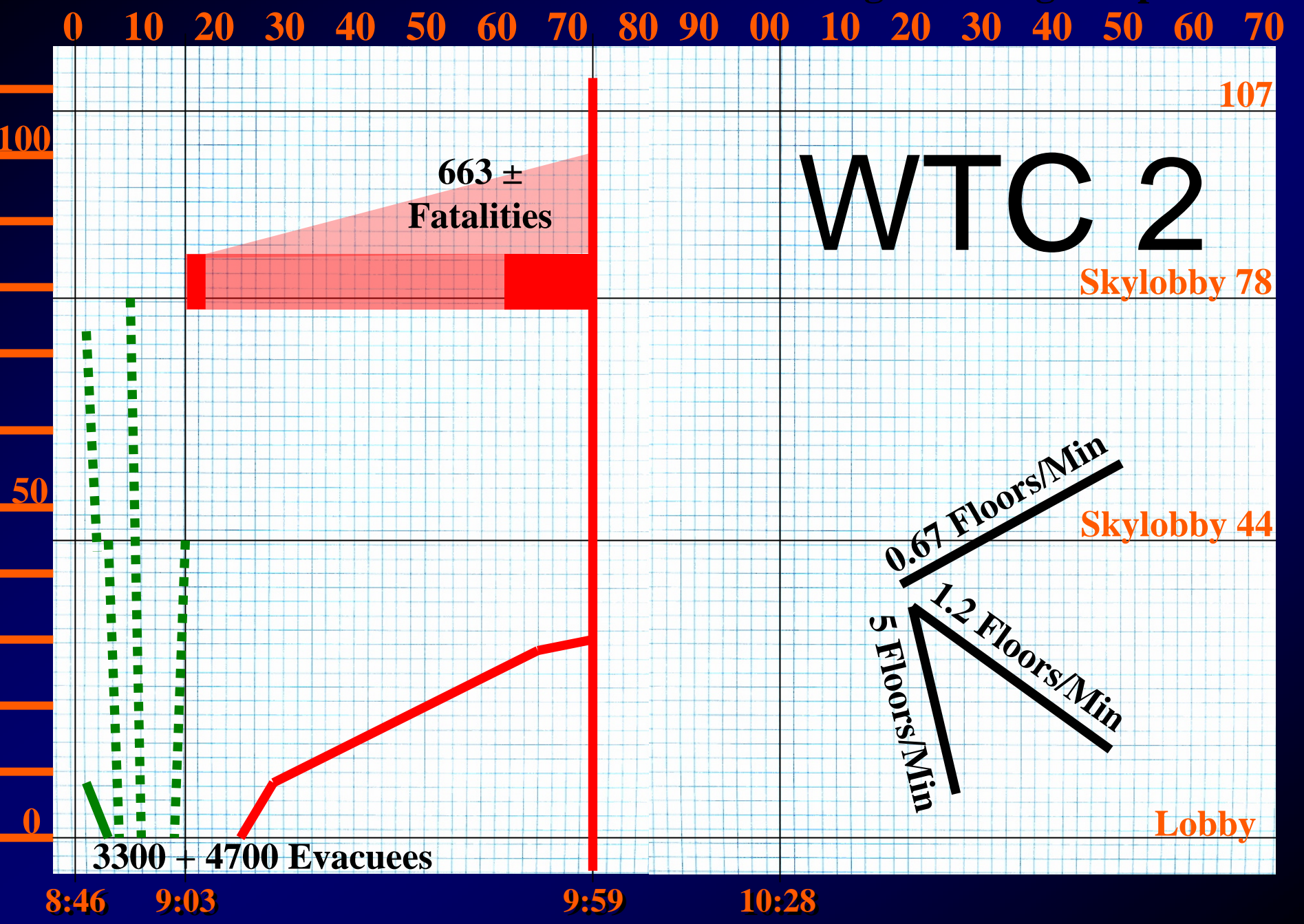
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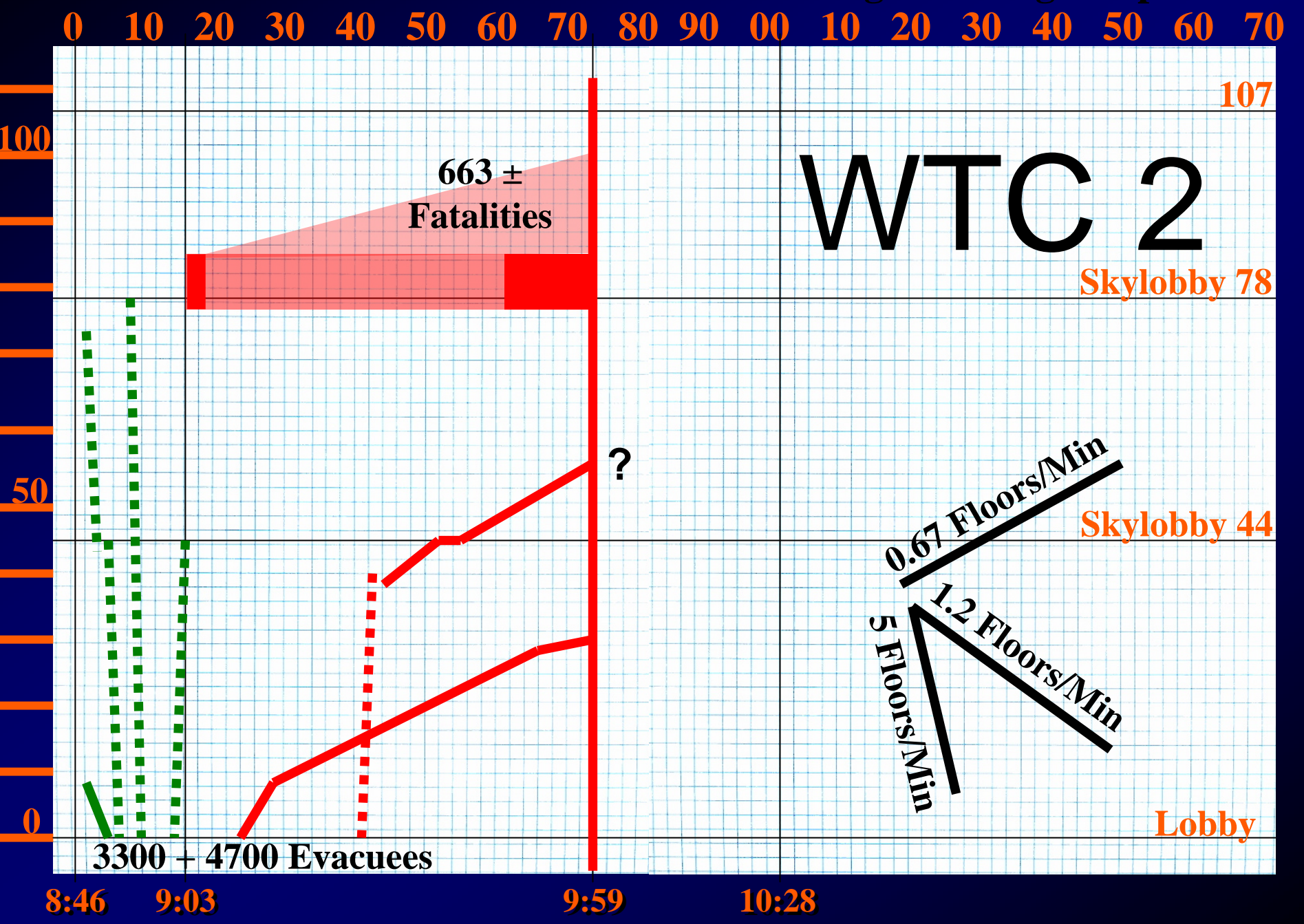
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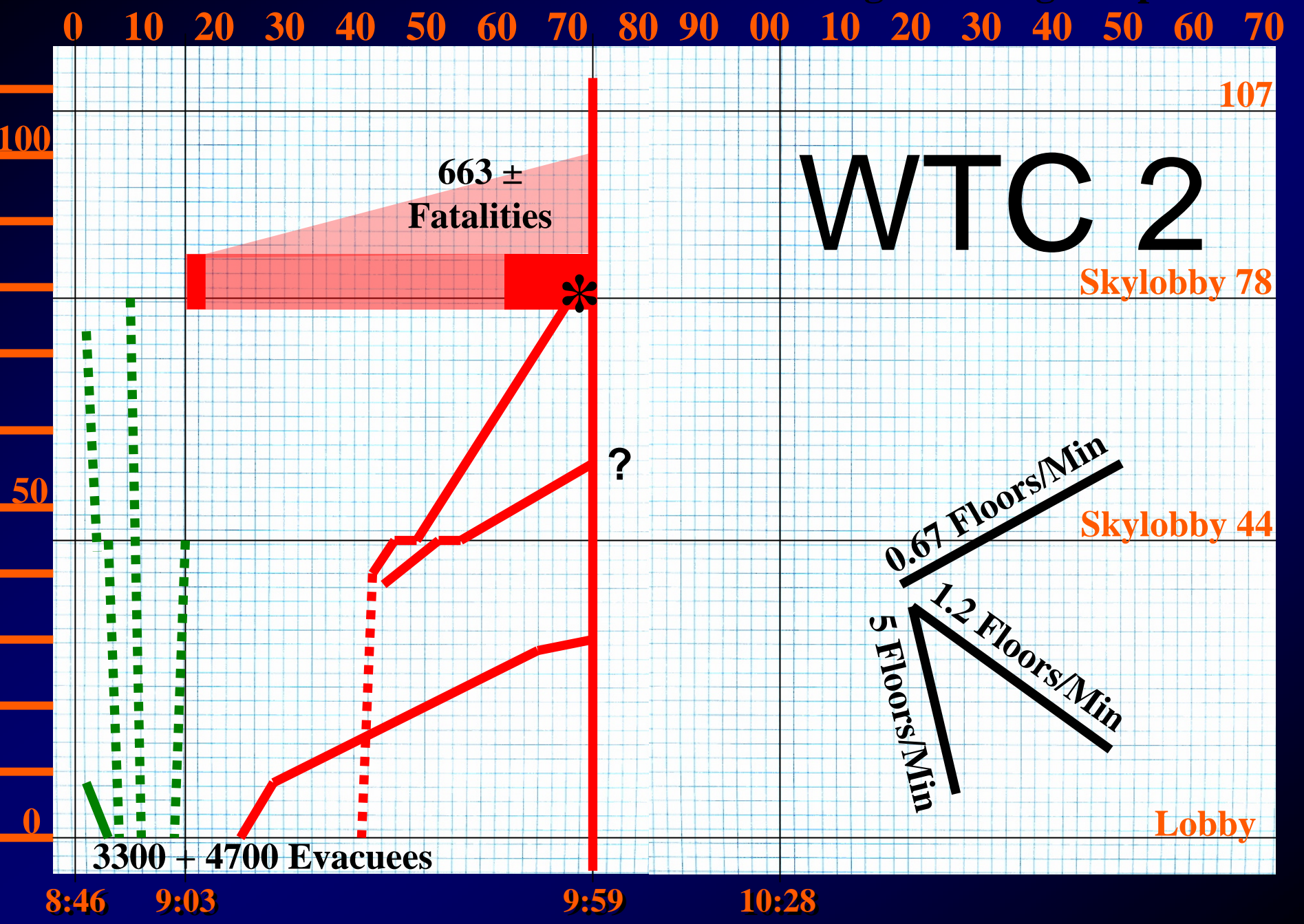
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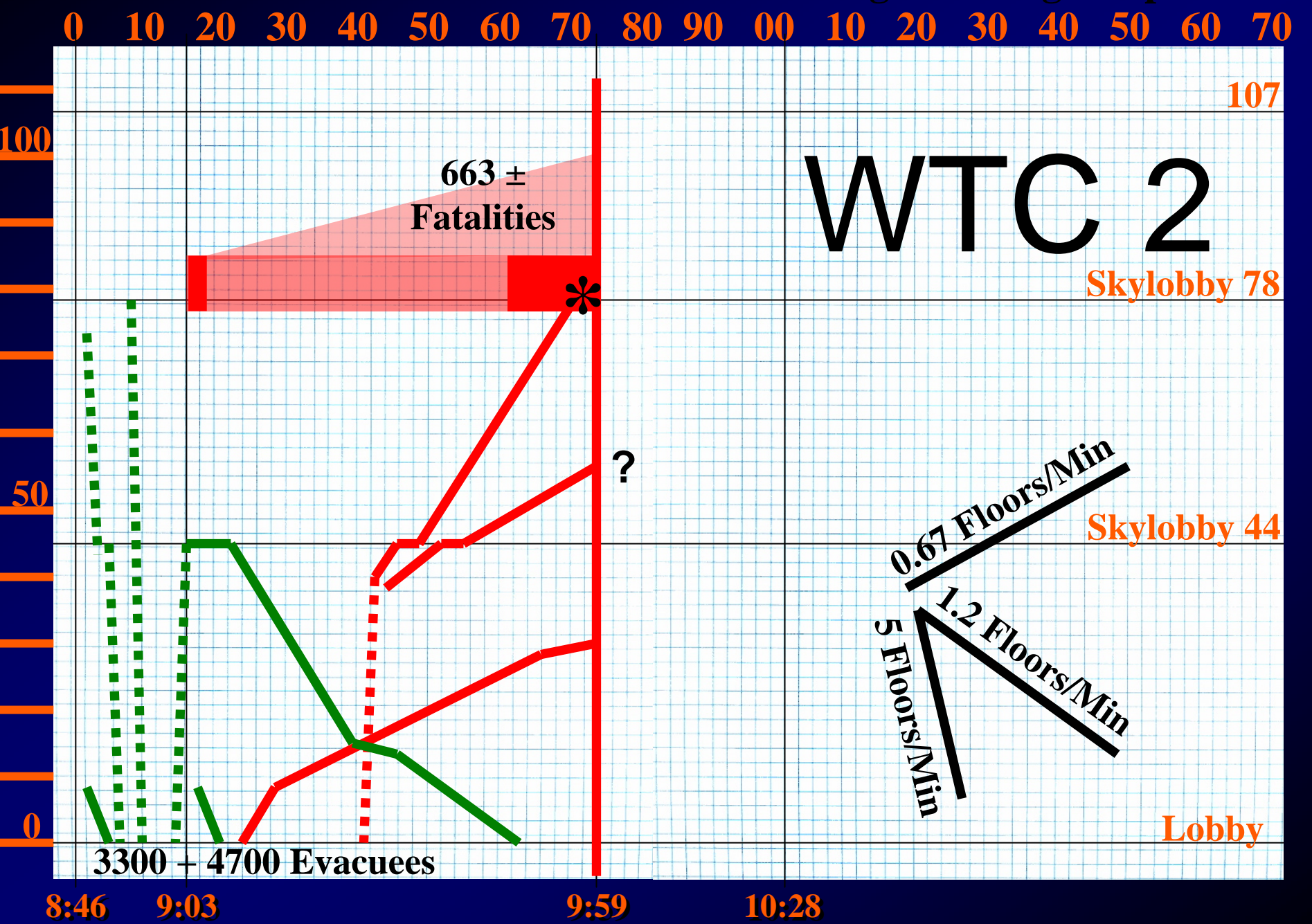
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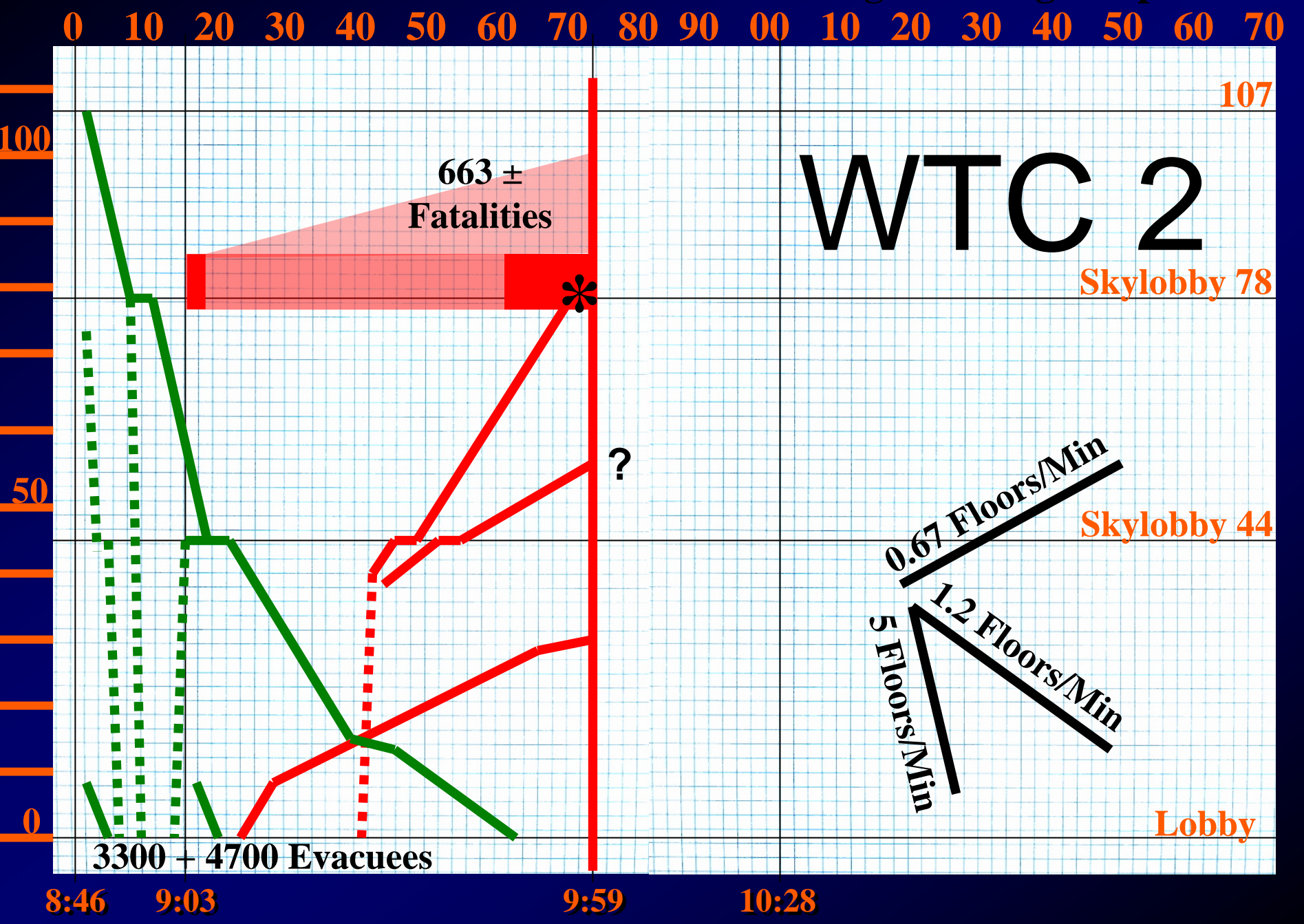
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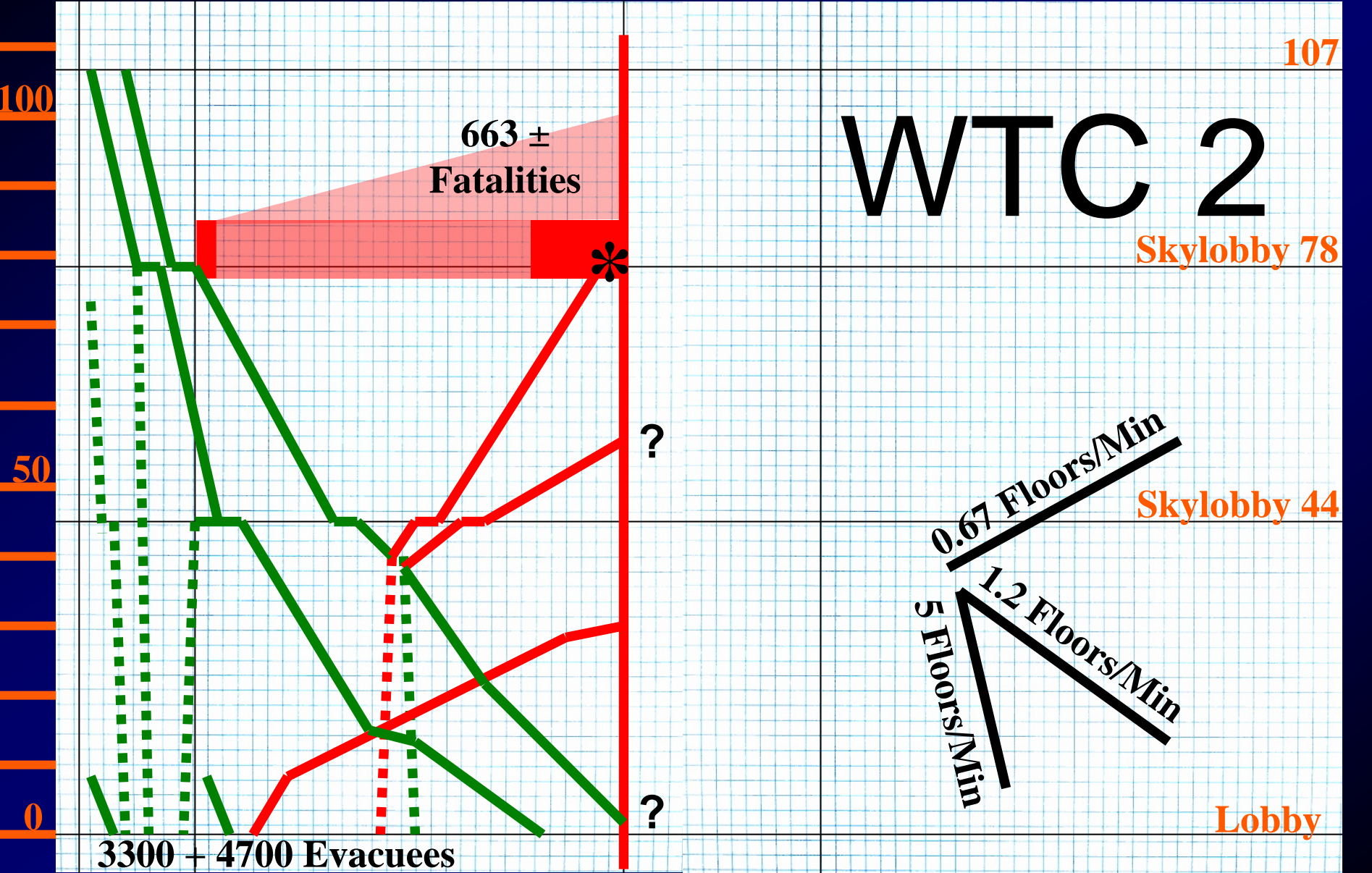


