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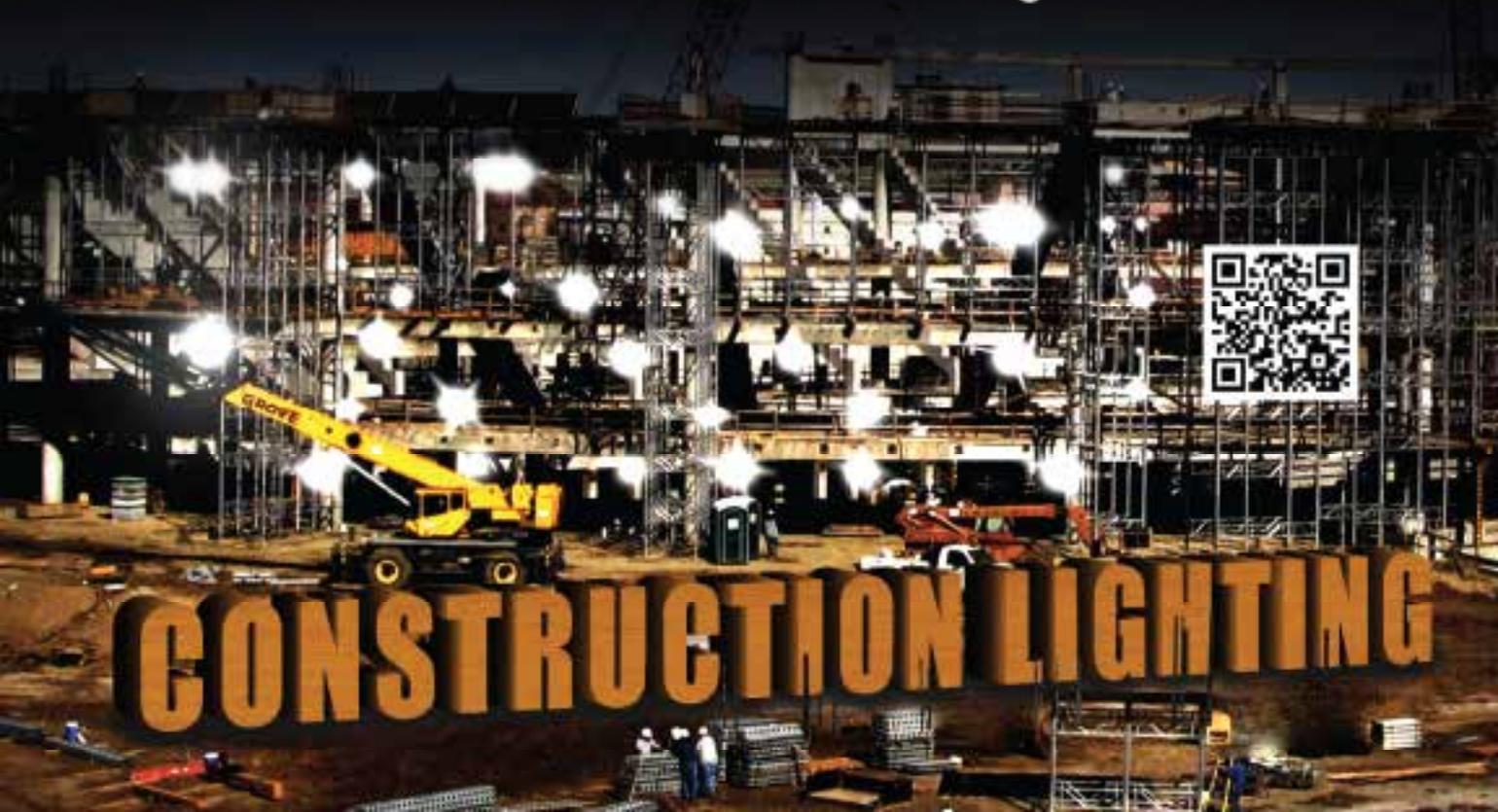
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CONSTRUCTION LIGHTING



NFPA70E, Arc Flash & Safe & Efficient Thermography Practices

By Josh L. White

What is an Arc Flash?

An arc flash is like a bolt of lightning that occurs around energized electrical equipment. It can occur spontaneously and is often triggered simply by the movement of air when an electrical enclosure is opened. The NFPA has recognized the significant hazard of arc flash and is attempting to protect workers via the latest implementation of NFPA 70E-The Standard for Employee Safety in the Workplace.

About 10-15 serious arc flash incidents occur in the US each day. Most causes of arc flash are operator induced.

Most technicians who routinely work around energized electrical equipment are familiar with arc flash-having seen it firsthand. It is thought of like a major automobile accident:

no one really expects it to happen to them, so people have a tendency to drive with significantly less caution than they should. So it is with arc flash, only worse. Similar to driving you can make a mistake, or you can be doing everything right when someone slams into you.

Specifically, what is an arc flash?

An arc flash is electric current flowing through an arc outside its normal path where air becomes the conductor of high thermal energy (5000°C %2B) and generates highly-conductive plasma. An arc flash will conduct all available energy and generate an explosive volumetric increase of gases which blows electrical system doors off and potentially generates shrapnel.

What are the causes of Arc Flash?

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An arc flash occurs when the gap between conductors or conductors and ground is momentarily bridged. There is always a trigger event which almost always involves human intervention. Typical causes and contributing factors include:

- Accidental contact with energized parts
- Inadequate short circuit ratings
- Tracking across insulation surfaces
- Tools dropped on energized parts
- Wiring errors
- Contamination, such as dust on insulating surfaces
- Corrosion of equipment parts and contacts
- Improper work procedures

An arc flash is electric current flowing in an arc outside its normal path where air becomes the conductor.

The vast majority of arc flash faults occur when the door is open or being opened. The National Fire Protection Agency (NFPA) is the author of NFPA 70, also known as the National Electric Code (NEC). This paper is not intended to provide a comprehensive review of the information available in the code, but merely to highlight some of the information that may be related to thermography.

NFPA 70E is the standard for safe electrical work practices.

