Homeland Security
Science and Technology

Summary

U.S. Department of Homeland Security
SAVER
System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

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Assessment of Circular Concrete Saws

This SAVER Summary contains information on the comparative analysis project conducted by The Texas A&M University System, Engineering Program Office at "Disaster City." The Market Analysis and Technical Assessment *and the* Results of Assessment and Validation *reports are available by request at* https://www.rkb.us/saver.

Background

Emergency responders must be trained and equipped to respond immediately in the event of a crisis. Often, rescuers must extract people who are below collapsed or damaged concrete structures using readily available equipment, such as concrete saws.

The Market

Concrete saws are commonly used in the construction industry on "green concrete," which is concrete that has recently been formed or poured. In contrast, natural disasters and terrorist attacks usually leave behind rubble-strewn debris, including hardened concrete with varying amounts of rebar reinforcement. Rescue missions often require unconventional, difficult cuts, and it is not uncommon for an emergency responder to require light, versatile equipment with maximum performance capability.

Concrete saws can do things that ordinarily equipped saws cannot. Knowledgeable, experienced emergency responders recommend and use diamond cutting systems because they are designed and built specifically for cutting into concrete structures. They provide significant cost advantages over conventional concrete removal methods and offer other advantages:

- Reduced downtime
- Precision cutting
- Maintenance of structural integrity
- Reduced noise, dust and debris
- Limited-access cutting
- The ability to cut heavily-reinforced concrete.

First responder practitioners reviewed the circular concrete saw market and identified the following set of six gasoline-powered circular concrete saws for assessment:

- Hilti KC 62-14
- Homelite MP-38
- Husqvarna 375K
- Makita 64-14
- Partner K700 Active III
- Stihl TS400.

These 14-inch circular gasoline-powered concrete saws have similar horsepower and are readily available to the emergency response community.

Assessment Plan

The concrete saws were assessed according to the following criteria:

Affordability. The ability of a particular user (or jurisdiction) to fully bear the total life cycle costs of an item (or a system).

Capability. The power or capacity of an item (or a system) to perform one or more defined tasks.

Deployability. The ability of an item (or a system) to be moved from its place of assignment (or storage) to the site of its intended use.

Maintainability. The ability of an item (or a system) to be retained in, or restored to, a specified condition when maintenance is performed using prescribed procedures and technician level skills.

Usability. The effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments when interacting with an item (or a system).

Overall. An overall rating based on the weighted sum of all other assessment criteria.

Emergency Responders in the rubble of the Twin Towers, NY.

Three different cuts were made on identical concrete slabs.

Cut 1: Three (3) foot long cut; flat cut; with slab horizontal.

Cut 2: Three (3) foot long cut; vertical cut; with slab vertical.

Cut 3: Three (3) foot long cut; horizontal cut; with slab vertical.

These cuts were selected to simulate cutting scenarios that are commonly found in the search and rescue operational environment. The cuts were identified based on input from practitioners in the user community familiar with concrete saw operation and search and rescue procedures. Each of these cuts forms a component of typical concrete demolition and removal procedures.

Results

Rate of Cut. Cut rate was calculated by comparing combined cut times for each cut type, saw, and user with corresponding aggregated cut areas. Cut rate is measured in number of seconds required to cut one inch-foot of reinforced concrete (see figure 1).

Saw	Average Time Per Cut Area (sec/in-ft)
Hilti KC 62-14	31.2
Homelite MP-38	21.2
Husqvarna 375K	13.1
Makita 64-14	14.7
Partner K700 Active III	14.0
Stihl TS400	14.1

Figure 1. Averaged Composite Rate-of-Cut for Tested Saws

Fuel Consumption. Refueling takes time away from cutting and interrupts saw operation. Thus, with fuel consumption rate, a slow consumption rate (a higher value) is considered desirable. To assess fuel usage and duration of saw operability in the field as a factor of fuel consumption, the quantity of fuel used during the tests was measured. The duration of saw operation per fuel tank, in minutes per tank, is shown in figure 2.

Filter Performance. In an emergency responder environment, filter capacity is also of importance because it directly affects how often filters need to be cleaned or changed. As such, the air filter system capacity was used as a measure of air filter system performance (see figure 3).

Saw	Tank Consumption Rate (min./tank)
Hilti KC 62-14	17.0
Homelite MP-38	31.4
Husqvarna 375K	14.3
Makita 64-14	29.8
Partner K700 Active III	17.3
Stihl TS400	17.2

Figure 2. Consumption Rate

Saw	Average Time Per Cut Area (sec/in-ft)
Hilti KC 62-14	17
Homelite MP-38	39
Husqvarna 375K	56
Makita 64-14	37
Partner K700 Active III	49
Stihl TS400	77