World Trade Center Evacuation and Means of Egress Design Implications



World Trade Center Evacuation and Means of Egress Design Implications

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WTC 2

Skylobby 78

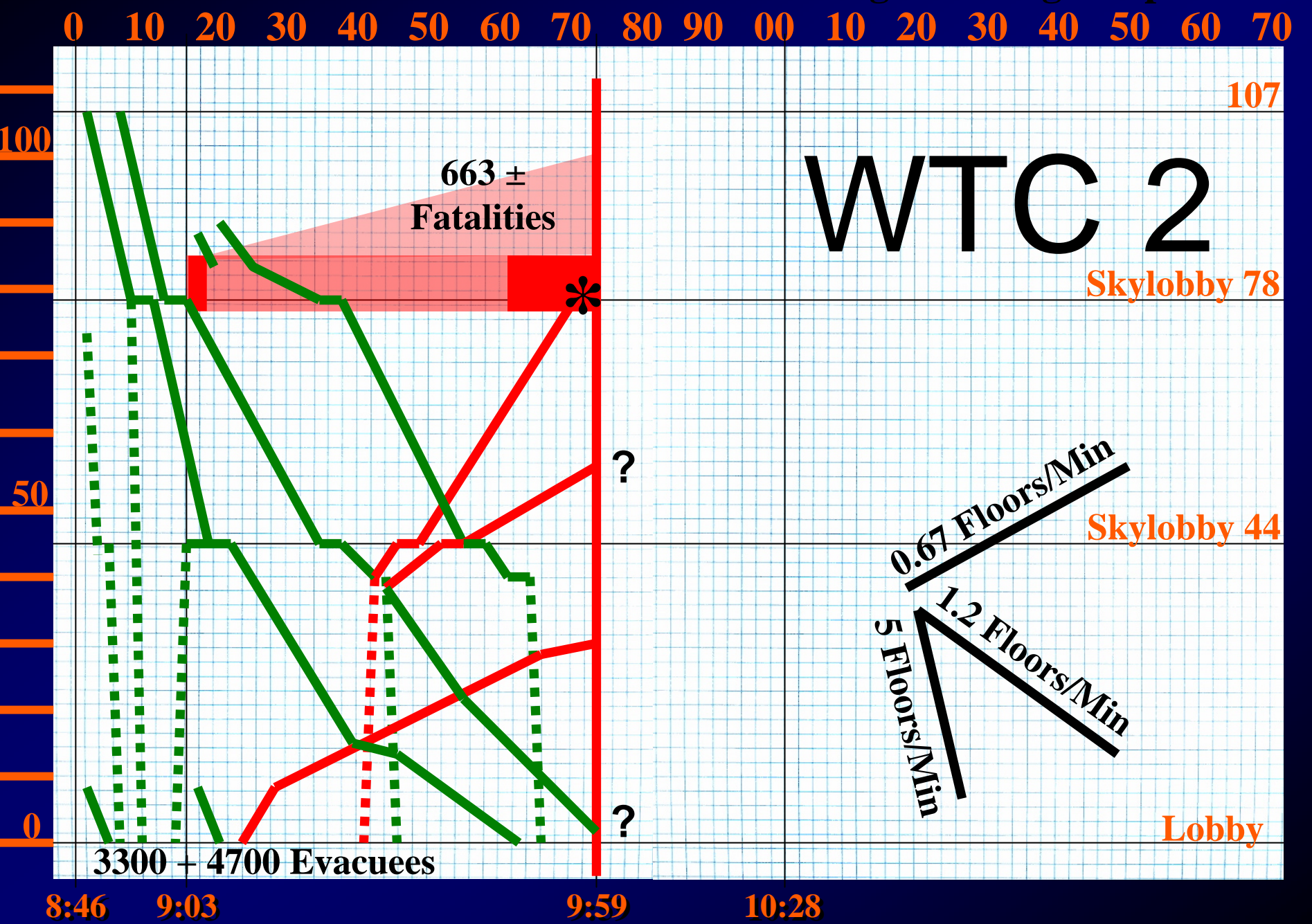
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Skylobby 44