The NEC is an electrical design, installation and inspection standard. It does not specifically address topics like electrical maintenance and safe work practices. A national consensus was needed for safety while working around live electrical equipment. NFPA 70E is the standard for safe electrical work practices. NFPA 70E addresses four specific topics: safety related work practices, safety related maintenance requirements, safety requirements for special equipment and installation safety requirements. NFPA 70 suggests that a Hazard/Risk analysis must be conducted prior to working on electrical equipment. The core of the analysis is based on shock and arc flash boundaries which must be done by a qualified electrical engineer.

Shock Hazards, Flash Hazards and Personal Protective Equipment (PPE) Selection

Prior to beginning work around live electrical components, an Energized Electrical Work Permit must be obtained and should include but not be limited to the following:

- A description of the circuit, the equipment to be worked on and the location
- Justification for why the work must be performed in an energized condition
- Description of the safe work practices to be performed
- Results of the Shock Hazard Analysis

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- ⬢ Determination of the Shock Protection Boundaries
- ⬢ Results of the Flash Hazard Analysis
- ⬢ The Flash Protection Boundary
- ⬢ Identify the necessary Personal Protective Equipment (PPE) required to safely perform the assigned task
- ⬢ Means employed to restrict unqualified personnel from entering the work area
- ⬢ Evidence of completion of a job briefing
- ⬢ Energized work approval from responsible management, safety officer and owner

Prior to working with live components, the correct Personal Protective Equipment and safe working practice must be determined.

NFPA 70E allows for an exemption to the safe work permit for qualified personnel who are performing tasks such as testing, troubleshooting, voltage measuring, etc. so long as they utilize safe work practices and the proper PPE. Prior to working with live components, the correct personal protective equipment and safe working practice must be determined by carrying out a Shock Hazard and a Flash Hazard Analysis. A Shock Hazard Analysis will determine the voltage to which personnel are exposed, boundary requirements and the proper PPE necessary to minimize the possibility of shock to personnel. The shock protection boundaries are identified as limited, restricted, and prohibited for the distances associated with various voltages.

Unqualified personnel should be notified and warned of hazards by qualified personnel when working at or near the limited approach boundary. When an unqualified person must work inside the restricted boundary, it is important that they be further notified of the risks and hazards and continuously escorted by a qualified person. Under no circumstances should they be allowed inside the prohibited boundary. It is important that a Flash Hazard Analysis be conducted in order to protect personnel from being injured by an arc flash. The analysis will determine the Flash protection boundary and determine the proper PPE. In so doing, the Flash protection boundary is calculated at the distance from energized parts where a burn will be "recoverable" (2nd Degree) and "incurable" (3rd Degree). The guidelines dictate that the Flash protection boundary for systems that are 600 volts or less be 4' for clearing times of 6 cycles (0.1 second) and available bolted fault current of 50kA or any combination not exceeding 300kA

cycles. For all other clearing times and bolted fault currents, the flash protection boundary is normally determined based on the calculated incident energy of an arc fault taking into account system voltage, available current, and clearing time (where incident energy is the measure of thermal energy at a specific distance from the fault). Where it is not possible to perform these analyses (or they have not been performed), NFPA 70 provides guidelines (NFPA 70 Table 130.7-C9a) that can be used to determine the required PPE based on the task conducted. In lieu of a Flash Hazard study, selection of PPE by task is normally allowed. However, for tasks not listed in the table and for clearing times different than those listed there, a complete Flash Hazard Analysis is required. Using Flash Hazard Analysis or Task Risk Assessment, the following table can be used to identify the correct PPE:

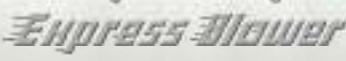
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Thermography Inspection Practices Infrared cameras have been used to identify problems in electrical systems for many years. Problems in electrical systems manifest themselves by connections and conductors becoming overheated as the result of increased resistance, the result of loose or corroded connections, or load imbalances. An infrared camera can readily identify these problems in a thermal image and is an excellent method for identifying failing or problem components prior to a failure. A failure can disable an electrical system and cause significant lost production, equipment damage and bodily injury. Insurance companies use infrared electrical inspection to help determine risk profiles and rates for industrial customers. More recently, thermographers have found that they can use IR to prevent and predict failures to help further reduce down time equipment failure and increase overall safety.

Often, during thermography inspections, panel covers are removed and subsequently replaced, a method that conflicts with the requirements of NFPA70E.

Like visible cameras, infrared cameras require a direct-line-of-site view of an object. In most cases surveys are hampered by cabinet designs that obscure the target components being inspected and thermographers are put at risk by having to open cabinets or doors in an attempt to gain access to the internal components. IR surveys of electrical systems are best conducted when the system is under heavy if not peak electrical load, which requires the thermographer to perform the inspection in and around live electrical components. Typically, electrical system covers are removed during thermography inspections and subsequently replaced. This working method conflicts with the requirements of NFPA 70E.

Recommendations of NFPA70E as they relate to Thermography Inspection

NFPA 70E recommends that only “qualified” personnel be allowed to perform work inside the flash protection boundary. Thermographers must be accompanied by “qualified” individuals if they intend to have panel covers removed. Both the thermographer and the additional person should be in full PPE. One way NFPA 70E determines Hazard and Risk and the required PPE is based on the activity that you are conducting around the equipment. Risk potentials are determined on a scale from 0-4, where 4 indicates the highest risk potential. For example, removal of a bolted cover on 600V equipment carries a hazard/risk classification of 3 and that goes up to a rating of 4 on voltages greater than 600V. As this work occurs within the Flash Protection boundary, the appropriate PPE must be worn. The required minimum PPE for Hazard/Risk Classification 3 work is to withstand 104.6 J/cm², and the required minimum PPE for Hazard/Risk Classification 4 work is to withstand 167.36 J/cm². As much of the work performed for an IR inspection requires removal of bolted covers, this would be the PPE that is required.

