Performance of plumbing vents experimental house, Hamilton, Ontario

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PERFORMANCE OF PLUMBING VENTS EXPERIMENTAL HOUSE, HAMILTON, ONTARIO

by

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The Division of Building Research has made a study of the performance of plumbing vents in the Research Home 1970 Hamilton Ontario, as part of an agreement with the National House Builders Association.

The Research House is a two-storey house with a basement having a single laundry tray; a first floor with a two-fixture powder room and kitchen containing a double sink; and a second floor with a three-fixture bathroom. It is similar in design to the Mark VI experimental home built in Kitchener (1), but includes changes in venting and waste pipe sizes (Figure 1). Figure 2 is a schematic drawing of the general arrangements of the waste and vent system. All the DWV pipes were of A.B.S.

The system is vented by a single 1-in. vent extending close to the peak of the roof into the soffit, which is separately vented to the outside. Individual branch vents extend from the 1-in. main vent to the fixtures. Internal couplings were used, reducing the inside diameter to a possible $\frac{3}{4}$ in. Two separate waste stacks of 2 and 3 in. provided drainage, and the toilets were mounted directly over each of the stacks. The 3-in. stack served all second-floor bathroom fixtures; the 2-in. stack served the first floor fixtures and laundry unit. The waste pipe for the bathroom basin joined the bath waste pipe, and the waste pipe of the powder room basin joined that for the kitchen sink. The bathroom basin was individually branch vented, but a combined branch vent pipe vented both the kitchen sink and powder room basin. The 2-in. stack was not directly vented.

TEST PROCEDURE

Losses to trap seals were produced by emptying the fixtures in different combinations. Measurements were made by means of a scale fastened to a glass U-tube fitted to the traps (Figure 3). Toilet trap losses were determined by measuring water levels in the bowls after shutting off the water supply to prevent recovery. No changes were made in the venting system. The quantity of water and rate of flow per fixture used during the test are given in Table I.

The Program of seven series of tests is listed below:

Test No. 1: All but one unit operating simultaneously to determine maximum trap loss for each unit.

Test No. 2: One unit operating singly to allow observation of effect on trap seals of other units and to determine whether any self siphonage had occurred.

Test No. 3: Repeated operation of two toilets simultaneously to observe effects of unrecovered trap losses on other fixtures.

Test No. 4: Repeated operation of bathroom toilet to allow observation of the effect of unrecovered trap losses of other fixtures.

Test No. 5: Repeated operation of powder room toilet to allow observation of the effect of unrecovered trap losses of other fixtures.

Test No. 6: Simultaneous operation of all but one unit serving 3-in. stack.

Test No. 7: Simultaneous operation of all but one unit serving 2-in. stack.

OBSERVATIONS

Test No. 1 caused a complete loss of seal in the powder room toilet (Figure 4).

In test No. 2 the powder room toilet, with a seal of 2.68 in., lost 1.14 in. when only the sink was operated and 1.77 in. by self siphonage (Figure 5).

Test No. 3 caused the greatest loss to any unit served by the 3-in. stack (Figure 6), a loss of 1.1 in. from a seal of 2.35 in. in the bath trap.

Test No. 4 caused no significant loss in any of the trap seals (Figure 7).

Test No. 5 resulted in partial trap losses in all fixtures served by the 2-in. stack (Figure 8). The powder room basin lost 2.52 in. from a seal of 2.75 in.; the kitchen sink trap lost 1.85 in. from a seal of 2.35 in.; and the laundry unit trap lost almost 1 in. from its seal of 2.35 in., with partial recovery.

Test No. 6 showed no significant trap losses, with a maximum loss from the basin trap of just over $\frac{1}{2}$ in. (Figure 9a).

Test No. 7 caused complete loss of seal in the toilet (Figure 9b) when the sink basin and laundry units were operated.