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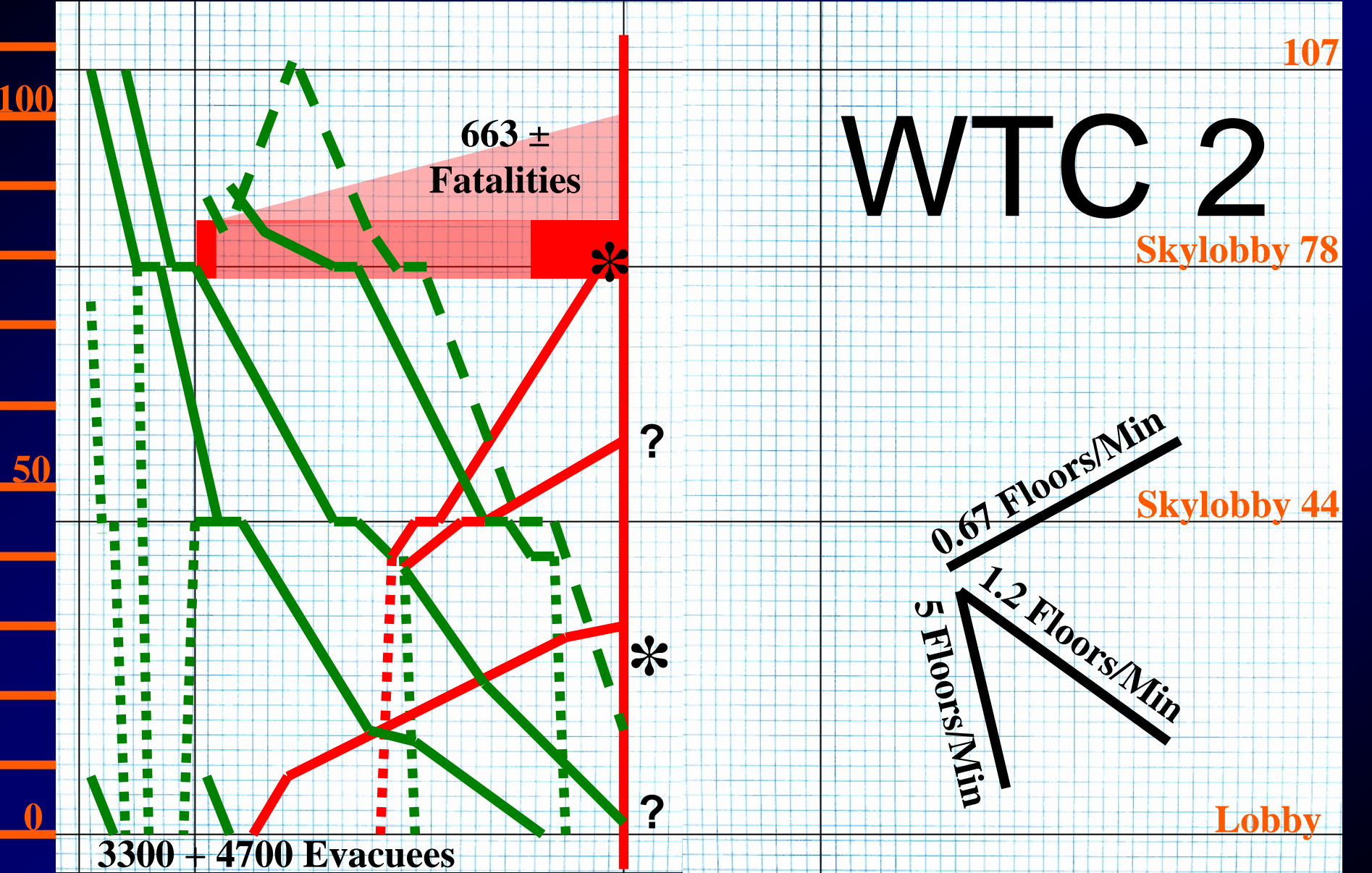
Lobby

World Trade Center Evacuation and Means of Egress Design Implications



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WTC 2

Skylobby 78

Skylobby 44

Lobby

0.67 Floors/Min

1.2 Floors/Min

5 Floors/Min

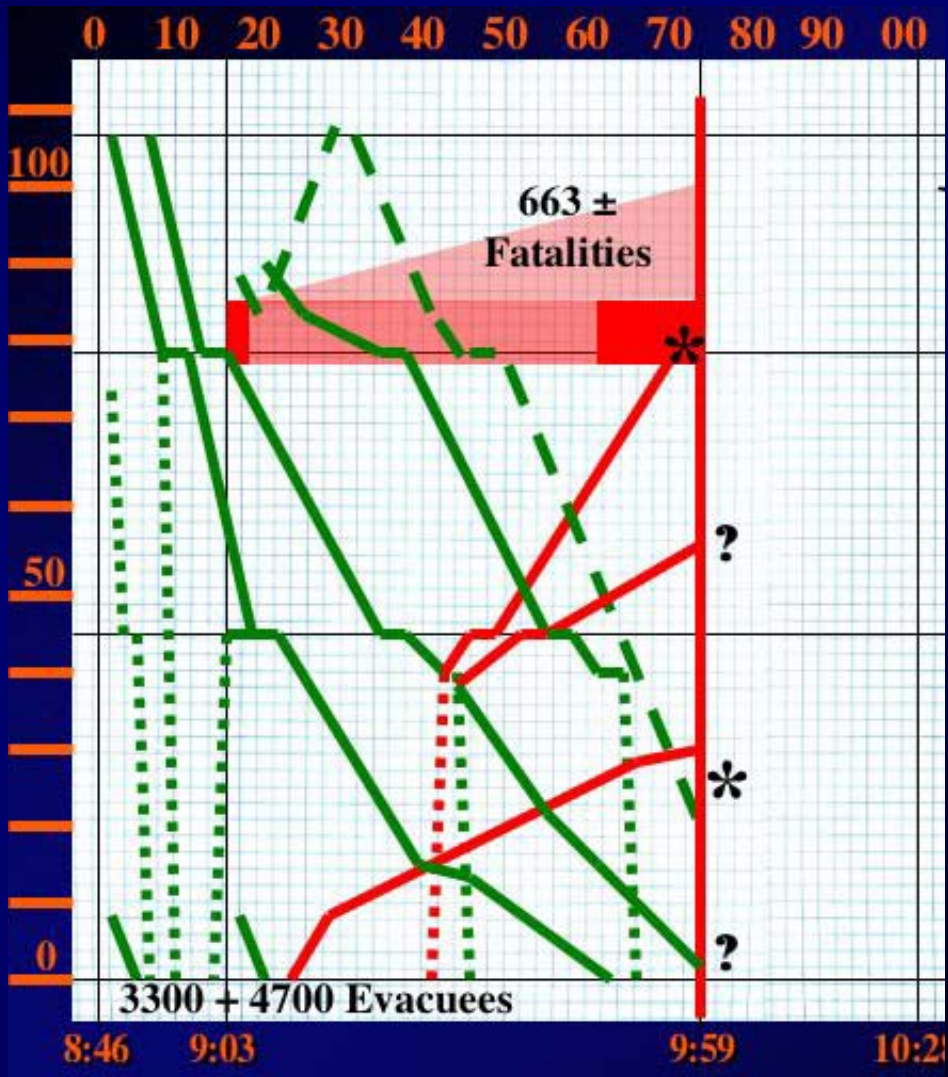
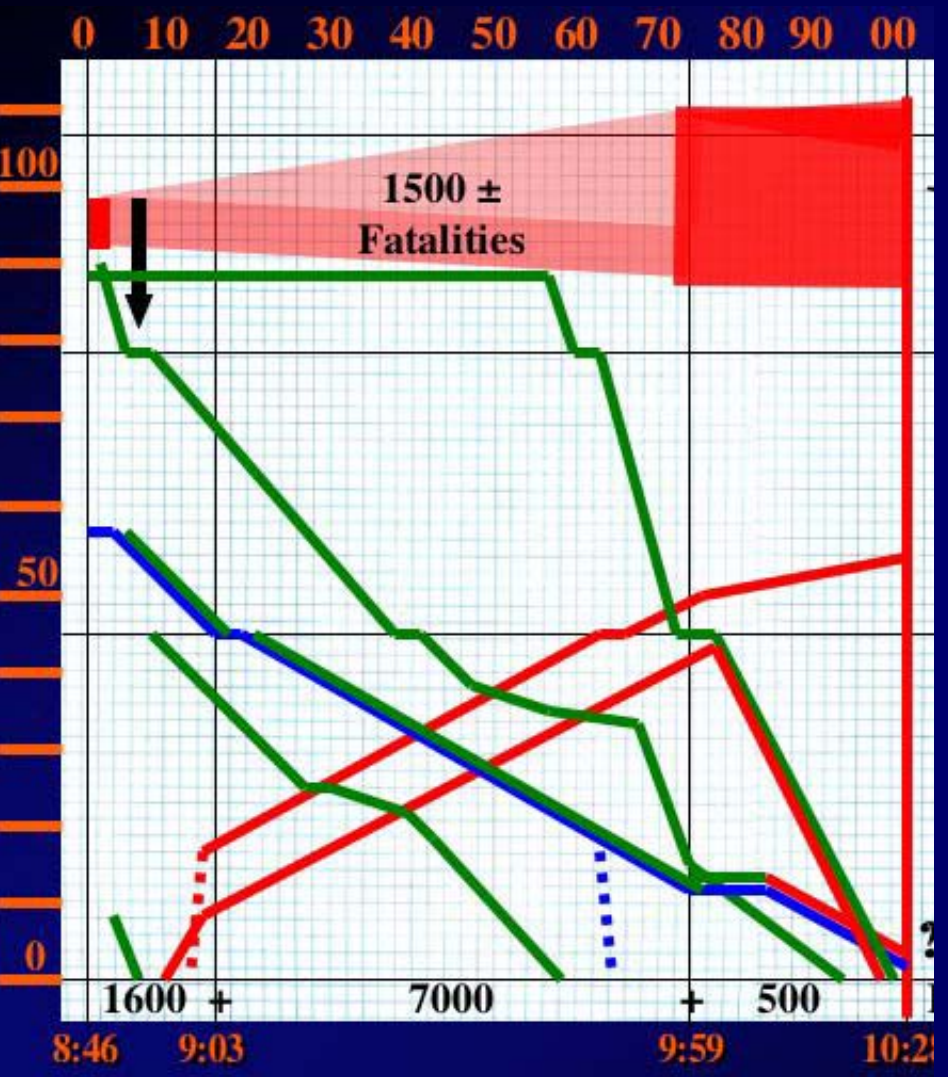
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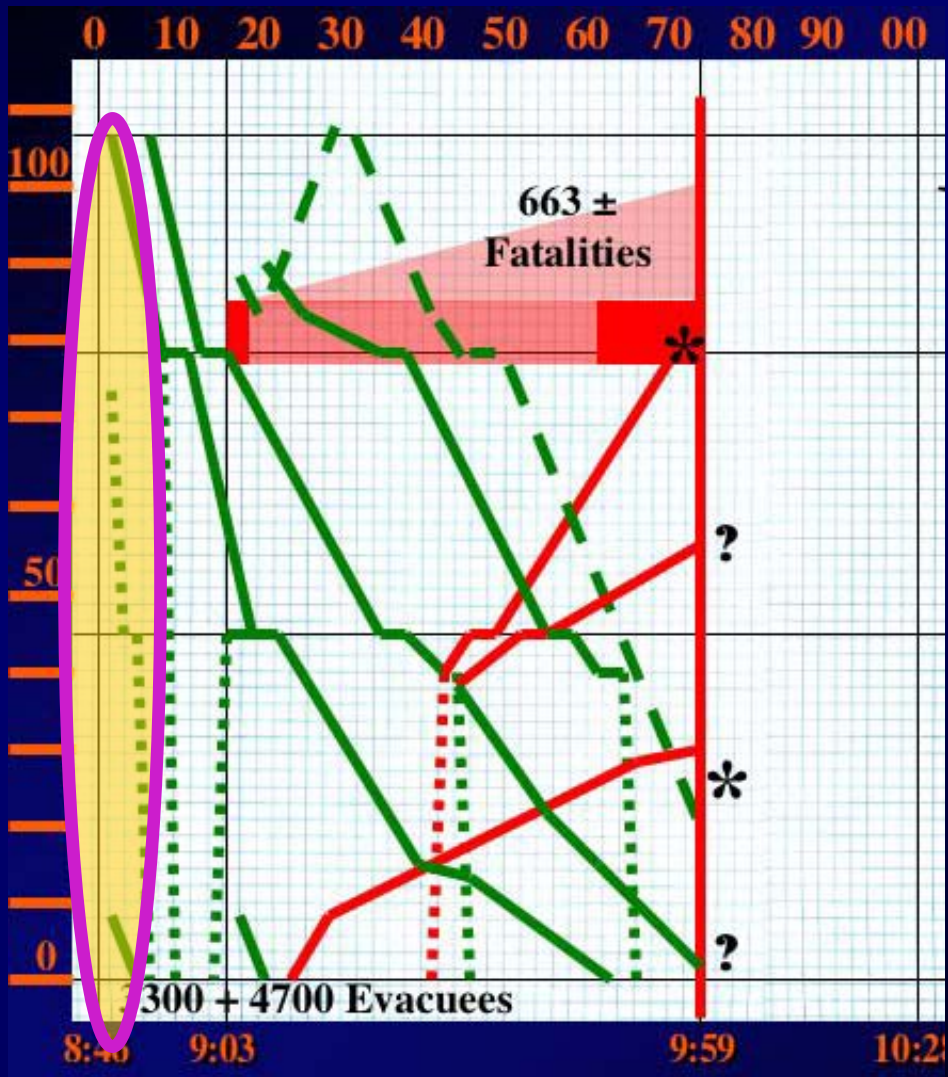
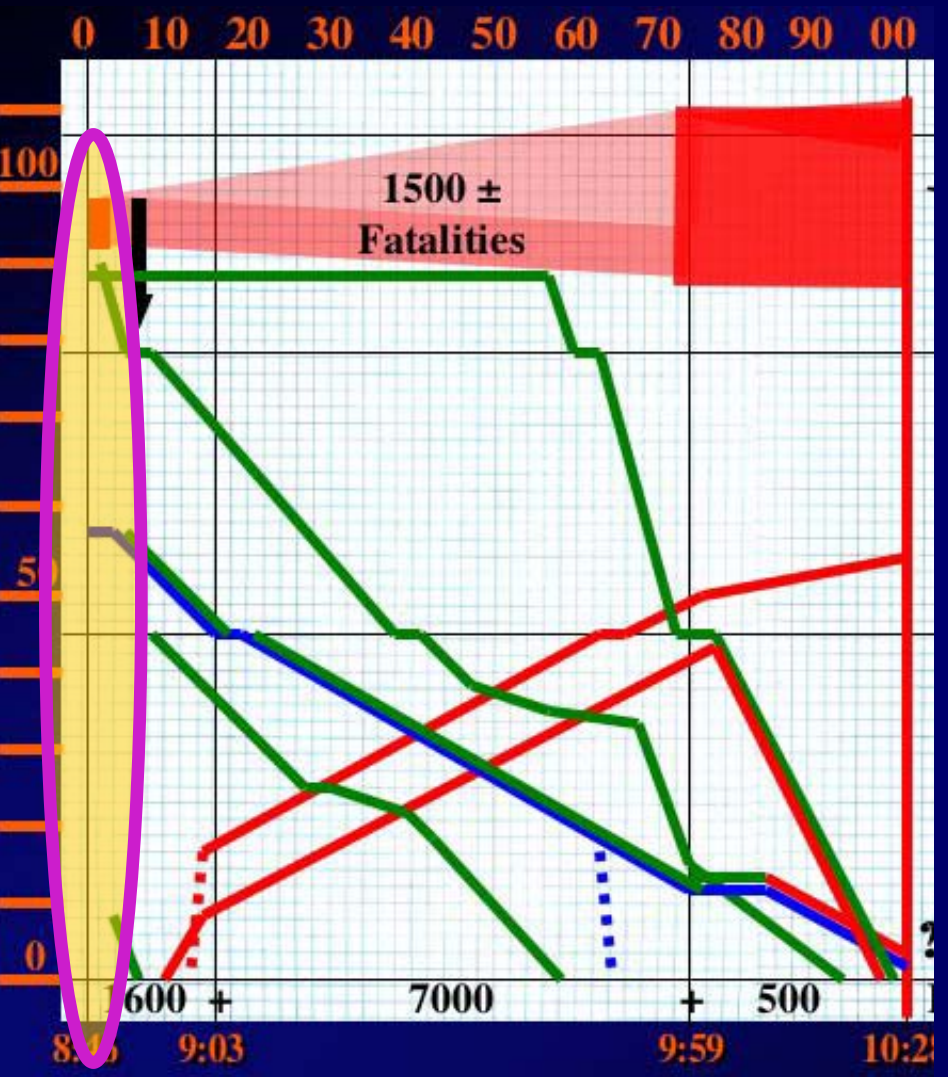
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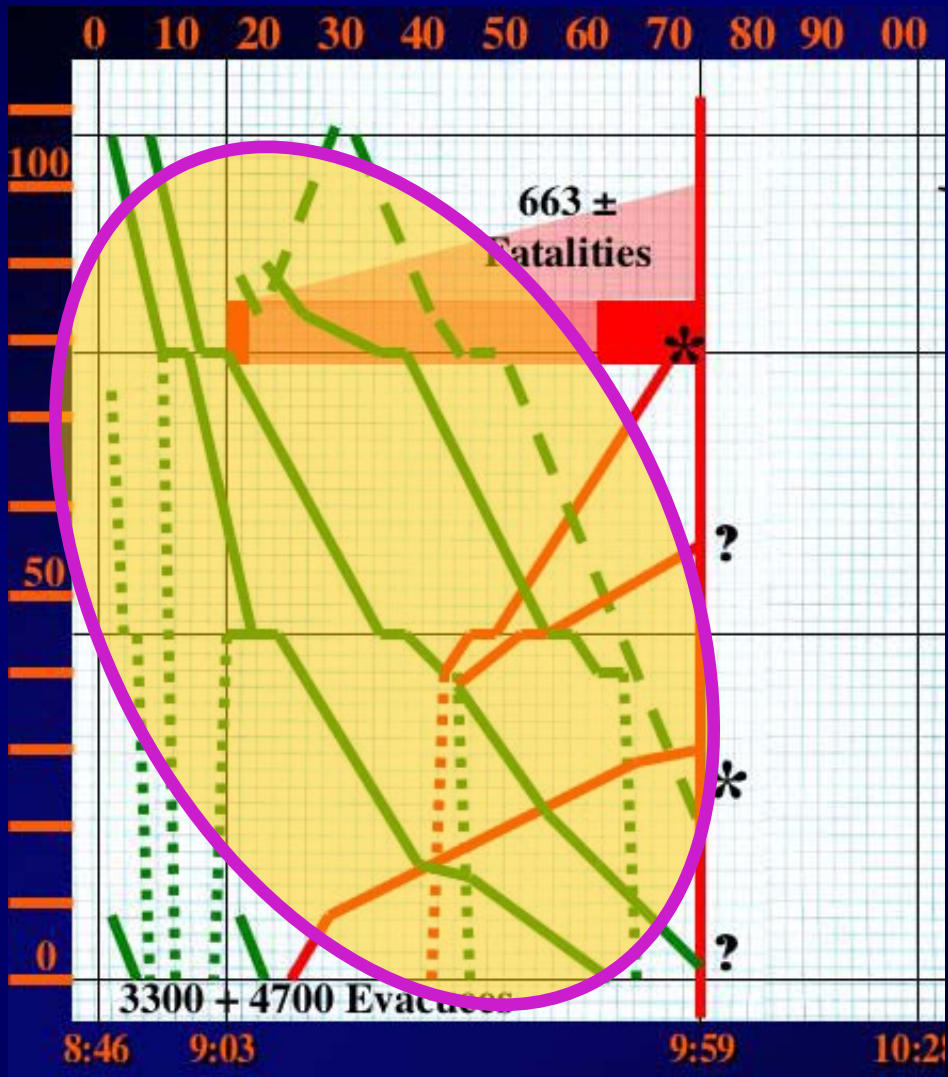
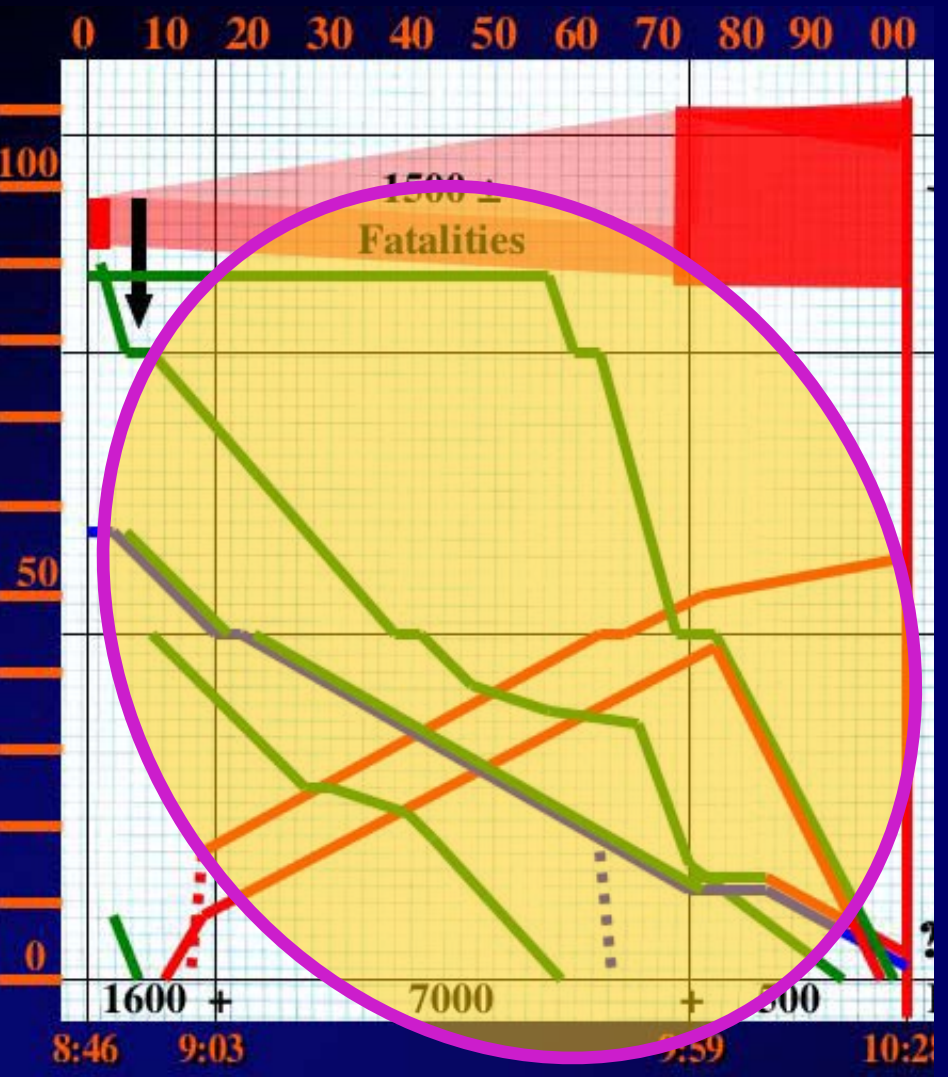
NIST Study Focus on Evacuation