Infrared Windows: Eliminate the Controllable Risk

The first rule in any risk assessment is to eliminate the risk if possible. Infrared Windows eliminate many of the risks associated with live inspections since they enable an infrared camera direct view of live electrical components without the need to open electrical enclosures. They provide an excellent means of accessing electrical equipment efficiently and safely. In addition, a second qualified technician is not required to open and unbolt enclosures. An IR viewing window is basically an infrared transparent material with a holder/mounting body. Thermographers may even decide to not use a window when inspecting energized components at some distance from the cover and use a protective grill in place of a window. The grill must be IP2X certified (the grill size must offer protection against foreign objects with diameters larger than 12mm). This method can significantly reduce the window cost and also has the additional benefit of allowing ultra sound inspections of the electrical switchgear. However when using grills, operators will be exposed to live electrical components and they must wear the appropriate level of PPE identified from the Arc Flash Hazard Analysis of the switchgear. Infrared Windows eliminate many of the risks associated with live infrared inspections since they enable an infrared camera direct view of live electrical components without the need to open electrical enclosures. The optics holder design depends upon a number of parameters: the field of view, equipment lens and window size are all functions of the design and must meet all the parameters that the thermographer requires before a holder is manufactured. Also, a protective cover should be included in the design as crystals are very expensive and in some cases, extremely fragile. Infrared Windows are available in multiple sizes and can be custom made to retrofit dead fronts on distribution



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and isolator boards. The larger the size of the window, the greater the field of view one can see with their IR camera

Considerations in Installing Infrared Windows

To correctly install infrared windows, the targets that require inspection must be identified. Typically, traditional surveys only look at the bolted connections within the switchgear. These are generally considered to be the “weakest points” or “points most likely to fail.” These may include:

-  Cable connections
-  Bus Bar Connections
-  Isolator or Circuit breaker connections

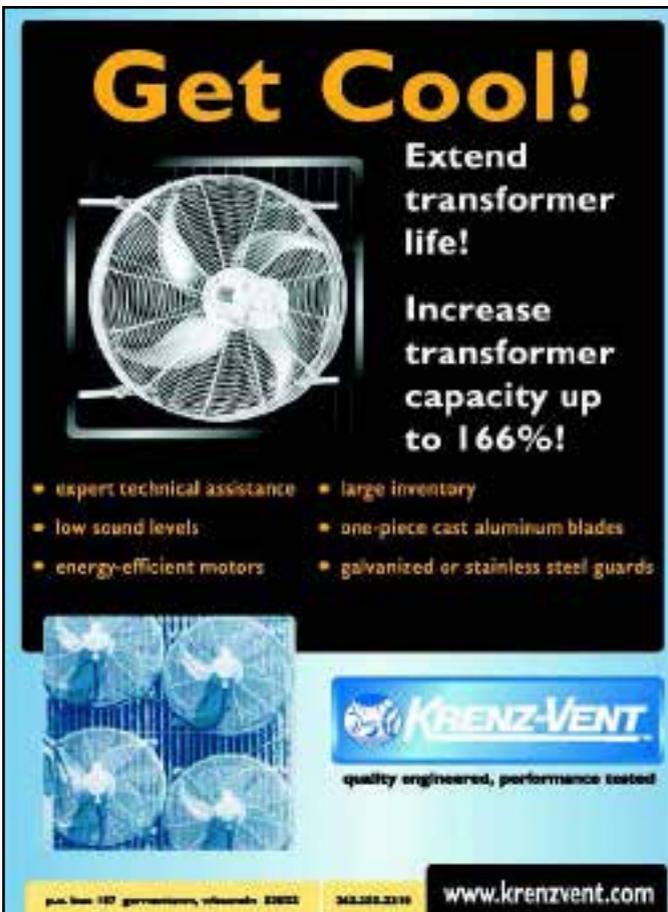
The formula for calculating the field visible through an Infrared Window is: $FoV = 2 \times \tan(\text{angle}/2) \times D$, where FoV is the width of the object area that will be viewed, the “angle” is the angular field-of-view of the camera, and “D” is the distance from the camera (ostensibly the window) to the objects being viewed. Once a decision has been made about what objects are to be inspected through the infrared window, the number of windows and appropriate size must be determined as well as where they need to be installed to ensure best coverage (and therefore maximum efficiency). The size of the infrared window will depend on several factors, including the infrared camera’s clear aperture, its ability to focus on close objects, its ability to be placed as

close as possible to the window, the camera’s angular field-of-view and the amount of manipulation is possible with the camera when viewing through the window. An important consideration is how the infrared camera can be manipulated when looking through an infrared window. A high degree of manipulation can have the effect of increasing the size of the inspection area by up to a factor of 3. This means that if the object under observation is 12 inches across, depending on several factors, it is possible that a window diameter of 4 inches (for IR window size calculation purposes) can still be used if the operator manipulates the camera from left to right or up and down.

The required size of the window will depend on the following:

-  the size of the objects to be viewed and their distance from the panel cover;
-  the infrared camera’s angular field-of-view and clear aperture;
-  the camera’s ability to focus on close objects and to be placed close to the window.

Typically, infrared cameras have a horizontal field of view of 25°. Those infrared cameras that offer a wide-angle lens option (for example 50°) permit the user to have a substantially wider field of view, resulting in an increase in viewing area through the same infrared window size. This can be a



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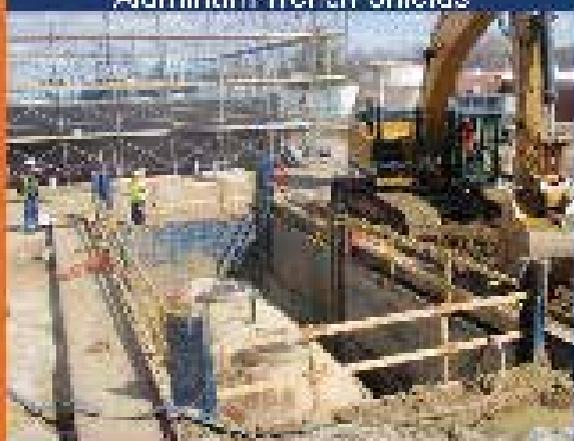
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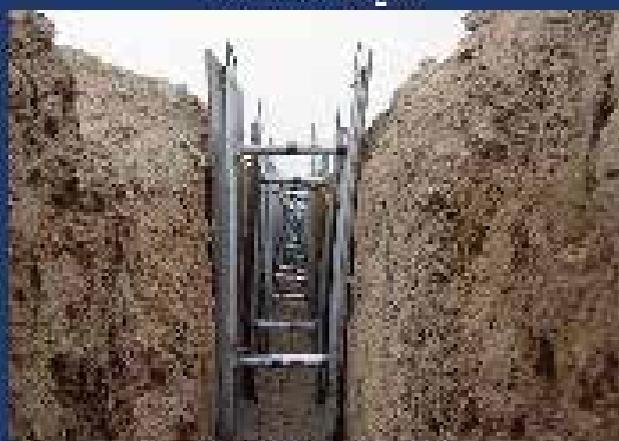
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great advantage in certain situations, reducing the size and possibly the number of windows. Other useful infrared camera features are close focus capability, small lens diameter resulting in a small clear aperture, motorized focus (eliminating the need to get fingers on the lens focus ring and moving the camera away from the window) and a chassis design that facilitates movement at the window such as an articulating camera head that allows the user to look into windows above eye level or at near floor level.