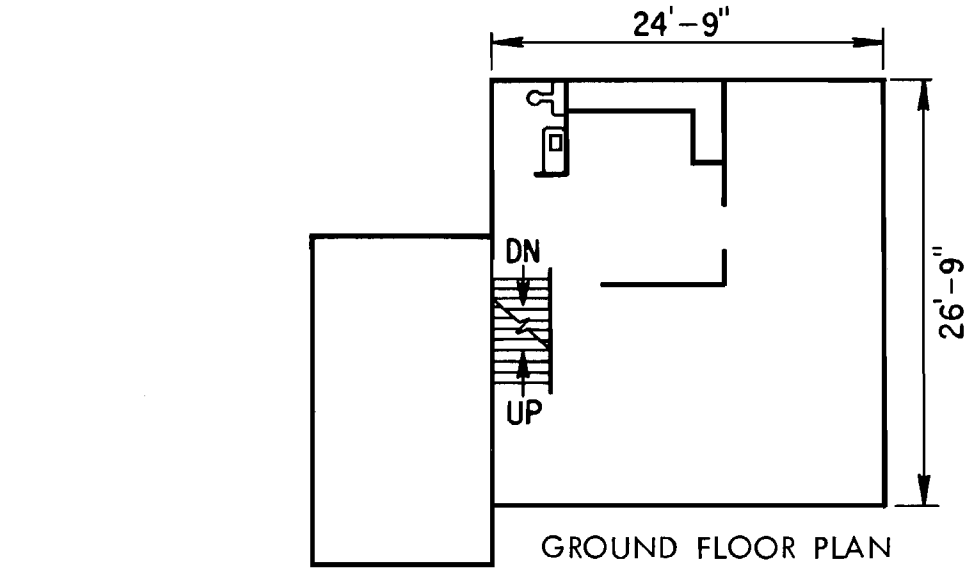
DISCUSSION

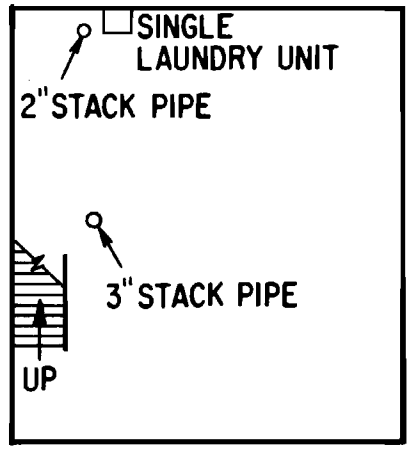
The complexities involved in the installation of the plumbing arrangements limited the selection of tests and allowed for only a conservative approach to evaluating the system. It was evident, however, that either the 2-in. waste stack or the 1-in. vent system was not adequate to serve the hydraulic loading from the sink and powder room toilet.

TABLE I

FIXTURE QUANTITY AND DISCHARGE RATE

Unit	Quantity	Rate of Discharge (gpm)
Toilet	2 gal	30.0
Bath	6 gal	4.5
Basin	1 gal	5.0
Kitchen sink	5.5 gal (3 and 2.5)	14.5
Powder room — Toilet	2.5	21.4
Powder room — Basin	1 gal	4.6
Single laundry tray	8 gal	9.0





