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By Jack H. Rife

1-17-73

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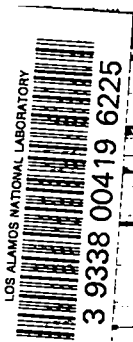
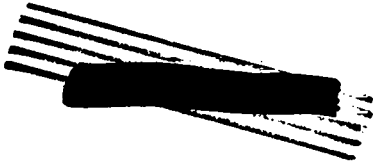
Per L. Wood FSS-16 Date: 11-20-95

By Marcia Balleja CIC-14 Date: 12-8-95

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Per LMS 6-12-79

By Marcia Balleja 12-8-95



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Effects & Instruments
[Redacted]

CONDENSATION OF BRITISH DAMAGE REPORTS

LAMS - 517 Series C

This document contains 3 pages

R. F. Christy

The object of these notes was to pick out salient data on damage by large bombs which might be extrapolated.

This document contains information affecting the national defense within the meaning of the Espionage Laws, Title 18, U.S.C. Sec. 793 and 794, and the transmission or revelation of its contents in any manner to an unauthorized person is prohibited by law.

Definitions of Damage:

To British housing

- A. 75% or more of building reduced to rubble.
- B. Damaged beyond repair and requiring demolition.
- C. Seriously damaged, uninhabitable but repairable.
- D. Damaged but still habitable and repairable.

To Foreign (German) Targets: Requiring assessment by air.

Concept of Vulnerable Area for particular kind of damage (including damage of higher degree) $V = \int_0^r 2\pi r p(r) dr$ where $p(r)$ is probability of suffering particular or worse damage (fraction of structures at distance r suffering the particular or worse damage).

Damage to housing:

Vulnerable Area (V.A.) of demolition: this is defined in the same way as A damage (report RE/H6) and would seem to coincide with that area. In another place it is said, however, that it corresponds to between A and B damage.

V.A. of "Visible" damage: this category is defined by its title but its relation to the A, B, C categories is somewhat obscure. It is suggested that it is roughly 2/3 of the C area. This correspondence doesn't agree with the figures on damage in Britain and Germany even allowing for the difference in construction.

LOS ALAMOS NATL LAB LIBS
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Feb. 17, 1944

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Perhaps $1/2$ of the C area (and ≈ 2 times the B area) would be better.

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In spite of the uncertainties in the exact meaning of these categories it seems more appropriate for us to use them both because there is better data on them and because they are the concepts in use for assessing foreign damage.

Damage to Industrial Targets:

V. A. of visible structural damage: area of collapse, bad sagging, or lateral distortion (exceeding 12") of main framework carrying roof. This is the class of damage aimed at in attacking industries.

V. A. of visible superficial damage: area of complete stripping of roof covering or breaking of roof glass if roof is 75 or more glass.

Observations of Damage. Foreign Targets.

Housing:

Some ten incidents with 4000 lb. H. C. (high capacity) bombs are considered most significant for our purposes. Observations on larger (8000 lb. H. C.) bombs are too few to form a reliable basis. The 4000 lb. H. C. bombs contain 2775 lbs. H. E. (60/40 amatol) and give positive impulses of $90 \frac{\text{lb}}{\text{in}^2}$ millisecc. at 126 ft., and $40 \frac{\text{lb}}{\text{in}^2}$ millisecc. at 2.5 psi feet. They give V. A. of demolition = 3140 sq. yds., and V. A. of visible damage = 13000 sq. yds. In the range of block busters it is uncertain if damage area goes up more or less rapidly than the wt. of bomb.

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Industrial Targets:

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There are practically no significant instances with large British bombs. With U.S.A. 1000 lb. bombs there are 62 cases. Their explosive weight is 538 lbs. and give V. A. of visible structural damage of 5000 sq. ft. per bomb. The fluctuations are large.

Conclusions: (not taken from the reports)

It appears that the data on damage to foreign housing is relatively good and will undoubtedly become better. We can expect with our bombs nothing essentially different from what has been observed. It will be somewhat uncertain how to extrapolate since the available data is in the transition region between where peak pressure is effective (large bombs) and where impulse is effective (small bombs). However, a lower limit for our expected damage should result from extrapolation on the basis of peak pressure-with corrections for height of detonation.

Concerning industrial targets, it seems that the data are new, and are apt to be, essentially inadequate. The reason for this is that because of the large size of such a target, all present data concern direct hits in which the destruction is caused by direct blast against one or two columns supporting the roof. Our case of blast against the entire outside area which is transmitted to the framework would seem to be essentially different and perhaps even more favorable. For this reason it is suggested that some calculations be made on the blast required to damage structurally a "typical" factory building.

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