The View through an Infrared Window

An infrared window allows a camera operator to inspect the inside of an electrical cabinet to check the physical condition of the components that you have chosen to inspect. As with traditional thermographic inspections we can see temperature differences very clearly. You need to have the confidence in the infrared windows that you are using. They are designed to allow infrared energy to transmit through them at a known transmission rate; therefore, if there is even a slight temperature difference you will be able to see that with your IR camera, and be able to record images for the IR inspection program.

Considerations for Installing Infrared Windows

Installing an infrared window requires cutting holes into very expensive switchgear. Therefore, it is very important to be very sure that they are installed in the correct location and that the switchgear ratings are not degraded in any way. Before installation, the following factors need to be considered:

-  NEMA or IP rating of the switchgear and IR windows: Remember to never install an IR window of a lower rating than the rating of the switchgear.
-  Test Certifications: Ensure that the IR windows have been tested and approved by the certification bodies as the switchgear for which they are intended (i.e. UL, IEEE, Lloyds).
-  Internal obstacles: Before removing internal Perspex/Plexiglas covers or cables, ensure that the local safety managers approval is sought first. In some cases you may not be able to totally remove the covers and may only be able to modify them by drilling or punching holes to retain the IP2X requirement for some switchgear.
-  Explosion Ratings (if applicable): Some panels are positioned in intrinsically safe areas and as such can never be modified in the field.
-  Dielectric Clearances: Where IR windows use grills or inspection orifices, they must comply with IP2X (13mm 0.5»), and clients must be made aware of the safe dielectric clearances for the type of switchgear that they intend to install the window into. The table shown at the left (from IEEE C37.20.2 table A.3) specifies minimum distances from live components, and it is recommended that these be considered as a standard for grills/inspection orifices.

When using Infrared Windows, it is important to correct for the transmission specification of the window and the emissivity of the component that is to be inspected through the IR window. One way of correcting for the effects of the window is by adjusting the camera's emissivity value for an object of known temperature until the camera's reading is correct. For objects at the same ambient temperature and emissivity, the new emissivity value can be used.

When using Infrared Windows, it is important to correct for the transmission loss of the window and the emissivity of the component that is to be inspected through the IR window.

Another way of using IR windows is to prepare all components that are to be inspected so that they have the same emissivity (for example, with electrical tape, emissivity paint, IR-ID Labels). In this case, all components being inspected will have the same transmission rate and emissivity readings; consequently, the results gathered will be far easier to compare.

Can IR Windows Carry a Generic Arc Rating?

Electrical switchgear takes on many different shapes and sizes. The surface areas and volumetric elements of the cabinets are different with each model, type and rating. Each cabinet is subjected to the testing that is laid down by the certification bodies such as UL, IEEE, etc. This test is completed on the cabinet assemblies and not the components that make up the assembly. Electrical cabinet designs and dimensions are infinite, and we therefore CANNOT or MUST NOT use the data from one cabinet design for another design unless they are identical in every way. This is why components never carry a generic arc rating and must be subjected to industry standard tests to confirm that they conform to the minimum required level of mechanical strength and environmental properties for the electrical cabinets and assemblies which they are going to be fitted into.

Conclusion

Because of the frequent occurrence of arc flash in industry, it is extremely important to be aware of the risks associated with inspection of high voltage switchgear and related items. Concerns about operator safety due to an arc-flash event are causing inspectors to adopt new practices in accordance with NFPA 70E, the standard for safe electrical work practices. Shock and Flash Hazard analyses are required in many situations. Personal Protective Equipment recommendations are also available. One new common safety practice involves the use of infrared transparent windows which eliminate many of the risks associated with live infrared inspections since they enable an infrared camera to have a direct view of live electrical components without the need to open electrical enclosures.

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Benefits of Using Subsurface Utility Engineering SUE With Pipeline Construction

By Daniel Locke

Subsurface utility engineering (SUE) is a highly advanced method used to locate positions of installed pipelines. SUE methods provide precise information that help pipeline contractors minimize project delays and lessen workplace accidents.

In the 1990s, subsurface utility engineering SUE was mainly used by the U.S. Federal Highway Administration for designing highways. Today, it has become an invaluable tool for the U.S. military, FAA, Department of Transportation, and pipeline construction companies.

Common types of tools used include ground penetrating radar (GPR), locatable rodders and sondes, and pipe and cable locator systems. Since SUE methods are non-invasive these methods are quickly moving to the forefront as the chosen technology for projects related to environmental restoration.

Subsurface utility engineering contractors need to work in harmony with utility companies. SUE contractors use subsurface geophysical equipment to determine if the depth and position of existing subsurface utilities. The collected data, along with planning sheets are shared between contractors and utility companies.

One method contractors use to analyze potential conflict of design plans and utility positioning is air/vacuum excavation. This method helps determine if utility relocation is required or if blueprints require modification. If utility relocation is deemed

necessary, SUE contractors draft relocation blueprints for approval from project owners and city planners.

Subsurface utility engineering encompasses many facets including: utility design and coordination; 3D underground imaging; GPS surveys; geographic information systems (GIS); and ground penetrating radar.

Combined methods supply a 3D map of existing utility pipelines from which blueprints can be developed. SUE contractors begin the process by collecting utility records and making a composite drawing from gathered information.

Another aspect of the design phase involves visiting the construction site to perform a topographic survey and locate surface features like catch basins and sewer manholes. When previously installed utilities affect the proposed design, SUE companies have to conduct further investigations using geophysical methods like ground penetrating radar and underground imaging.