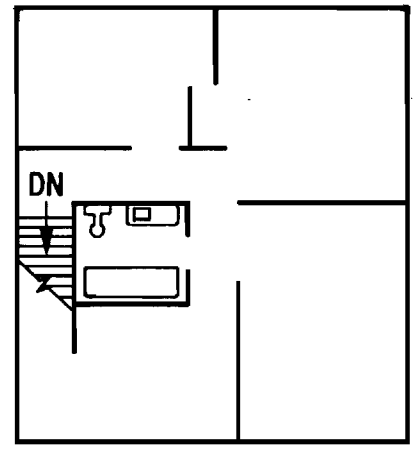


FIGURE 1

FLOOR PLAN, HAMILTON EXPERIMENTAL HOUSE

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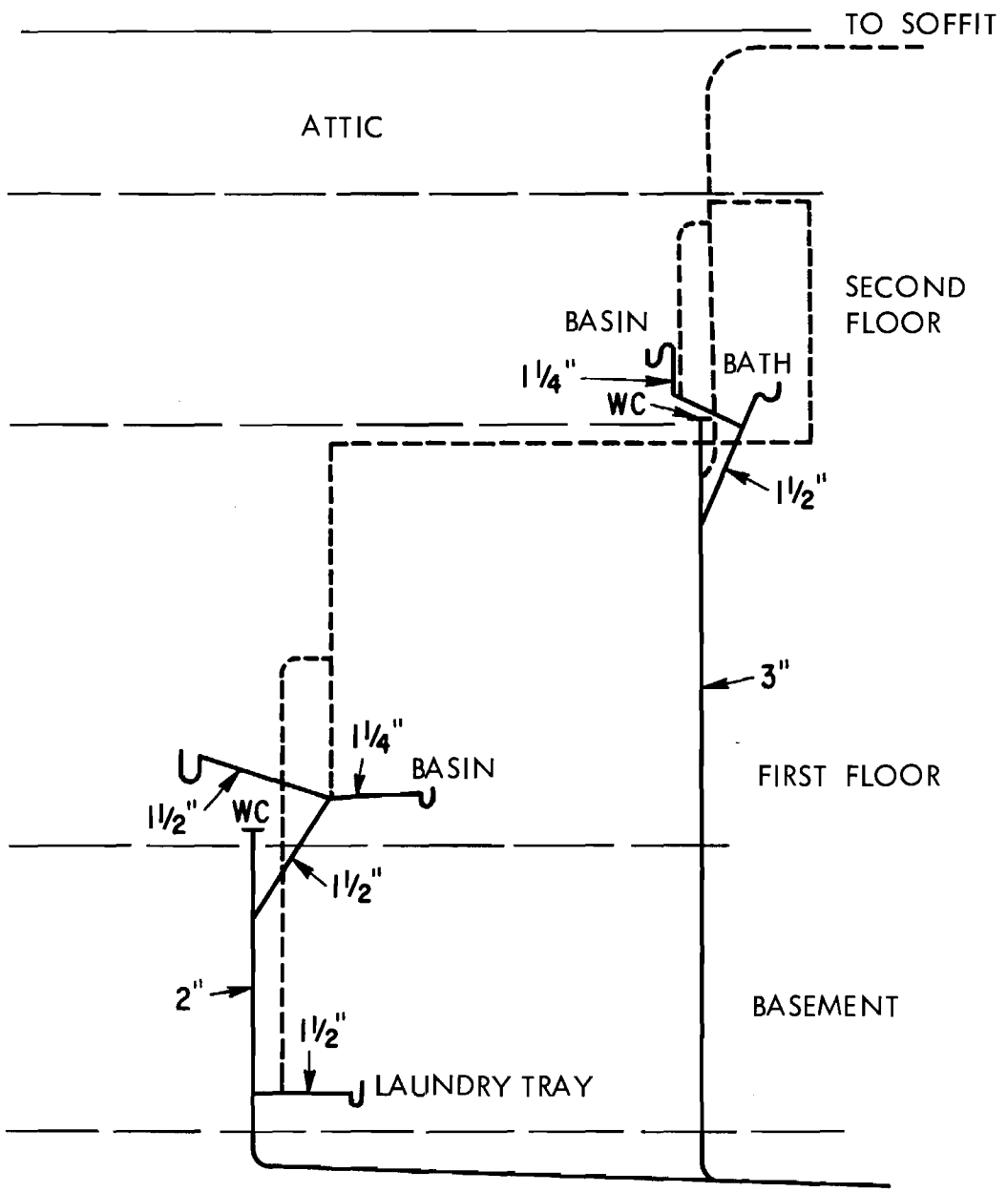

FIGURE 2 OUTLINE SHOWING WASTE AND VENT

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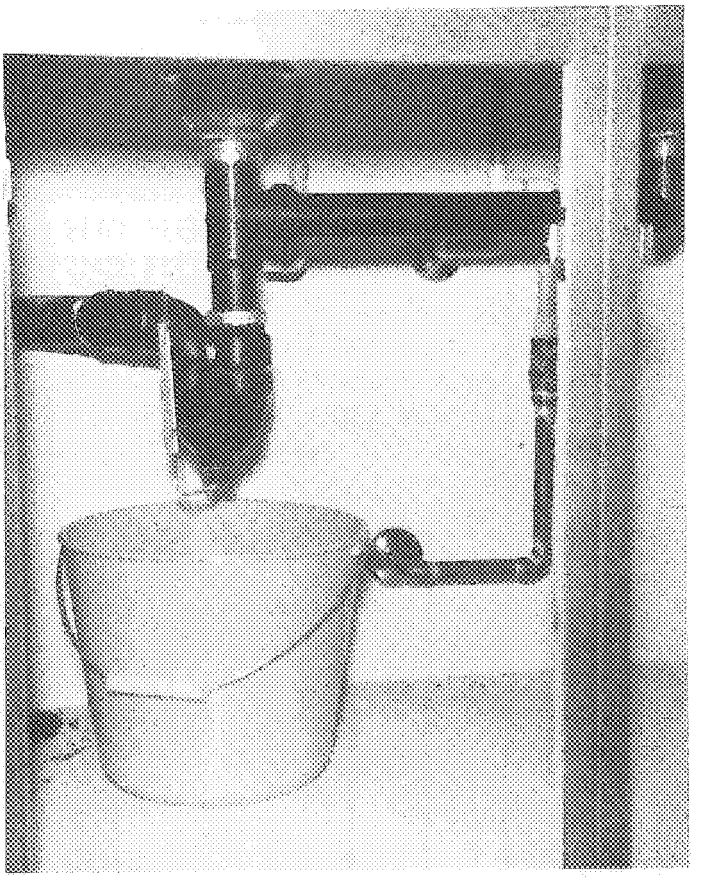

Figure 3 - Trap with U-tube and Graduated Scale.