World Trade Center Evacuation and Means of Egress Design Implications



Pre-Evacuation Focus of Many Questions

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Exit Activity Focus of Very Few Questions

So what?

A general failure by NIST to devote more effort on what happened in the exit stairwells should raise significant questions about projections made about the 4-hour total evacuation time with full building occupancy and about the 14,000-person potential loss of life had the attacks occurred with full building occupancy.

Key Questions:

Will NIST preserve—and *make available to other researchers*—the occupant survey data in the most original form so that other researchers can analyze and present the data in more meaningful fashion?

How Soon?

Key Questions:

Will NIST preserve—and *make available to other researchers*—the occupant survey data in the most original form so that other researchers can analyze and present the data in more meaningful fashion? **YES**

How Soon? **WE DO NOT KNOW**

Other Uses of the Charts:

Other Uses of the Charts:

Evacuation Priority

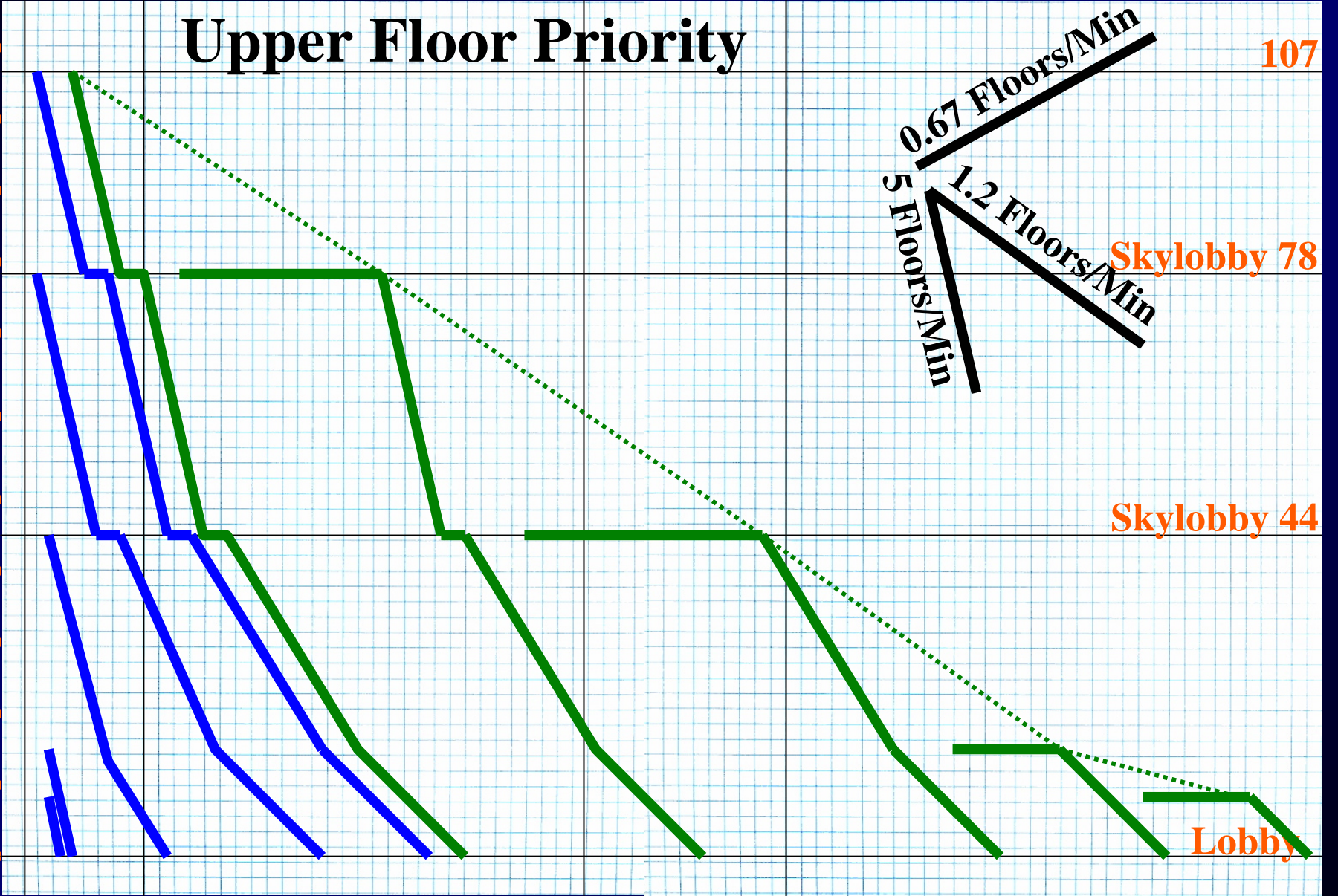
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Deference Behavior