Subsurface utility engineering is vital for identifying existing underground pipes and to classify utilities. SUE contractors can lessen risks of delays and workplace injuries by determining the position, depth, condition, and size of existing pipes.

SUE necessitates cooperation amongst project owners, utility companies, pipeline contractors, and engineers. Engaging in open exchange of information speeds up progress and provides a safer workplace.



Subsurface utility engineering SUE is advantageous to public utility companies, municipalities, and private enterprises. In addition to improving construction safety, these methods have proven to reduce project costs and are responsible for saving taxpayers millions of dollars in highway construction and road repairs.

Kana Pipeline utilizes subsurface utility engineering SUE when engaged in pipeline construction jobs. These methods are effective at reducing costs and improving safety conditions when installing water and sewer pipelines, fireline, and storm water drainage systems. Learn additional benefits of using SUE by visiting us at www.KanaPipeline.com.

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Recycled Concrete Aggregate and the Need for Sustainability

By Soroush Nazari

The interest of including sustainable development in construction is on the rise due to the changing systems of the world based on its economy, its environment and society. The most immediate and obvious way to achieve more sustainable construction today is by conserving new raw materials such as natural aggregates, and reusing construction and industrial wastes.

Recycled concrete aggregate, better known as RCA, is an example of a common construction waste that is produced after demolishing concrete structures. Supplementary cementing materials (SCM) such as fly ash and slag are industrial by-products, which have a long history of use with Portland cement (PC) in concrete. Although Portland cement is the primary source used for construc-

tion, it has been found that it is no longer feasible and the continuation of its usage will no longer supply benefits in cost management and will further deteriorate the environment, consequentially impacting global society.

The study of recycled concrete aggregate is interesting because it is a new mechanism used that could potentially impact society as a whole, economically, environmentally and socially. The aim of this article is to examine and provide an analysis of the technology used when recycling concrete aggregate, instead of using virgin aggregate, as is the current procedure in Canada.

Due to the high urbanization of many cities in Canada, concrete is one of the most popular construction materials used in the country. Environment Canada has identified that two thirds of the concrete's production is used

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in basement's foundations for commercial and residential constructions. The basic components that produce concrete are aggregates, cement, water and some chemical admixtures. Concrete consists of 75% of the weight of all construction materials. Interestingly, construction and demolition waste in Canada amounts to 15-20% of all landfill materials. Due to the increase in waste in general, there needs to be a mechanism in places where waste can be reduced and one place is within the process of recycled concrete aggregate. By finding new applications for concrete waste, and creating a market for its use, we can bypass the need to consume virgin natural aggregate and simultaneously conserve landfill space.

So far, RCA has been used based on a granular base, mixed with natural aggregate in concrete applications used for roads. Research has shown that the use of 30% RCA and 70% natural aggregate in high strength concrete produces concrete of similar strength as that containing only natural aggregate. Although the strength of RCA is similar, the concern is the shrinkage that occurs during the drying of RCA in concrete. New concrete made with RCA experiences creep and drying shrinkage that is 10-30% greater than that of concrete made from natural aggregate. It has been found that the porosity level in RCA increases the levels of shrinkage when it is in the drying process. Furthermore, RCA is also known to have lower elastic modulus than natural aggregate, which also contributes to drying shrinkage and creep. Although these negative impacts occur, this does not mean that RCA cannot be used entirely.

Previous to the notion of use recycled concrete aggregate, blended Portland cement (type I (SM) ASTM or CEM II-M), river siliceous sand, and granitic crushed stone (nominal size 6-20 mm) were used to make the concretes. Now, as a result of virgin concrete shortage, there is a use of not only RCA but recycled fine aggregate (RFA). For recycled concretes, recycled fine aggregate (RFA) is taken from crushed waste concretes of varying qualities, and made with granitic stone, and is used by replacing its contents (0%, 20%, and 30% by volume) of natural sand. In all concretes, an admixture acting as a water-reducer is used. The physical properties consist of either coarse and fine aggregates, they are determined by their fineness, gravity (saturated and surface dry - SG_{ssd}), water absorption, and material finer than 75 μm.

Many countries have begun discovering the use of RCA but RFA has been found to be just as workable and each RCA and RFA have their benefits in varying industries. Several countries have recommendations for the use of recycled coarse aggregates in structural concretes, but the recycled fine aggregates (RFA) are discarded because they may produce modifications on the fresh and hardened concrete properties. It is not only the use of RCA that can reduce waste and help benefit the environment and the economy, but RFA is a precious material and has become more important in concrete production because of economic implications related to the shortage of natural sands suitable for that, and the need for a comprehensive utilization of such wastes, since the fine fraction remains when the recycled coarse aggregates are used,

which storage and control is complex.

Dr. Khatib, an environmentalist, illustrates that concrete made of 25% and 100% of RFA reduce compressive strength by 15% and 30%. However, another research at hand demonstrate that the compressive strength is not affected by the utilization of RFA, but the most significant changes within concrete with RFA is the higher drying shrinkage and less durability. Previous studies have been made on the use of RFA in concrete which show that the use of RFA over 50% produce significant decreases on the slump of the mixes at the fresh state, similar to those produced in concretes made with natural crushed sand.

With every new process that arises, there are impacts to the economy, the environment and society. It is first interesting to understand the economic impact of RCA. The cost of aggregates typically is between 20 and 30% of the cost of materials and supplies, or 10 to 15% of the total construction cost of a roadway section. Due to the high quality of virgin aggregate and its known shortage, the price is increasing. Since there is a shortage in virgin aggregate and the price is increasing, access to this very important construction material is decreasing and an economical option is crucial.

The good news is that concrete pavements are 100% recyclable. Concrete recycling has been used predominantly in Europe since the 1940s and in the U.S. since the 1970s. Concrete recycling for paving applications is now performed in at least 41 states and has the support of the Federal Highway Administration. The FHWA has found that reusing the material used to build the original highway system makes sound economic, environmental, and engineering sense. The cost of aggregate is one of the major costs of highway construction. As the sources of virgin aggregate becomes scarce, haul distances increase, which then cause additional supply costs. As the source becomes scarcer, the more the costs of using virgin aggregate will increase.