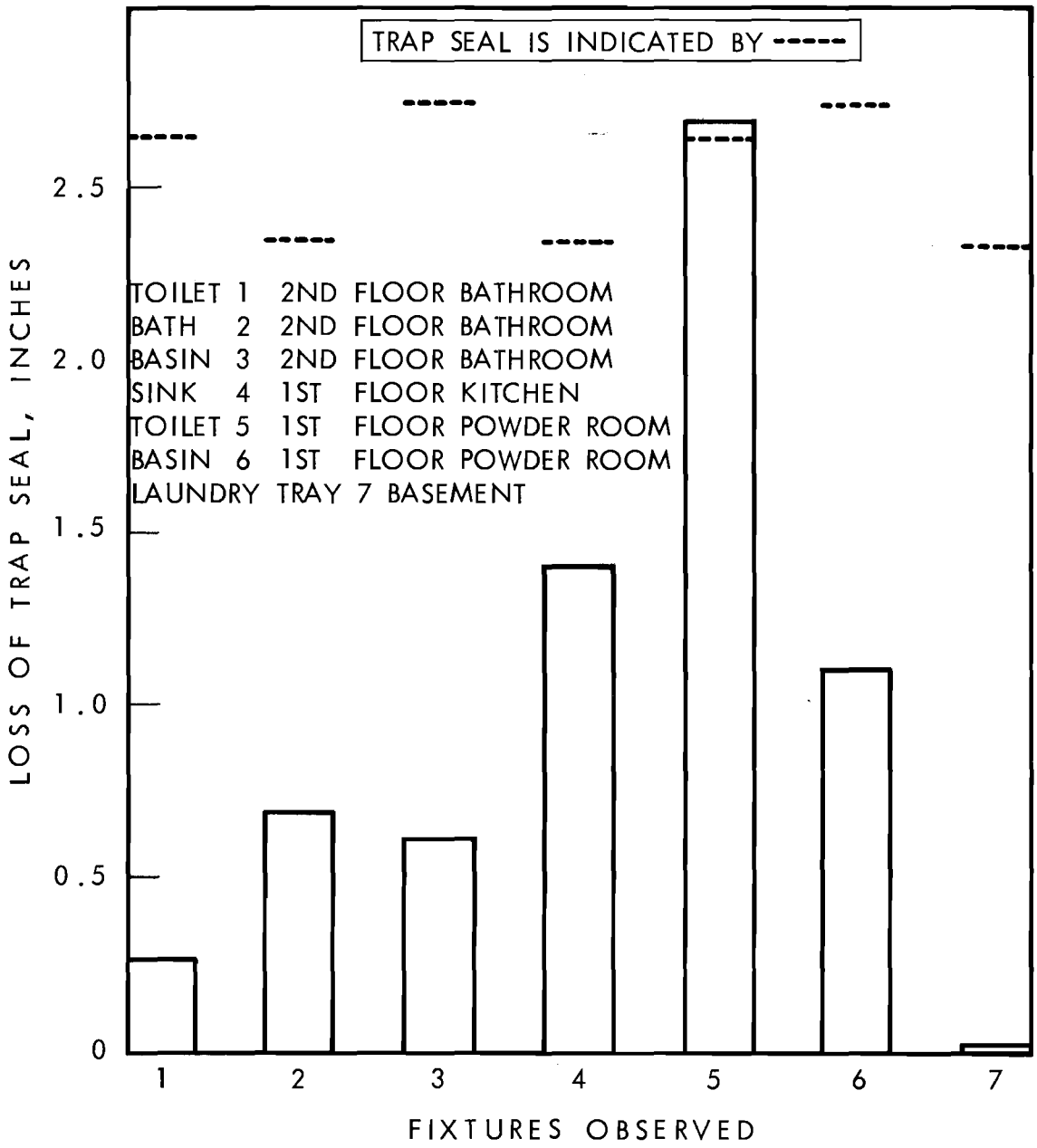

FIGURE 4

MAXIMUM TRAP SEAL LOSS ON EACH UNIT WITH ALL OTHER FIXTURES OPERATING

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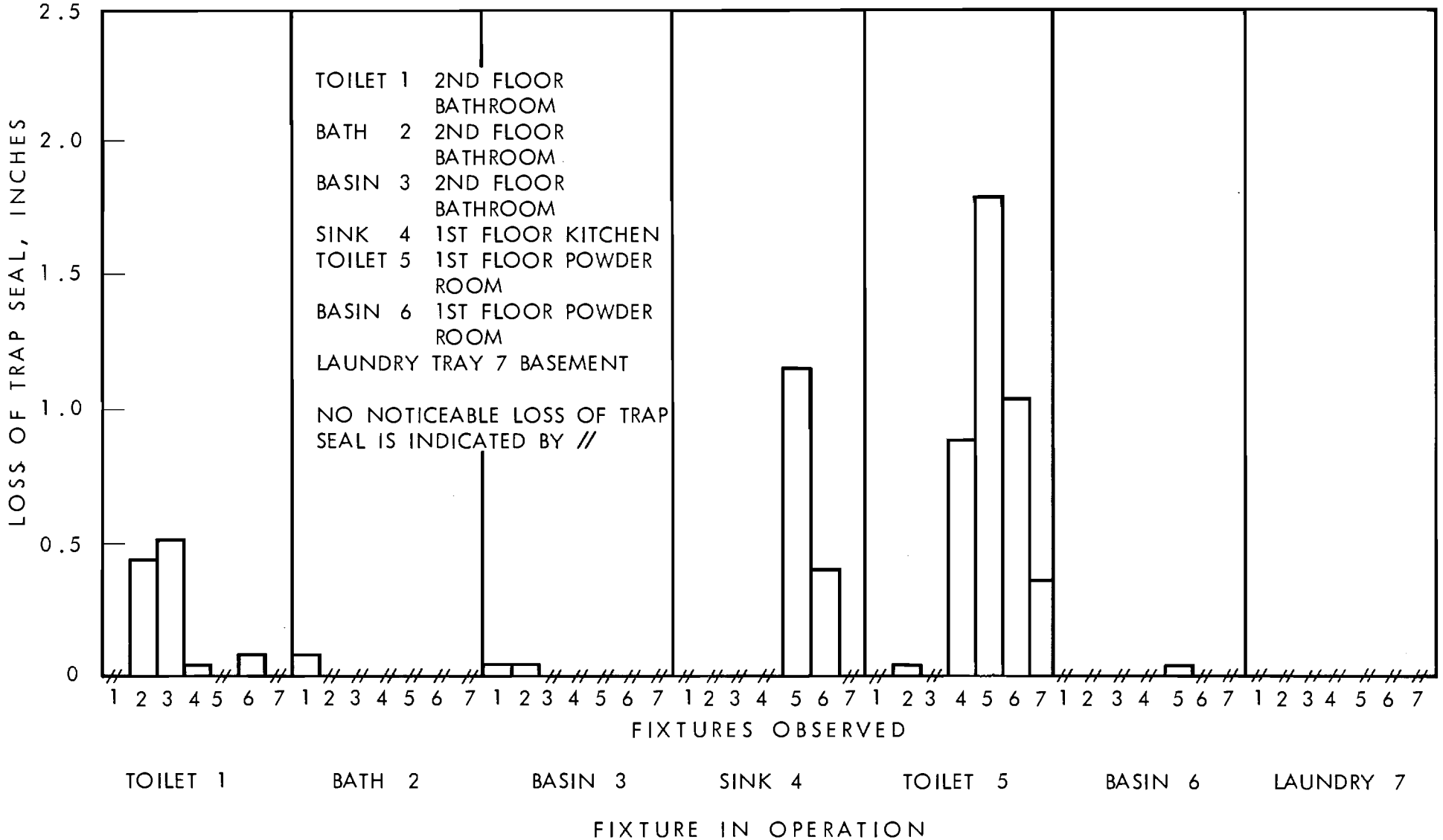