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Upper Floor Priority



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Skylobby 78

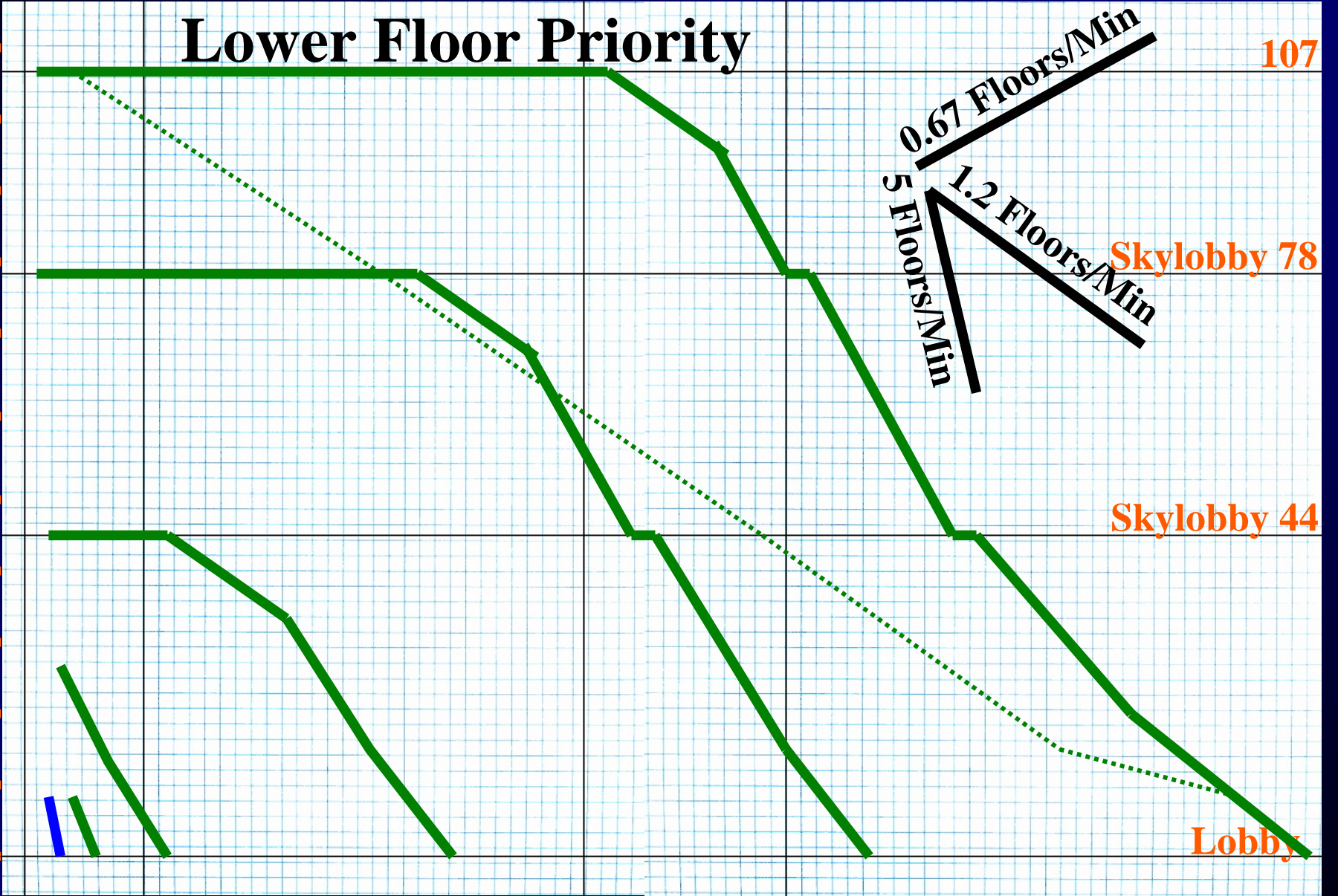
Skylobby 44

Lobby

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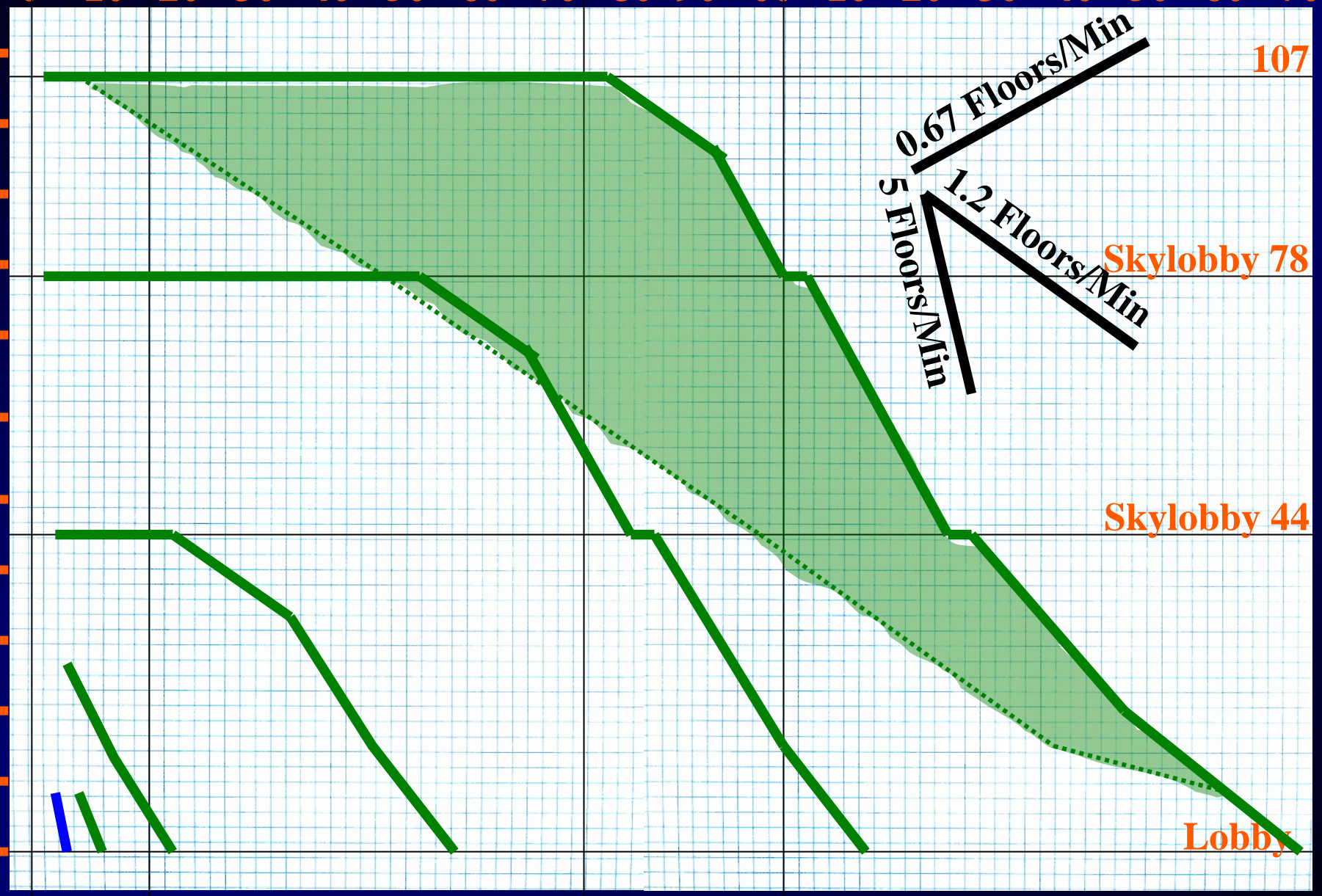
Lower Floor Priority



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Exit Remoteness

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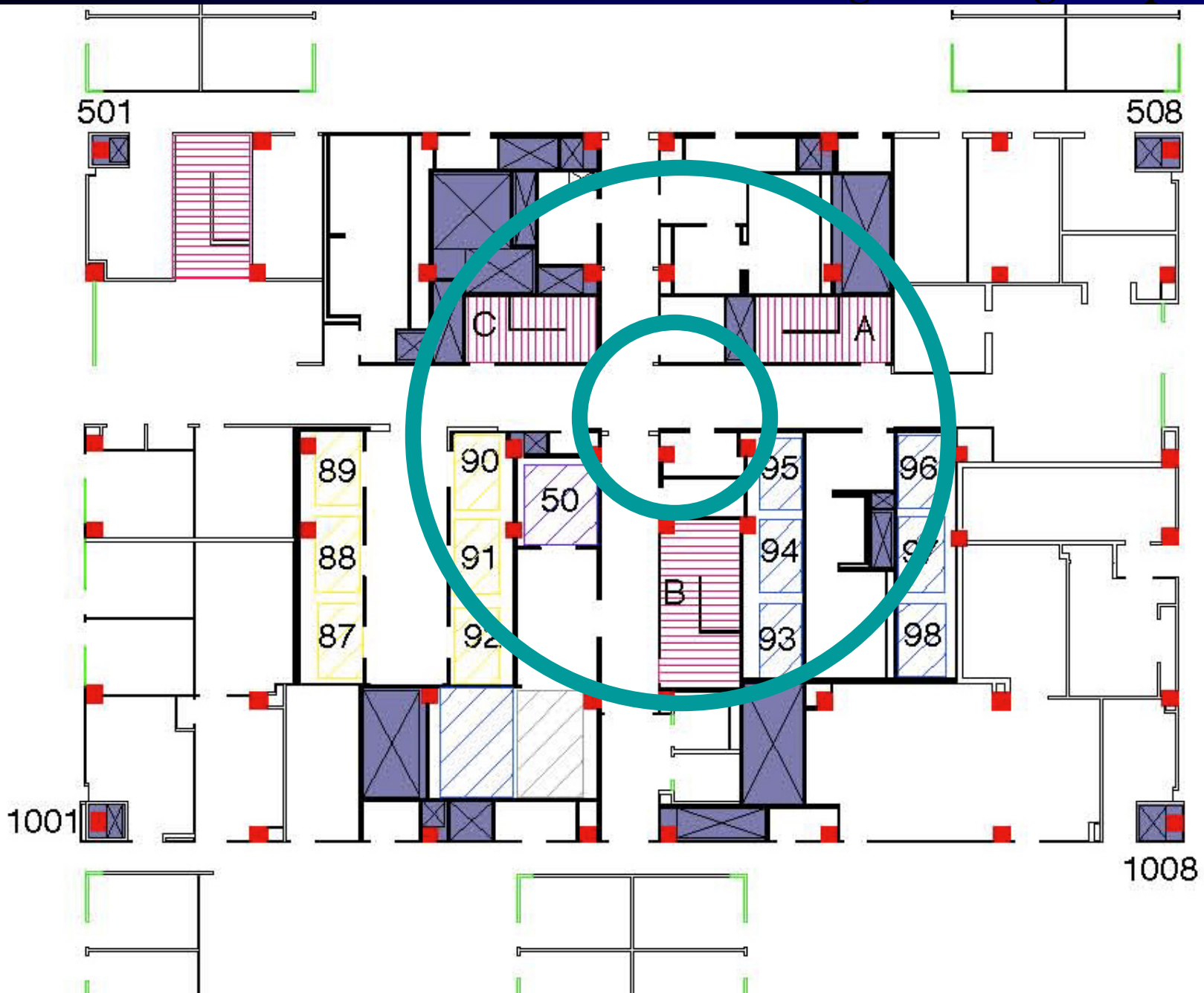
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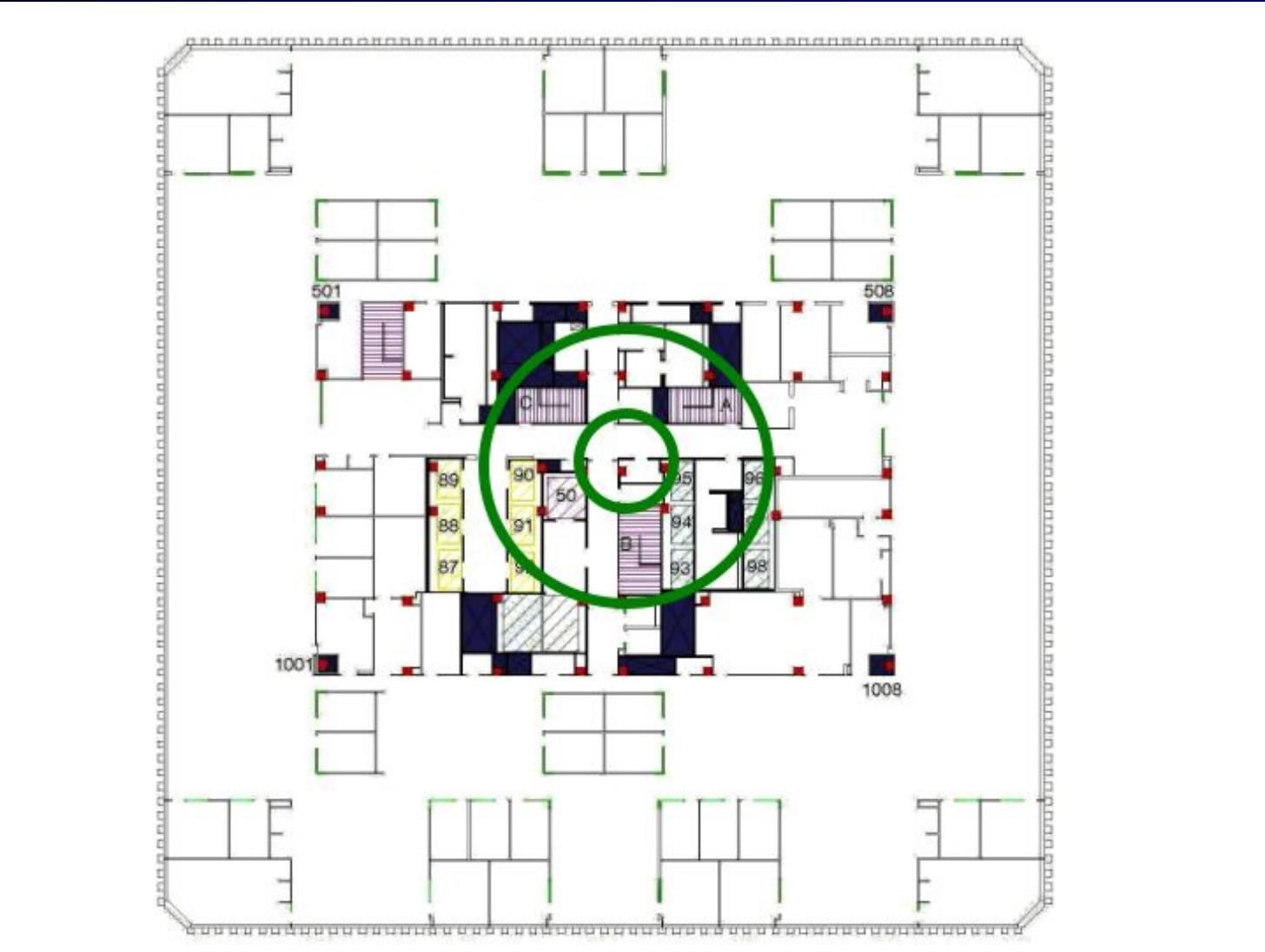
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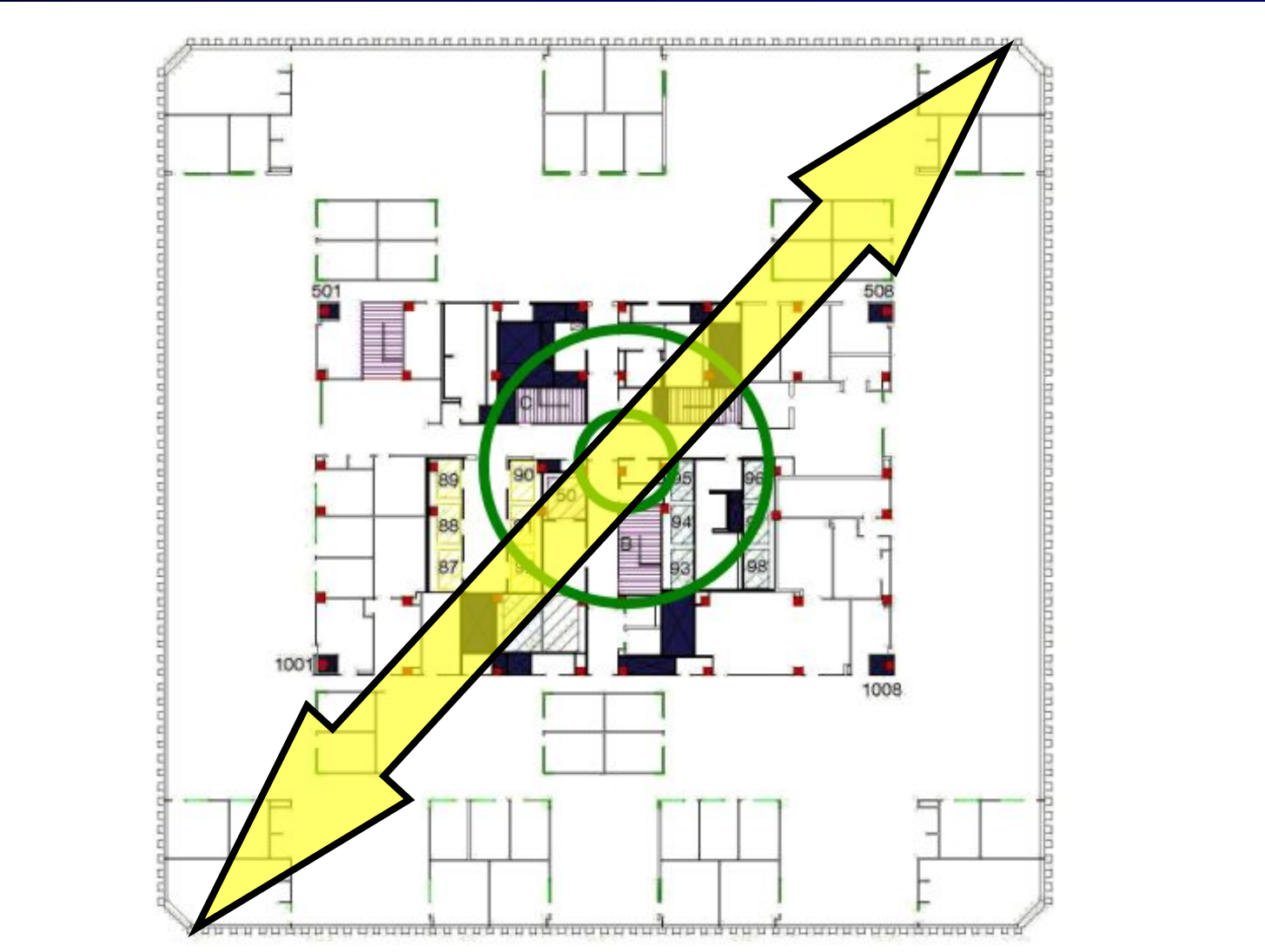