The cost of producing RCA can be considered to be limited to the costs of crushing the demolished concrete and screening and backhauling the RCA. The cost of removal and demolition of concrete will stay the same, regardless of whether it is natural aggregate or recycled concrete (RC). However, the usage of RCA can produce savings in the hauling and disposal costs, especially if the RCA is produced on site. Moreover, the waste issue comes back when the economical benefits of RCA are discussed. Disposing of demolished concrete slabs in landfills is becoming expensive because the space available in landfills are also becoming limited. The recycling of concrete pavement annihilates the need to dispose the concrete, which results in cost savings and allows more room for our landfills to be filled with waste that cannot be recyclable.

Other than impacts stemming from cement production, transport has a large influence on the environmental load which is then dependent on transportation distances and the transportation vehicle used. Regardless of the transport scenario, the impacts of cement and aggregate production life-cycle phases for RAC are slightly larger than

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for NAC. In consequence, the results present the fact that the impacts of cement and aggregate production phases are slightly larger for RAC than for NAC. There are varying studies that show that sometimes NAC has higher impacts on the environment and other studies show that it is RAC that could be costing more impact economically, environmentally and ending up affecting the social aspect as well.

Total environmental impacts in terms of energy use, global warming, eutrophication, acidification and photochemical oxidant creation depend on transport distances and types. By observing a study done by Dr. Marinkovic on the matter, I understand that transport scenario 1 (transport distances of recycled aggregate are smaller than those of natural river aggregate) the environmental impact of RAC and NAC production in terms of studied impact categories is approximately the same and the benefit from recycling in terms of waste and natural mineral resources depletion minimizing is clearly gained. Whereas scenario 2 indicates (transport distances of natural and recycled aggregates are equal), the total impacts of RAC are larger, increase ranging from 11.3% to 36.6% depending on the impact category.

This then trickles down to having the process of RCA also reduce the emission of greenhouse gasses (GHGs). Every activity that requires fuel and/or electrical power when producing virgin aggregate is inevitably responsible for the creation of GHGs and other pollutants. Concrete recycling helps to reduce the environmental impact of pavement reconstruction activities while helping to ensure the maintenance of our transportation infrastructure. Another environmental benefit that RCA produces is that it lowers the carbon dioxide (CO₂) levels in the air. Research at the University of New Hampshire has shown that RCA has significant value as a sink for carbon dioxide (CO₂), a primary greenhouse gas, through the mechanism of spontaneous carbonation, in which atmospheric CO₂ reacts with calcium hydroxide (Ca(OH)₂), a by-product of the cement hydration, in the concrete mortar to produce calcium carbonate.

In order to continue the wave of recycling, many participants of the Global North have been increasingly adding to their lifestyle. The recycling of concrete aggregate also needs to begin and be woven as a process in Canada and needs to be regulated under its government. One interesting factor about recycled aggregate is its use for an abundant resource at the moment, which is water. However, this precious resource is endangered for beginning to be scarce. Although there is a lot of water on earth, less than 3% is fresh and most of that is either locked up in fast-melting glaciers and ice caps, or is too deep in the earth to retrieve. The status of water being an endangered natural resource is in part due to the rise of global warming and the growth of agricultural, urban, and industrial needs, where water is increasingly used to keep up with the demand of various industries. Therefore, our resources need to be used more efficiently so if we do not cut back on the water usage and concrete in construction, then this industry could be adding to the



woes humans will have to face when there is a shortage of water. Concrete companies and construction sites, being the largest industrial consumers of fresh water, it is crucial that the concrete industry use water more efficiently. Approximately 100 L/m³ (20 gal./yd³) wash-water used by the ready mixed concrete trucks, we're using too much water for concrete mixing and the yearly global mixing water requirement of 1 trillion L can be cut in half by better aggregate grading and by greatly expanding the use of mineral admixtures and superplasticizers. Drinking water has been identified as being acceptable for making concrete so there is no harm in not using fresh water all of the time for recycled aggregate.

Tapping into a system that introduces a product that is a hundred percent recyclable like recycled concrete aggregate is a large movement forward in saving the environment because as shown, using virgin aggregate is not feasible due to its shortage but the methods used with this product is not helping the environment either. RCA can open up new spaces in landfills, it can conserve our water and disables toxins to disperse in our atmosphere. It is crucial that Canada jump on the bandwagon of recycling concrete aggregate as part of their goal for a "greener" society.

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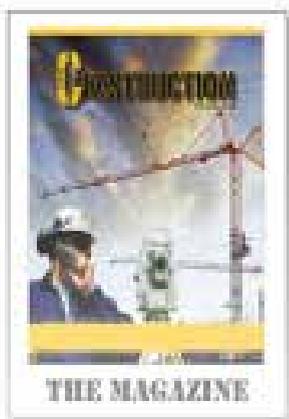
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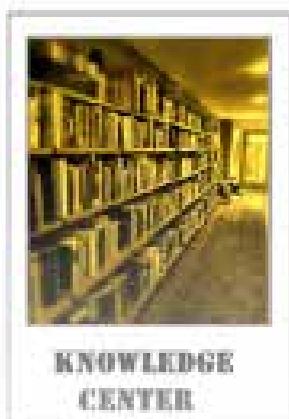
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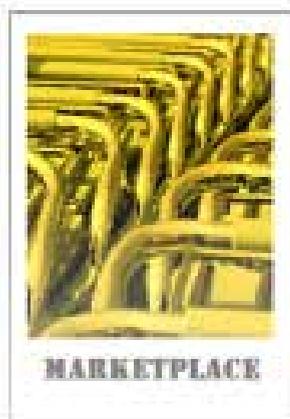
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DEWALT® Introduces New Folding Pocket Knife

DEWALT® introduces its new heavy-duty Folding Pocket Knife – model DWHT10272 – featuring a stainless steel blade for durability and rust resistance, and other convenient jobsite features.

The DEWALT® Folding Pocket Knife is designed to be a versatile everyday carry knife with cross compatibility at a competitive price of only \$14.99. The knife is light-weight, thin, and comfortable to use. It is ideal for quick cutting on the jobsite such as removing strapping around lumber and other building materials.