FIGURE 5 EFFECT ON THE TRAP SEAL OF OTHER FIXTURES WHEN ONE FIXTURE OPERATING

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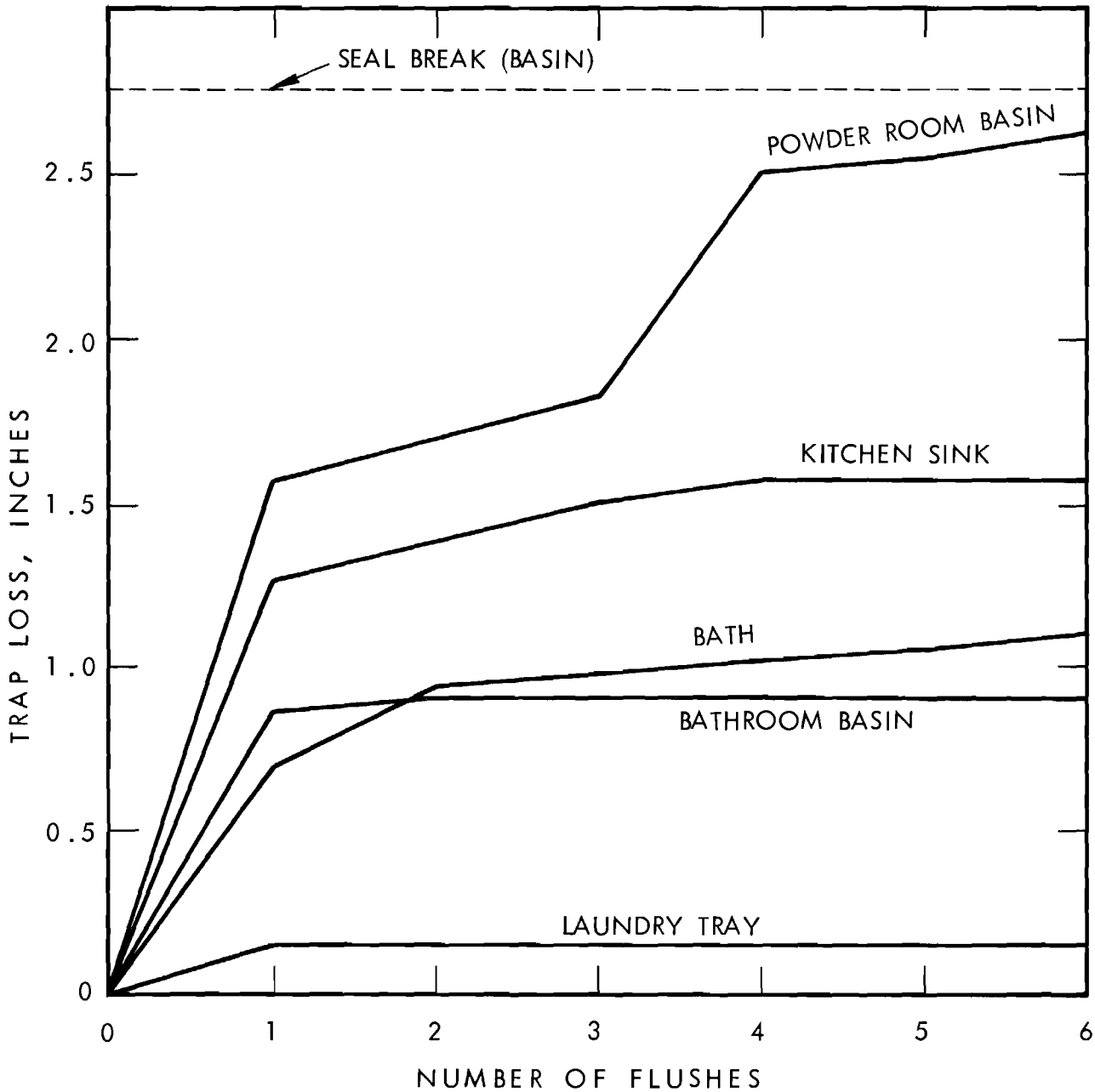