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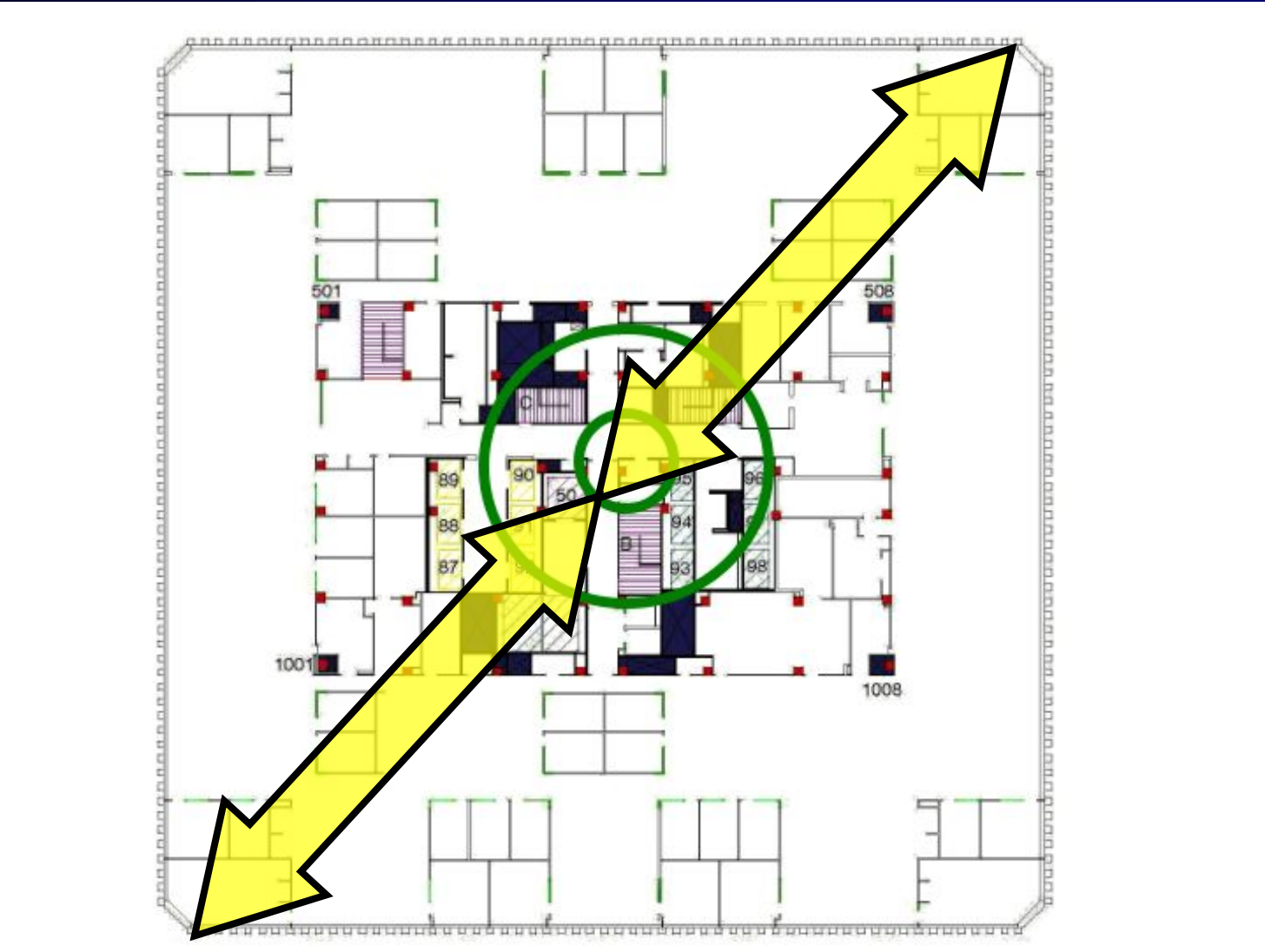
Exit Remoteness

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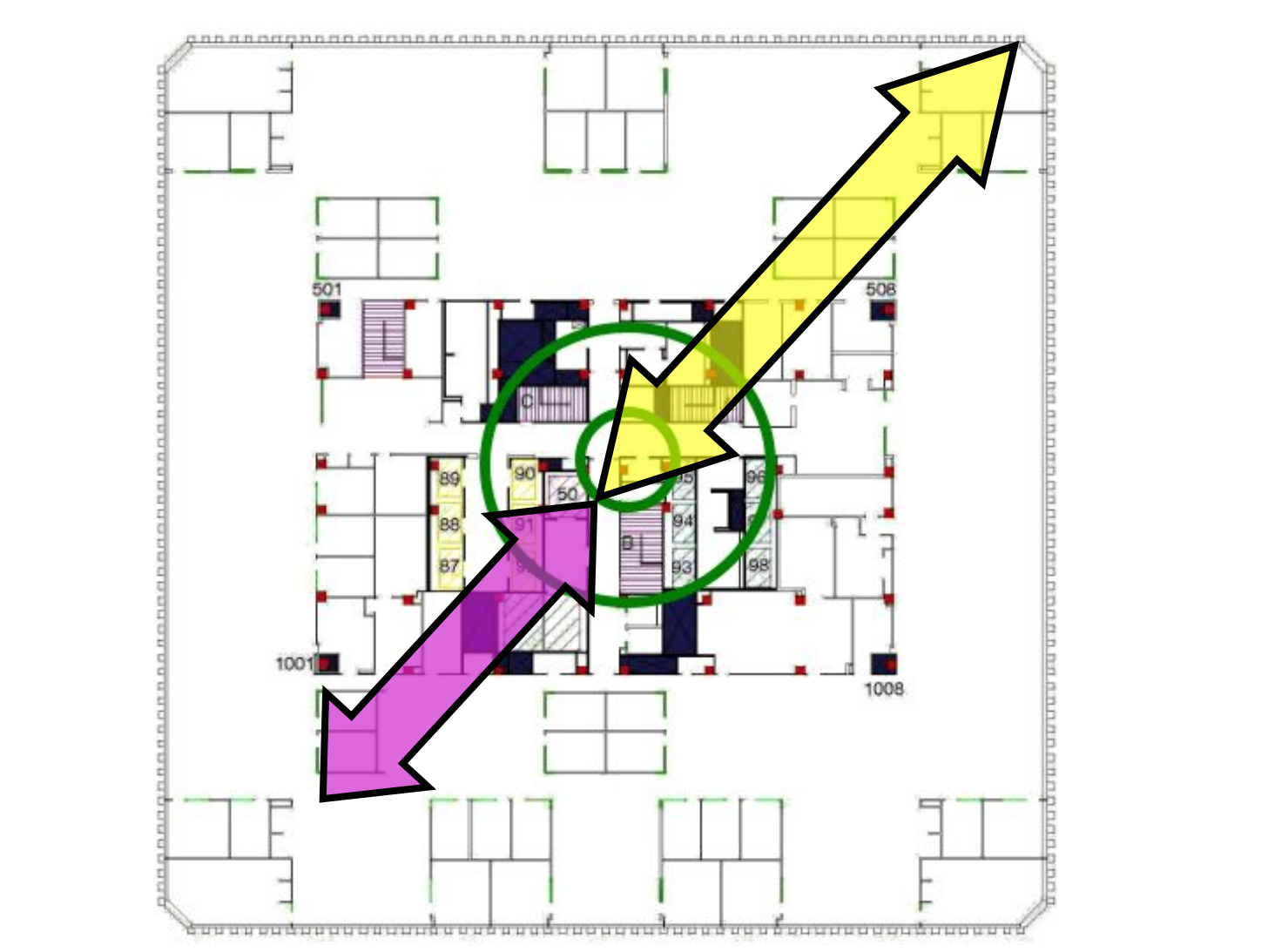
Exit Remoteness