The pocket knife offers a combination blade with both a serrated and straight edge for versatile cutting. A thumb stud makes the knife easy to open. A tanto tip design allows for piercing through tough materials. A liner lock secures the knife blade in the open position while in use.

The DEWALT® Folding Pocket Knife will be available in July 2014 at mass retailers, home centers, and in the independent channel.

DEWALT® Introduces New Folding Auto-Load Knife

DEWALT® introduces its new Folding Auto-Load Knife – model DWHT10261 – which automatically loads a new blade to save time on the jobsite and provides a better cutting experience.

The Folding Auto-Load Knife is a premium cutting utility knife for professional drywallers and general contractors. When a utility blade dulls, simply remove the used blade by depressing the blade release button and retracting the slider to load the new blade. With features such as the convenient automatic blade loading as well as on-board blade storage, you can spend more time making cuts and less time changing blades.

Changing blades with traditional utility knives requires removing work gloves, unscrewing the knife, and manually removing the dull blade and inserting

a new blade. Other auto-load utility knives are bulky, having an oversized auto-load mechanism inside the handle. The DEWALT Auto-Load Knife and auto-load mechanism is compact, providing a slender handle design that is easy to grip. The Auto-Load Knife stores up to 3 blades and accepts standard utility blades. No special blade packs required. The Auto-Load Knife also features a soft grip so the knife is comfortable in your hand.

The DEWALT Folding Auto-Load Knife is available now at mass retailers, home centers and in the independent channel and it will retail for approximately \$14.99.

DEWALT® Introduces Three New Specialty Saws

DEWALT® introduces three new specialty woodworking hand saws for quick grab and go cutting in difficult to reach areas, including a Double Edge Pull Saw, Flush Cut Backsaw, and Single Edge Pull Saw.

The new specialty woodworking saws, with their flexible blades, slide into places power saws will not reach such as when cutting dowels, drywall, shims, trim, molding, and more.

The DEWALT® specialty woodworking saws offer 14 teeth per inch (TPI) for fine-finish smooth cuts and/or 7 teeth per inch (TPI) for quicker, coarse cuts. The saw blades are also heat-induction treated for long blade life. All three saws feature an ergonomic, over-molded handle for a comfortable grip.

The Flush Cut Reversing Backsaw – model DWHT20000 – features a reversing blade with push button for left or right handed cutting. With 14 TPI, the Reversing Backsaw offers smooth cutting. The offset handle assists with flush cuts and helps protect knuckles.

The Single Edge Pull Saw – model DWHT20215 – features a flexible blade for easy, flush cuts. With 14 TPI, the Single Edge Pull Saw provides precise cuts.

The Double Edge Pull Saw – model DWHT20216 – features a flexible blade

for easy flush cuts. The Double Edge provides two cutting options: 14 TPI on one side of the saw for fine-finish smooth cuts and 7 TPI for quick, coarse cuts.

Double Edge Pull Saw retails for \$22.99. The Flush Cut Backsaw retails for \$10.99. The Single Edge Pull Saw retails for \$13.99. Each saw is available now at home centers, mass retailers, and in the independent channel.

STANLEY® Anti-Vibe® Hammers Constructed with a Two-Piece Steel Core Designed to Reduce Vibrations*

Stanley® introduces two new FAT-MAX® Anti-Vibe® 2-Piece Hammers representing the newest generation of Anti-Vibe® technology.

Vice President of Innovation Christopher Woolley said, "This new iteration of Anti-Vibe® technology has built upon a decade of engineering. These new Hammers and Sledge Hammers are our best yet.

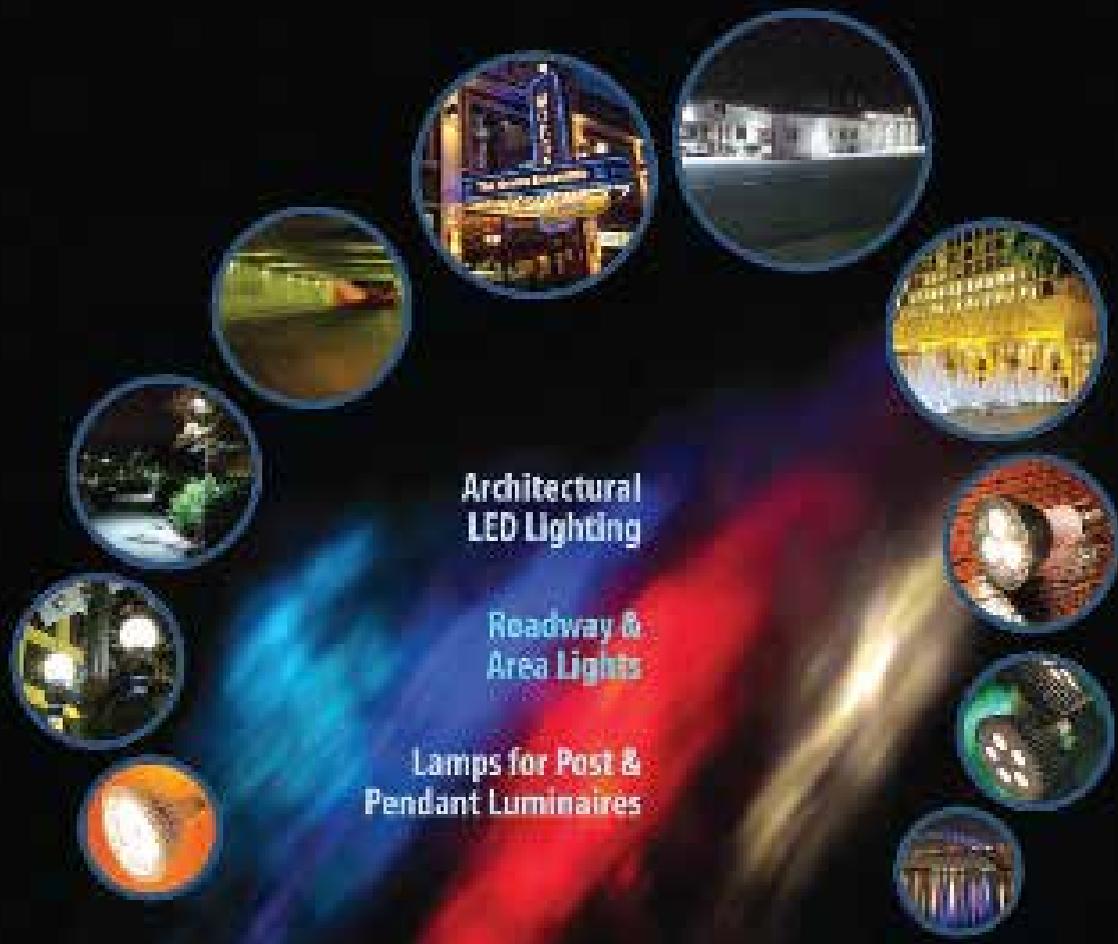
Each hammer is constructed of a two-piece steel core to isolate vibration* to the hammer head and reduce vibrations* transferred to the user.