FIGURE 6 REPEATED SIMULTANEOUS FLUSHING OF TWO TOILETS

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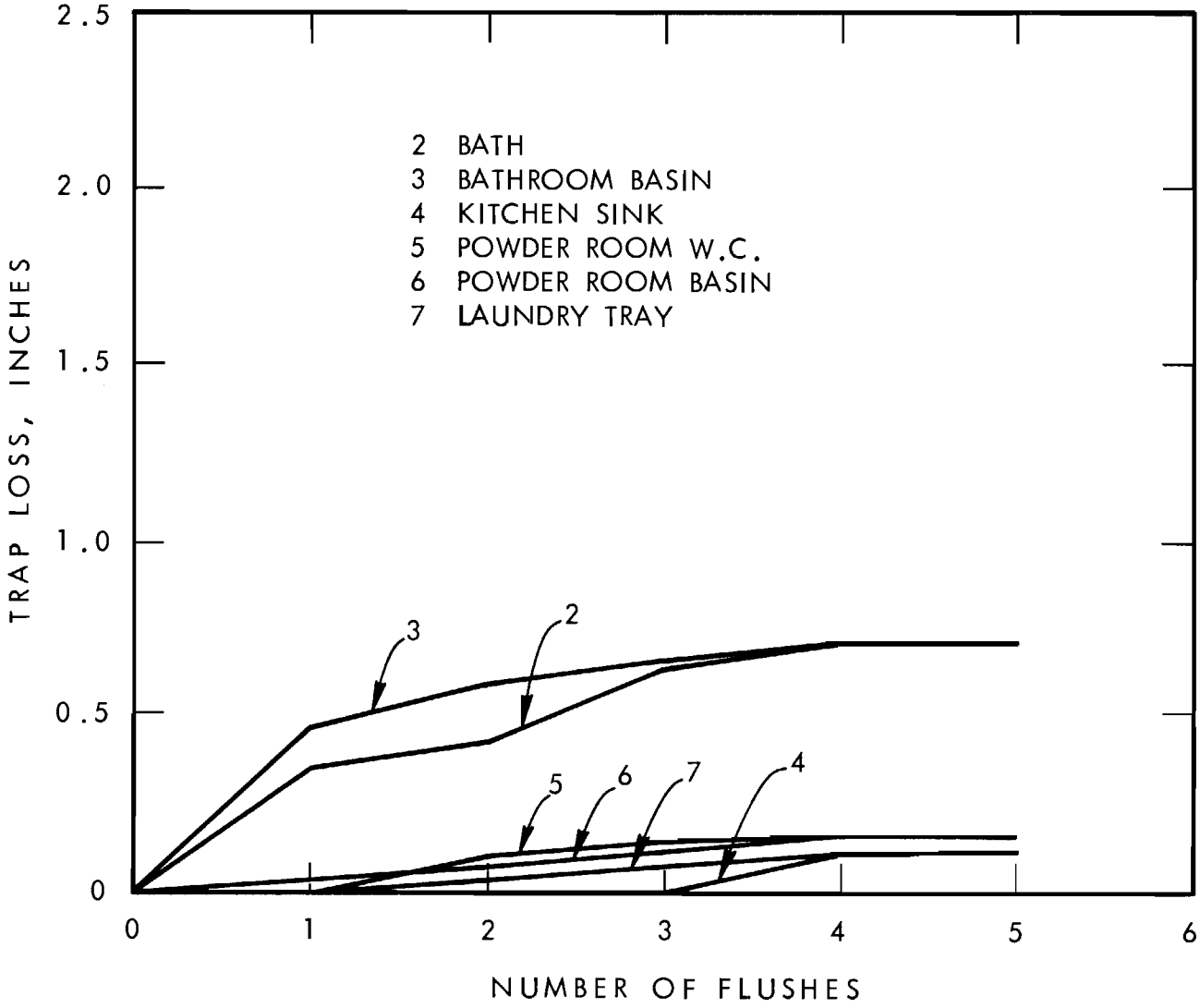