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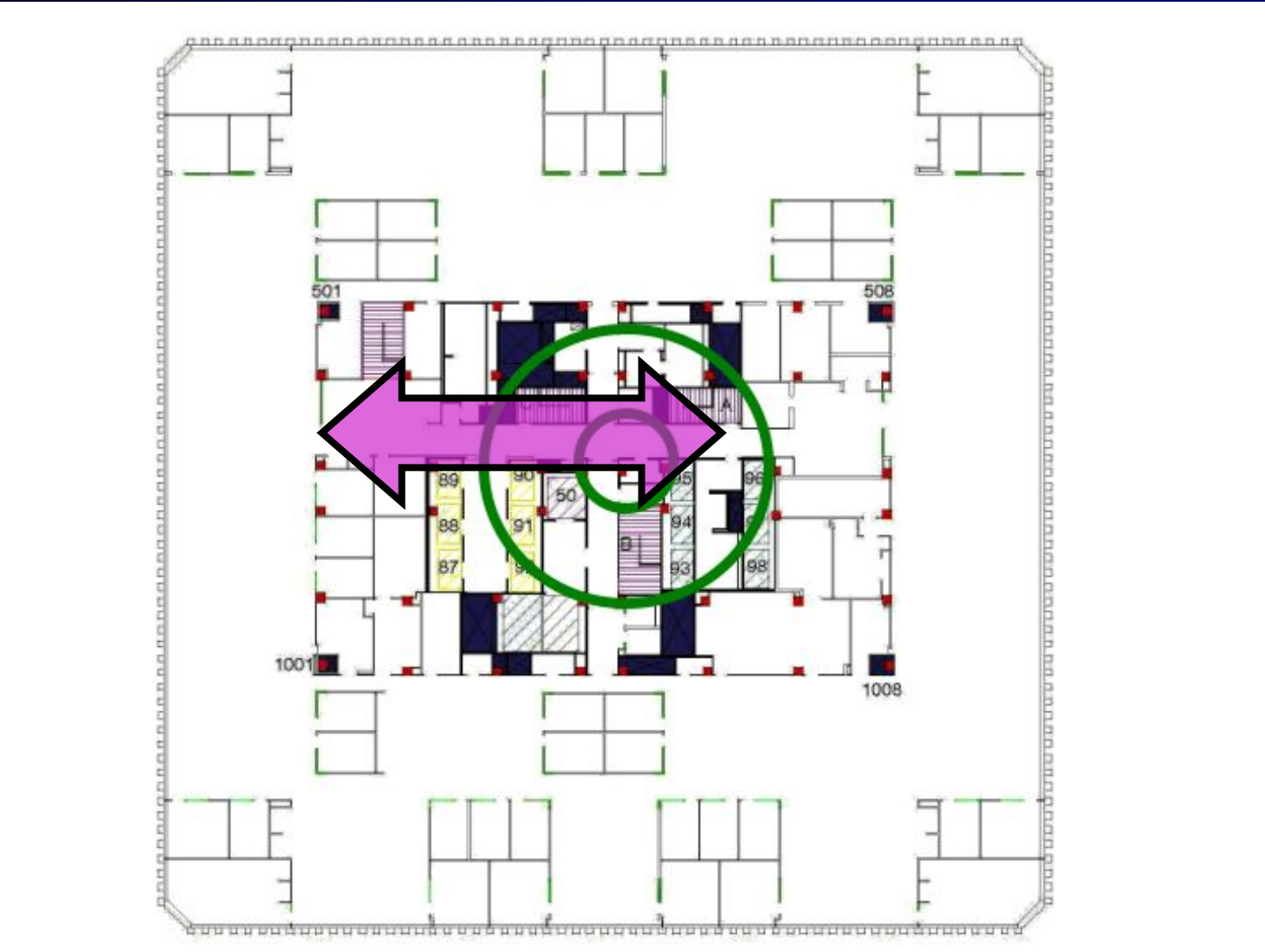
Exit Remoteness

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Exit Remoteness

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Exit Remoteness

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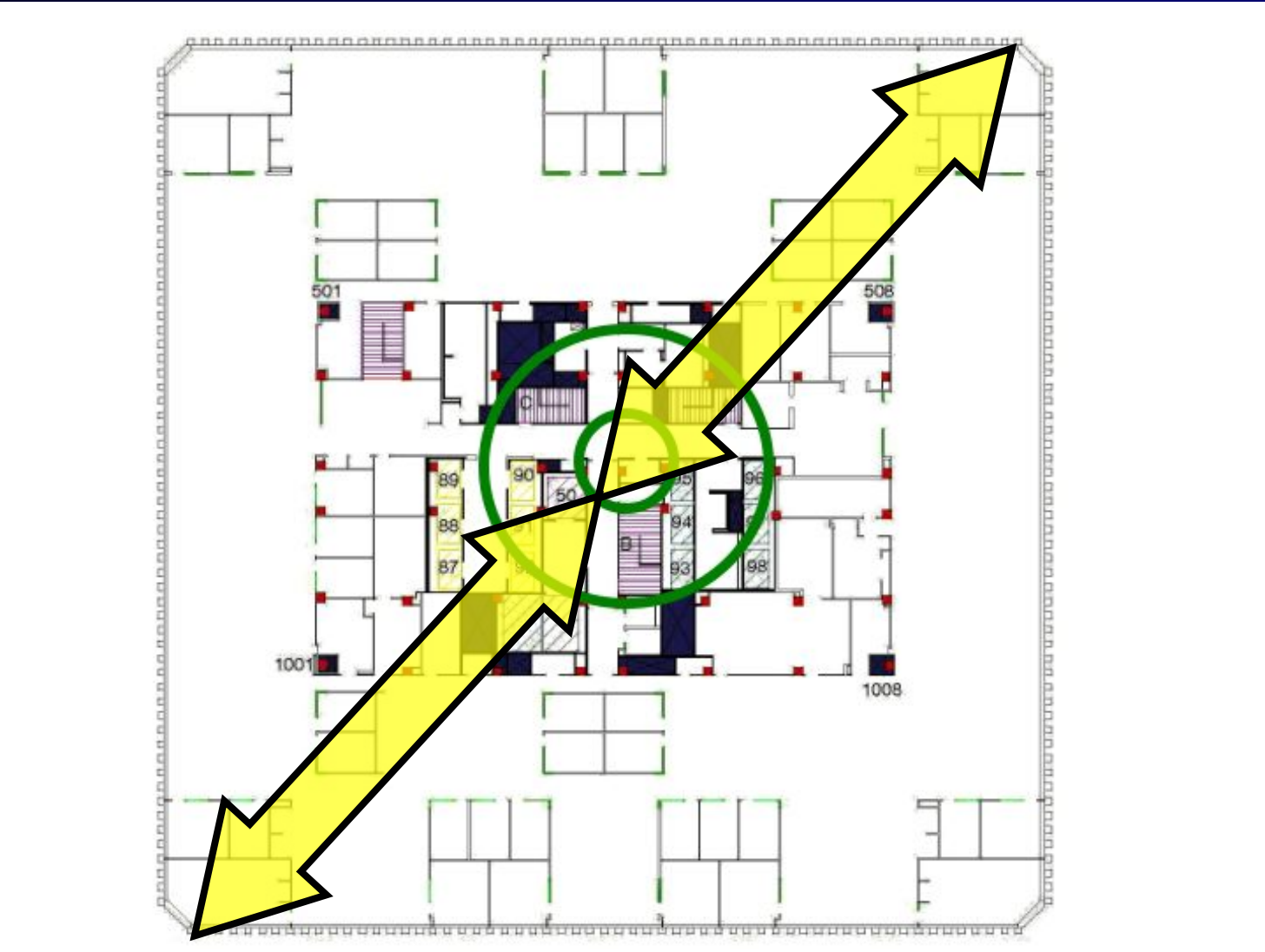
So What ?

**More-remote
exits might have
reduced death toll,
especially in WTC2**

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Thank You

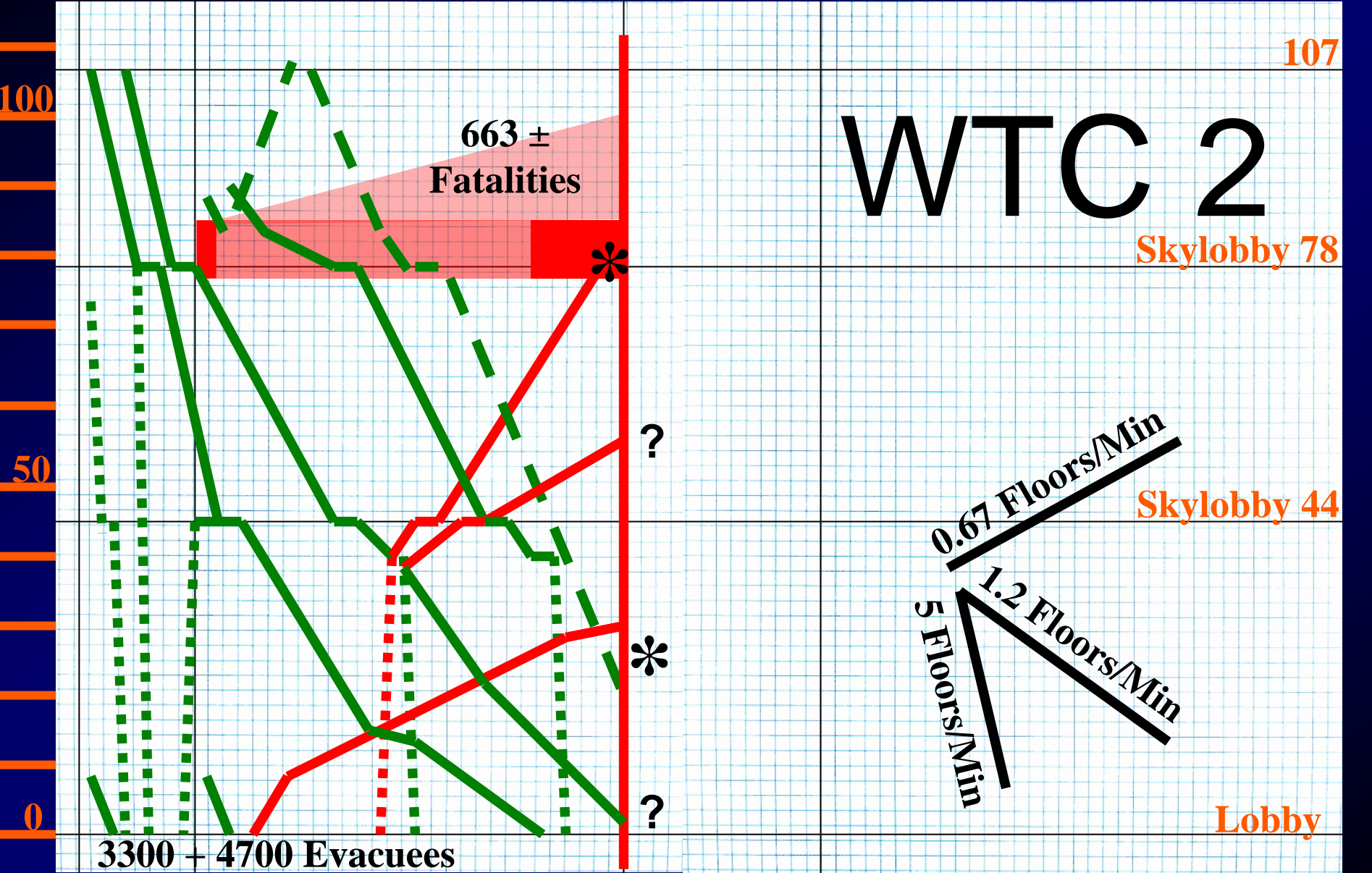
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Exit Remoteness

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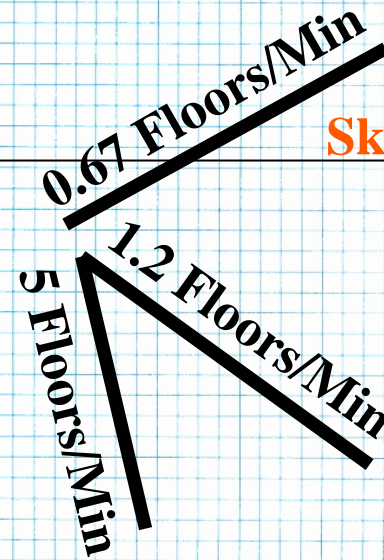
WTC 2