Additionally, the two-piece design isolates more shock waves to the hammer's head than a one-piece design. The steel core is wrapped in multiple layers of dampening materials, and a shock absorbing collar between the head and the handle further isolates vibrations to the head.

The hammers feature black exposed steel under the head, which provides over-strike protection, to help prevent damage to the hammer body if the handle accidentally strikes a surface.

The 17-ounce Frammer Hammer – model FMHT51244 – features a checkered face design to reduce slipping off of nails when striking compared to a smooth face hammer. It also features a magnetic nail starter for one handed nail placement. The 14-ounce Nailer Hammer – model FMHT51249 – features a smooth face.

Both hammers are available at mass



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retailers, home centers, and in the independent channel. The 17oz Framing Hammer retails for approximately \$39.99 and the 14oz Nailing Hammer retails for approximately \$34.99.

STANLEY® Adds 16' and 30' Tape Rules to FatMax® Auto-Locking Tape Lineup with Customizable Hook System

Stanley® announced today the addition of a new 16' FatMax® auto-locking tape rule – model FMHT33316 – and 30 foot FatMax® auto-locking tape rule – model FMHT33348 – to its lineup of FatMax® auto-locking tape rules.

Stanley® introduced the new 25 foot FatMax® auto-locking tape rule – model FMHT33338 – in 2013.

At the very heart of every professional's tool collection is a tape rule. Vice President of Innovation Christopher Woolley explained why this tape is unique, "Our engineers are constantly looking for new ways to deliver innovation that matters to our users, and

this tape is no exception. We know pros are often on the jobsite measuring with one hand and marking with the other. The auto-locking design combined with professional features such as eleven feet of stand-out*, help to deliver a solution for the jobsite where we know time is limited and maximizing performance is a must."

The new FatMax® tape has a blade that automatically locks at the length to which it is extended. When the release button is depressed, the blade retracts. The auto-locking feature allows users to control tape retraction which helps to provide long blade life. The tape also features a manual mode, a setting used to override the auto-locking mechanism, enabling it to become a traditional retractable tape, by depressing the button and pulling back away from the hook. Featuring a customizable hook system, users can configure their tape for the right application. Woolley added, "Pros will love our new detachable hook system. They can connect the over-sized hook attachment for framing applications or remove it for standard applications.

All of these features allow the FatMax® tape to be the most versatile tape we've made to date."

Historically, auto-locking tapes have been popular among DIY users, but this tape offers the features and benefits that professionals have come to expect from the FatMax® brand. The 1-1/4 inch blade touts eleven feet of stand-out*. The blade is coated in Mylar®** and features BladeArmor® coating for durability and long life. The True-Zero™ end hook provides accurate measurements.

The lineup of FatMax® auto-locking tape rules will be available in June 2014 in home centers, mass retailers, and hardware stores. The 16 foot FatMax® auto-locking tape rule – model FMHT33316 – will retail for approximately \$19.99. The 25 foot FatMax® auto-locking tape rule – model FMHT33338 – will retail for approximately \$24.99. The 30 foot FatMax® auto-locking tape rule – model FMHT33348 – will retail for approximately \$29.99.

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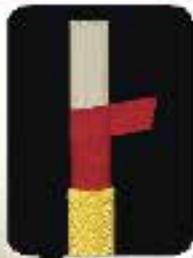
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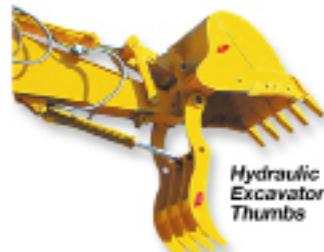
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Regular oil changes are an important part of equipment maintenance— but draining the oil can be very messy, and if you're not careful, you might cross thread the drain hole when reinstalling the plug. Take the pain out of the drain by using the EZ Oil Drain Valve!

The EZ Oil Drain Valve simply replaces your stock oil drain plug for fast, clean and easy oil changes. No need for tools — just lift and turn the lever of this nickel-plated brass ball valve to drain oil, and then return the lever to its original locked position when finished.

An optional hose end makes it easy to connect a hose to drain the oil into a remote receptacle, if desired. The EZ Oil Drain Valve is available in 30 different sizes for all engines.

For more information, visit www.EZoilrain.com or email us at EZoilrain@msn.com

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Towmaster's Hydraulic Tail trailer has quality features built to stringent Towmaster specs. It features a T1 steel large outer frame design with the axles attached to a sub-frame and junior I-Beam inner members to tie it all together. This trailer includes hydraulic operated two-piece tail with a low load angle for hauling low-ground clearance type equipment. An optional hydraulic deck ramp allows equipment to be loaded onto the 8-foot top deck. A hydraulic winch can be installed to pull equipment onto the deck.

The hydraulic operated fore-under tail design features a diamond plate metal approach with wood ramps to aid in traction. Stake pockets and tie-downing parking stands are standard equipment.

Two-way side controls make it easy to operate the functions. All lights on the trailer are long-lasting LEDs and the trailer is finished with two-component corrosion-resistant polyurethane primer and top coat.

More information can be found at www.towmaster.com or call Towmaster at 800-462-4517.

AMERICA'S BEST TRAILERS

Towmaster is the trusted brand for auto, construction, and equipment hauling. Backed by a Limited Lifetime Frame Warranty, 20 years of experience, and 100 years of Towmaster, it's a sound investment. Visit www.towmaster.com or call 800-462-4517 for more information.

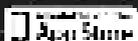
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