FIGURE 7 REPEATED FLUSHING OF BATHROOM TOILET

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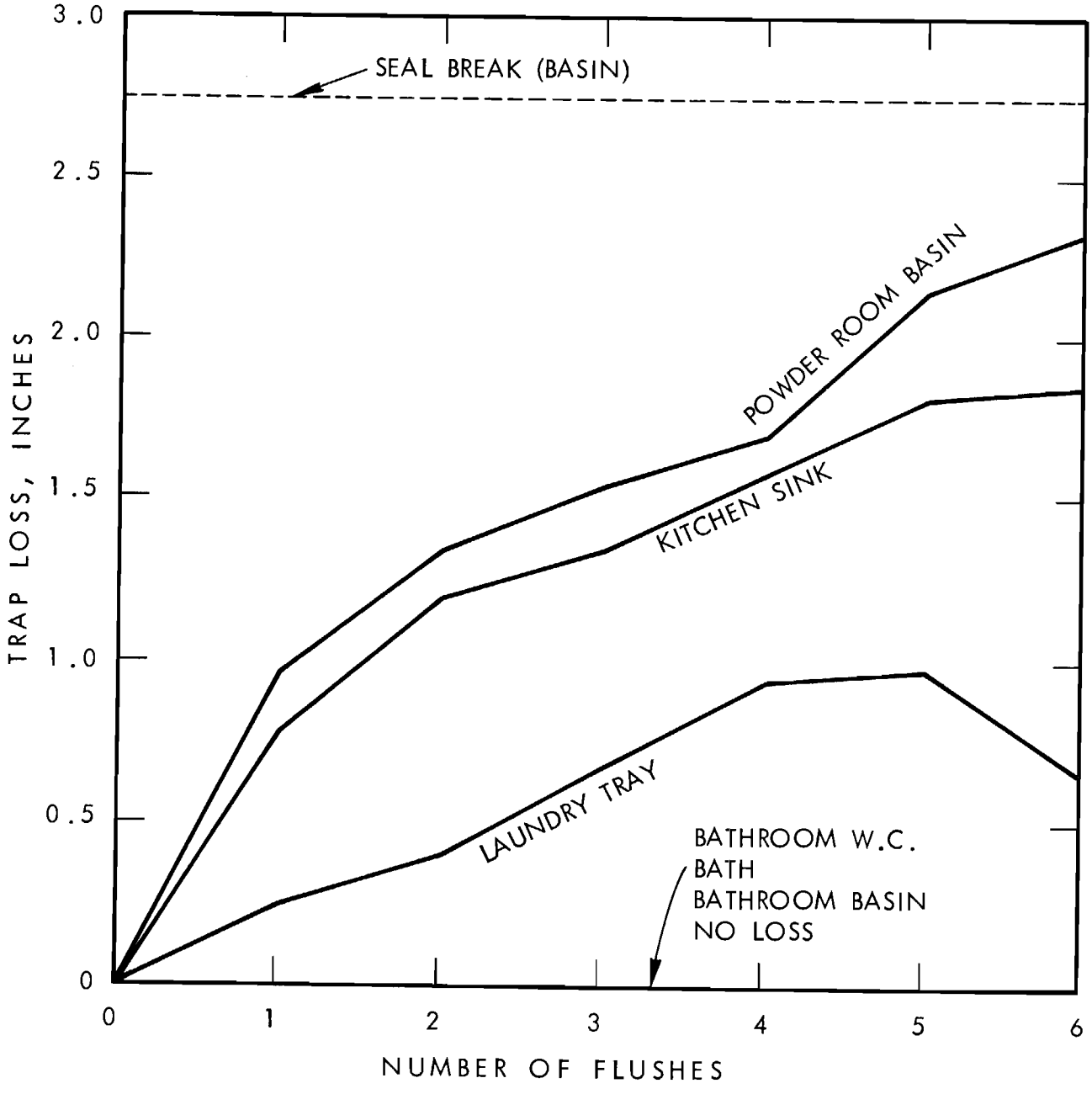