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Skylobby 78

Skylobby 44

Lobby



3300 + 4700 Evacuees

8:46 9:03 9:59 10:28

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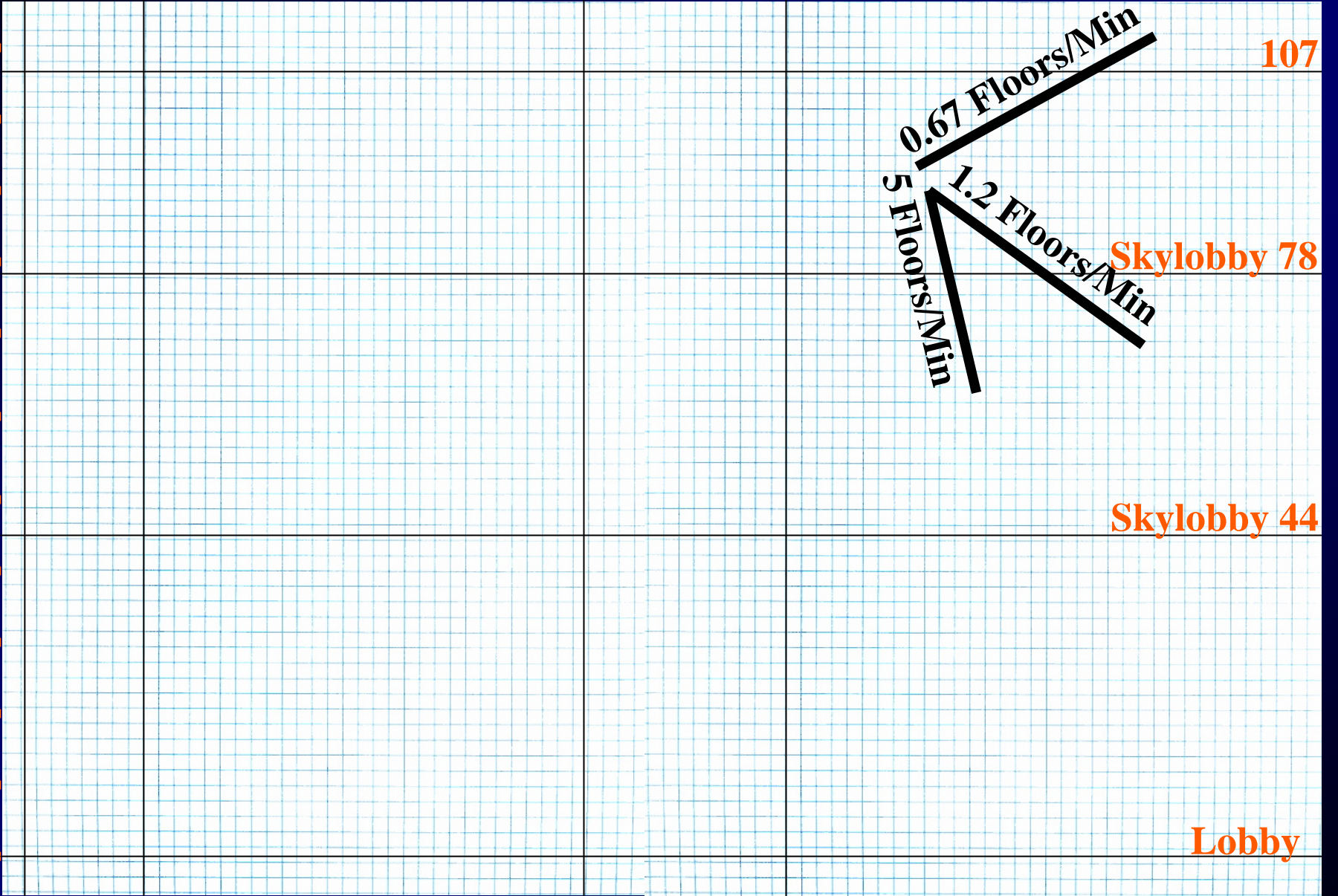
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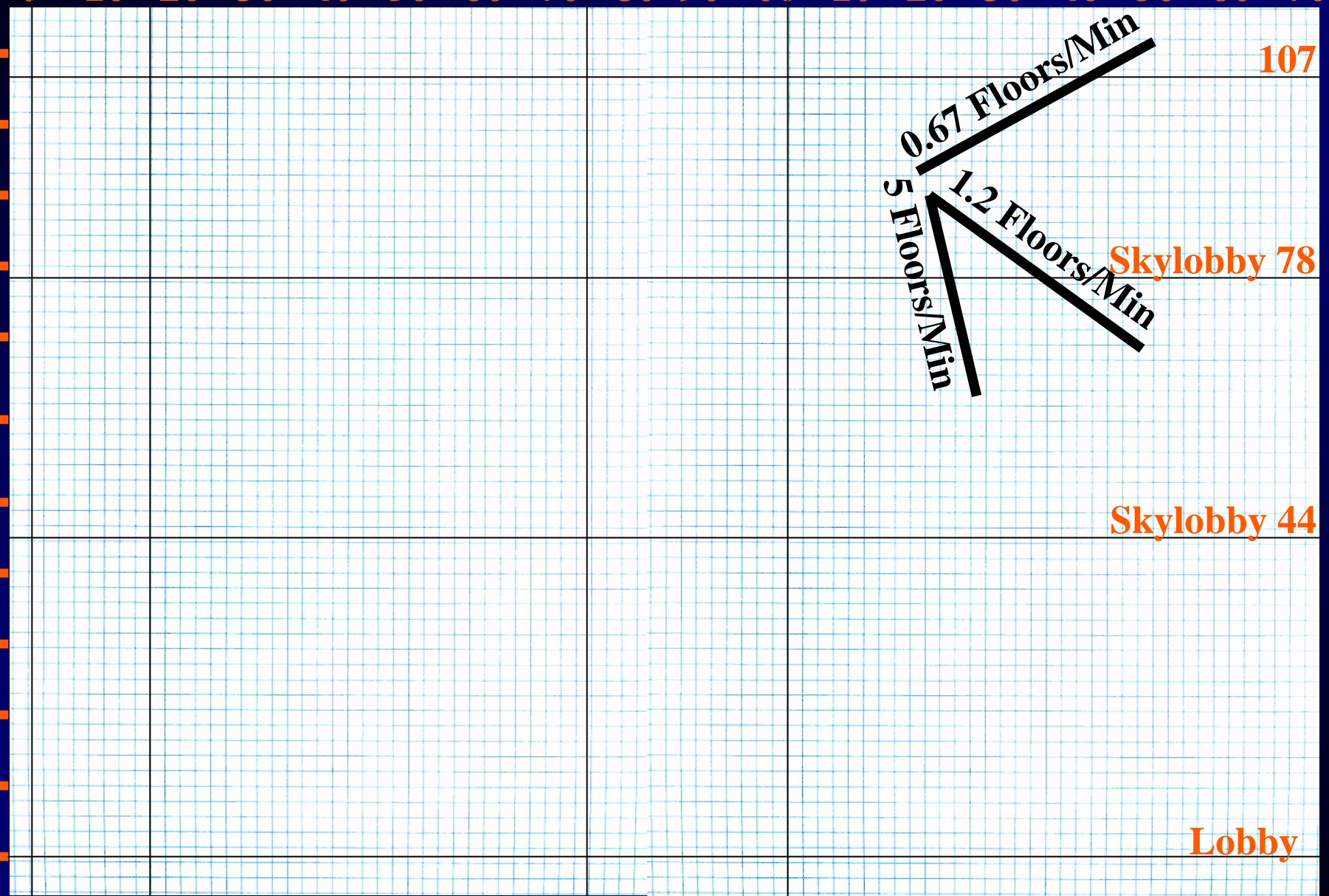
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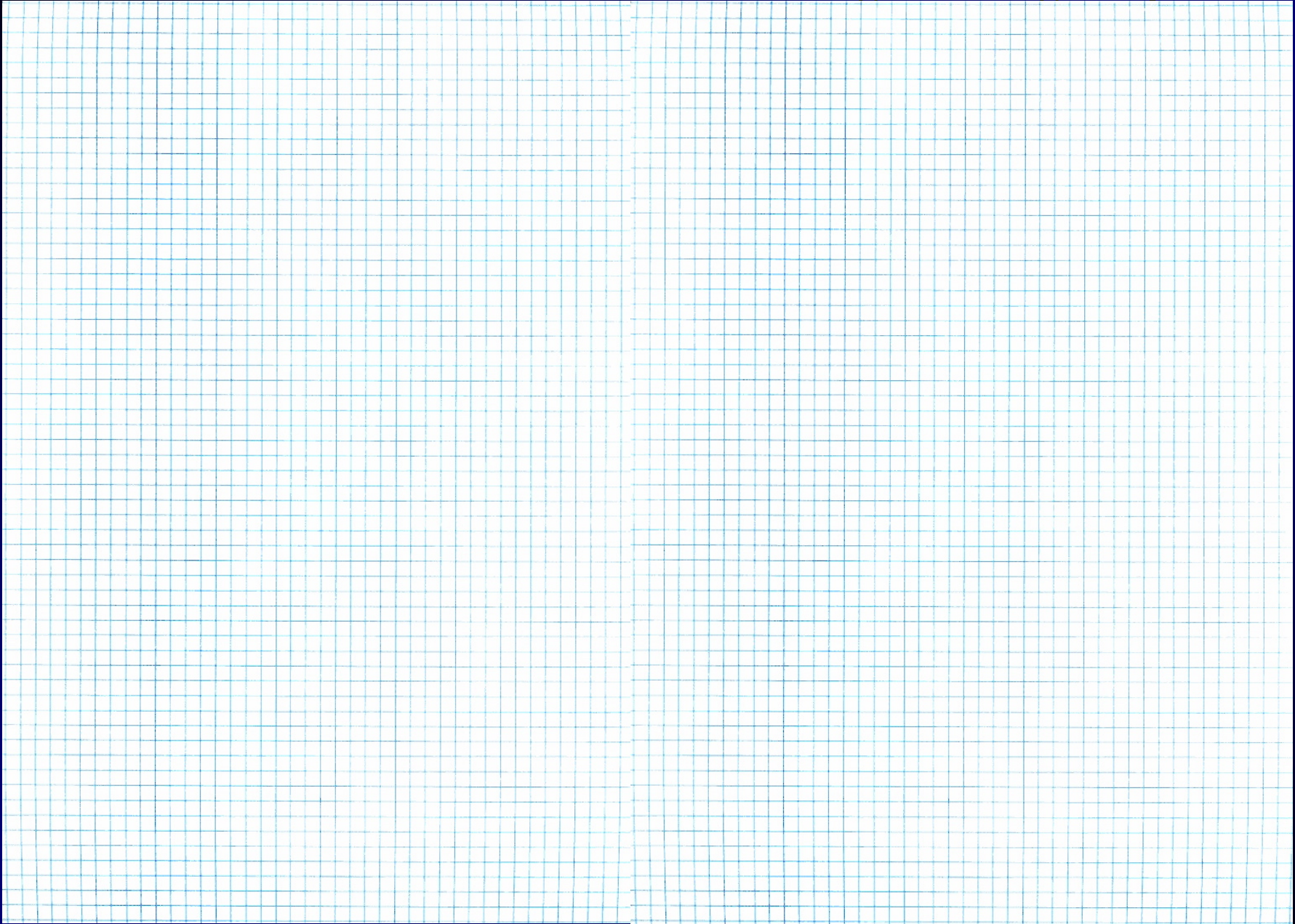
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9:03

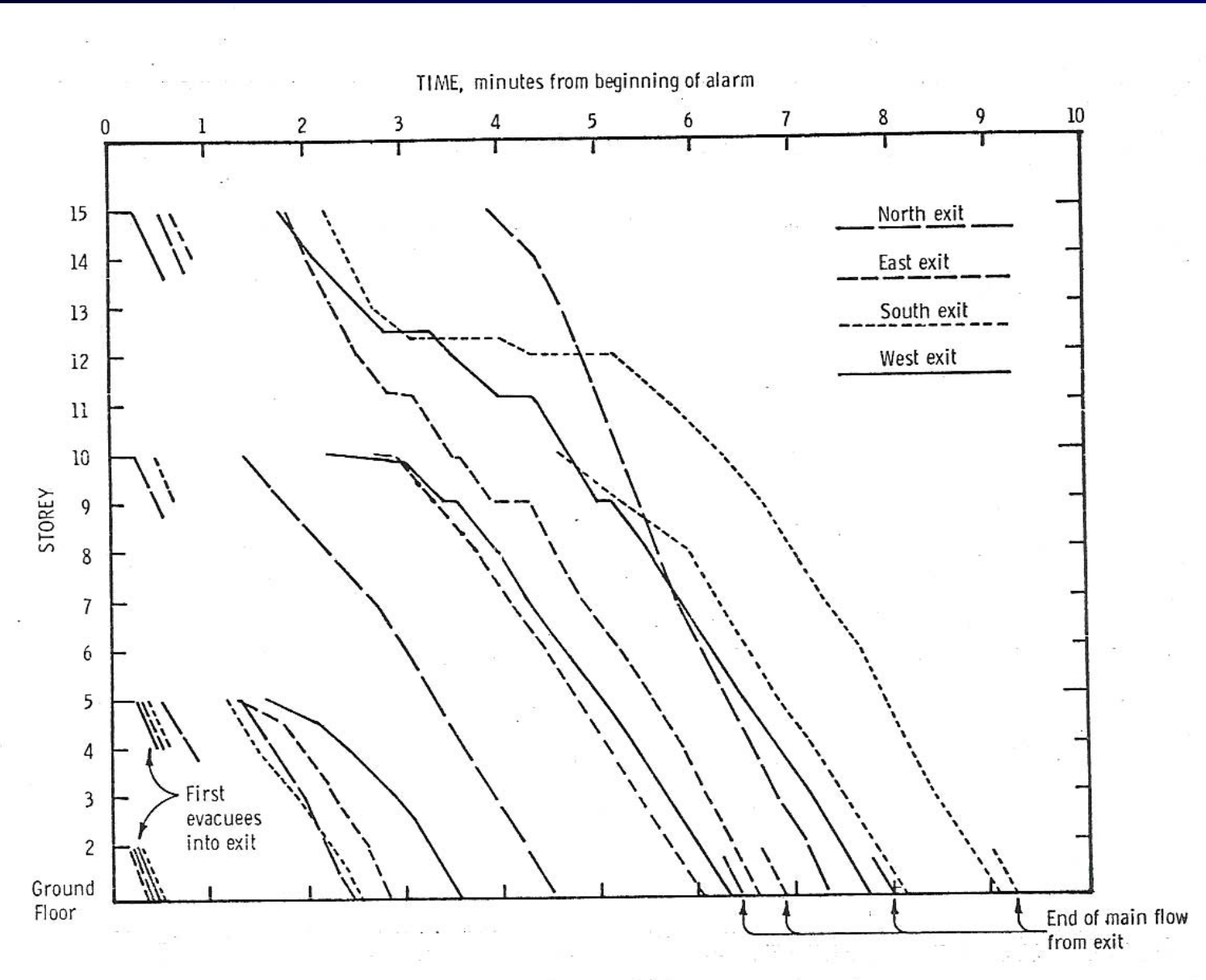
9:59

10:28

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