Figure 3. Filter System Capacity

Saw	Weight	Water System	Ergonomic Features	Size	Handle/ Grip	Smoothness	Torque	Overall Usability
Hilti KC 62-14	3.0	2.3	3.2	2.7	2.3	2.8	2.3	1.7
Homelite MP-38	3.2	1.0	3.3	3.3	3.5	3.5	3.2	3.3
Husqvarna 375K	3.2	2.8	3.3	3.5	3.3	3.5	4.0	4.0
Makita 64-14	3.2	3.8	3.7	3.0	3.7	3.7	3.5	3.7
Partner K700 Active III	3.2	3.3	3.8	3.3	2.7	3.5	2.8	3.7
Stihl TS400	3.2	4.0	2.5	3.2	2.7	3.8	3.3	3.3

Figure 4. Saw Usability Survey Average Response Ratings

Saw Usability. The saw operators were asked to complete a usability survey after completing all three cuts with each saw. Figure 4 shows the survey results, with responses ranging from a rating of "1" being poor and "5" being excellent (see figure 4).

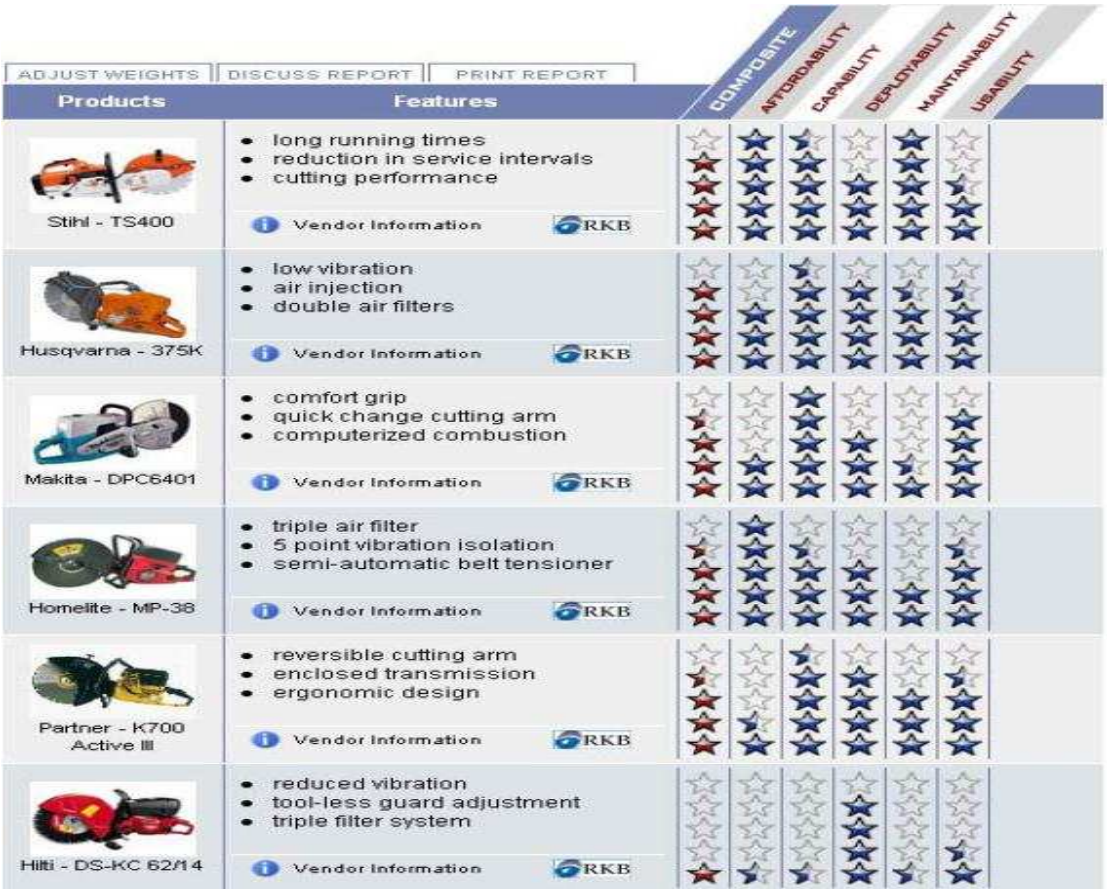
Storage Envelope. The term "storage envelope" refers to the minimum dimensions required for housing an equipped saw in an enclosed compartment.

As shown in figure 5, the Partner K700 Active III and the Hilti KC62-14 had the smallest storage envelopes, requiring the smallest cumulative storage space volume, while the Makita 64-14 and the Stihl TS400 had the largest storage envelope, requiring the largest cumulative storage space volume.

Saw	Average Time Per Cut Area (sec/in-ft)
Hilti KC 62-14	2.4
Homelite MP-38	3.1
Husqvarna 375K	2.5
Makita 64-14	3.2
Partner K700 Active III	2.2
Stihl TS400	3.3

Figure 5. Circular Concrete Saw Storage Envelope

"Emergency responders must be trained and equipped to respond immediately in the event of a crisis. Often, rescuers must extract people who are below collapsed or damaged concrete structures using readily available equipment, such as concrete saws."



QuickLook Evaluation for Concrete Saws

To adjust the weighting factors, visit the SAVER Web site at https://www.rkb.us/saver