FIGURE 8 REPEATED FLUSHING OF POWDER ROOM TOILET

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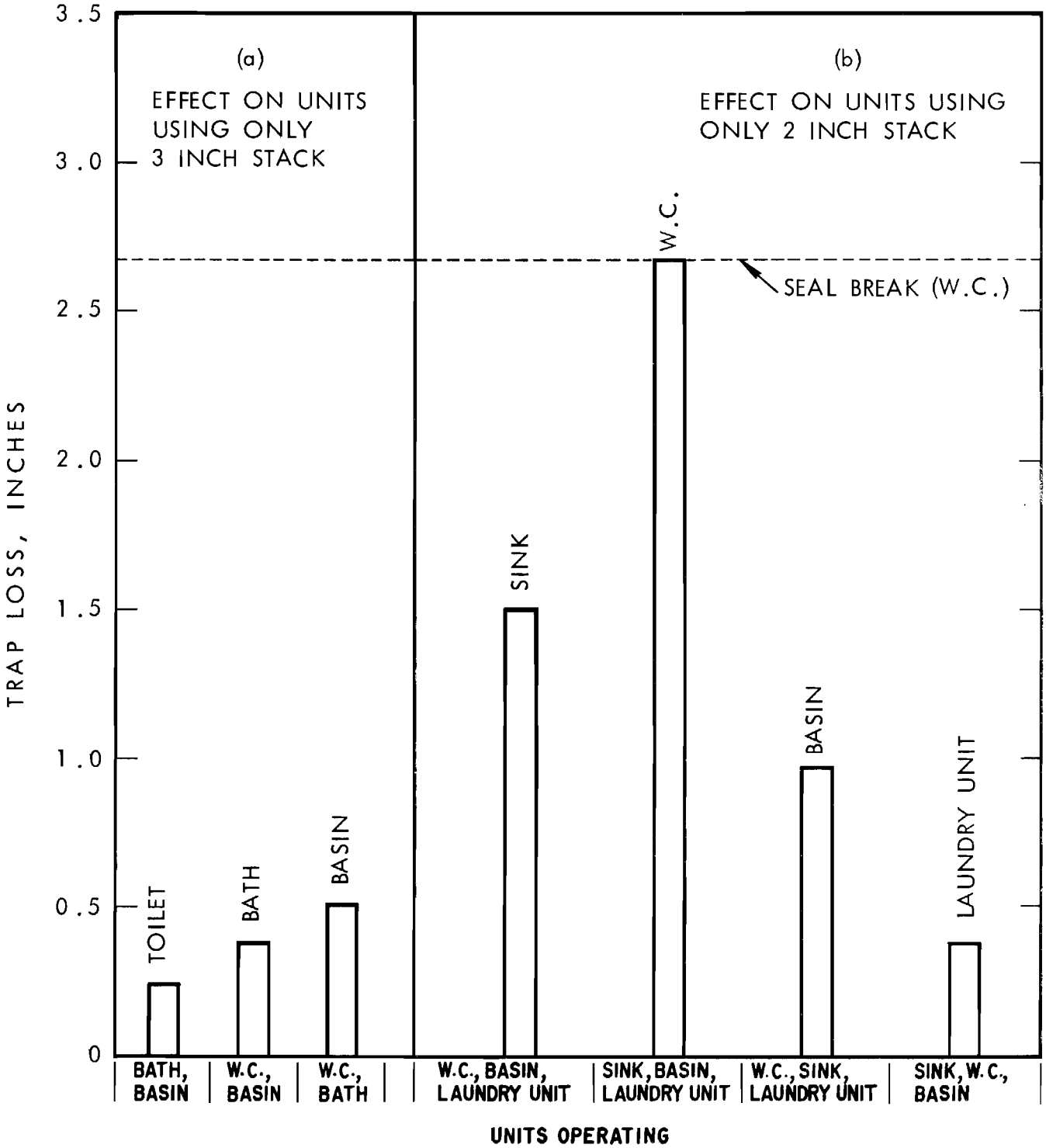

FIGURE 9

MAXIMUM TRAP SEAL LOSS FOR EACH UNIT WHEN ALL OTHER FIXTURES USING 3 INCH STACK AND 2 INCH STACK WERE OPERATING

BR 4679-8