

# “GREEN” DEMOLITION CERTIFICATION

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## ABSTRACT

This paper/presentation will describe a “green” demolition certification proposed as a means to validate environmentally and socially responsible building removals. Typical demolition practice includes varying levels of salvage and recycling. Deconstruction is a term that has emerged to describe a form of selective demolition. This certification is an attempt to overcome the semantics of the terms “demolition” versus “deconstruction” through a reasonable and practical method. The certification uses three categories: *Building* Credits, *Planning* Credits, and *Environmental Health and Safety* Credits. The certification has application for defining and documenting sound demolition waste management when a deconstruction plan or waste management plan is proposed as a means to approve demolition permits. The certification is also proposed to provide a basis for marketing and creating rewards for deconstruction and to act as an educational tool and guide for the implementation of specific organizational, municipal and Statewide building-related sustainable development goals. This paper will describe the certification method as proposed for further stakeholder development.

**KEYWORDS:** Deconstruction; Standards; Deconstruction Permitting; C&D Waste Management

## INTRODUCTION

Demolition has the connotation of destruction. Webster’s Dictionary defines demolish as “to tear down” “to break to pieces” and “smash.” These terms clearly do not suggest a considered or selective approach including reuse and recycling. Greater levels of selective dismantling occur when there are economic benefits to any degree of source separation that will make the building debris more compatible for reuse or recycling, and to remove hazardous materials. For the purposes of this paper, “green” demolition is a form of building removal that maximizes environmental, social and economic benefits within the local municipality.

### Goals of Green Demolition Certification

This Green Demolition Certification has been developed to provide guidance for a broad audience interested in environmentally and socially responsible management of demolition wastes. Its aim is to provide guidance, and a valid means to qualify a “green” building demolition, as compared to “standard” building demolition. Green Demolition exceeds the goal of removing a building from a site for disposal. It includes the diversion of the maximum amount of materials from the landfill and maximizing social and economic benefits to the community.

The Green Demolition Certification is intended to provide a means to support alternative building removal regulatory incentives, market deconstruction services, and validate

environmentally and socially beneficial project outcomes. This certification is intended to help bridge the gap between large-scale mechanical-based demolition and predominantly hand demolition, so-called “deconstruction,” when the results can be equally beneficial to the community. It is also intended to help reward the best effort within the constraints of local reuse and recycling infrastructure and to normalize the achievement of a responsible building removal for different building types. Until such time as buildings are designed for deconstruction, and many of the inherent difficulties of source separation of the building materials from existing buildings are alleviated, a green demolition certification will require a certain amount of flexibility to reward both “best practice” and quantifiable waste diversion. The proposed certification can be used to develop environmentally responsible demolition practices, demonstrate commitment to such practices, and provide guidance to governmental entities seeking to enact policies for more environmentally sound C&D waste management. Lastly, the certification will act as a tool for raising public awareness and understanding of the societal impacts of building demolition, and the opportunities to alleviate those impacts.

The certification process uses a set of standards to compare different demolition processes and outcomes in order to rate them for environmental and social responsibility. It allows for differences in building types and the context of a particular project at the site and community levels. It uses three major categories of 1) ***The Building***, 2) ***Planning***, and 3) ***Environmental Health and Safety***, and specific criteria within each category. It gives policy-makers a means to validate a “green” demolition when developing demolition debris management regulations and incentives, and to communicate the outcomes of these regulations and incentives. The goals of a green demolition include:

#### *Goals of Green Demolition*

- Divert demolition debris from landfills
- Recover materials for reuse and recycling
- Contribute to the environmental and economic health of the community
- Provide a safe and healthful work environment
- Regard necessary building removals as a community development opportunity

#### **Rationale for Certification**

There is considerable confusion over what constitutes an environmentally and socially responsible building removal - other than relocating an entire structure intact. The highest and best reuse of an obsolete structure is through adaptive reuse in place or through relocation. The Green Demolition Certification is not intended to supersede these options. It is intended to address the process of building removal after these other options are deemed infeasible. Typical measurements of good environmental practice for building demolition include the amount of building materials that are recovered for reuse and recycling, either by weight or volume. These measurements may not provide an adequate reflection of an overall effort that will maximize all the possible mitigations of a building removal. Concrete and wood have very different densities and economic value, and therefore a measurement of tons of materials diverted may not reflect desired goals of preserving landfill space by volume, or maximizing economic development benefits. A valid effort to implement a responsible building removal may also be limited by factors beyond the demolition contractor’s control. This standard is an attempt to create a

flexible means to guide, validate and reward those entities that seek to implement responsible building removals in a variety of building projects, and to allow local governments or building owners to gauge the performance of firms for the purposes of rewards, incentives, alternative regulatory approvals, and selection for future projects. Some of the audiences for a green demolition certification include:

#### *Green Demolition Certification Audiences*

- Building Owners
- Policymakers
- Contractors
- Architects
- Planners
- Researchers

## **BACKGROUND**

There are many forms of building environmental or sustainable performance labels. The US Green Building Council Leadership in Energy and Environmental Design (LEED) Green Building Rating System is one well-known commercial green building certification in the US. It is a comprehensive system based upon five categories. These categories include: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Air Quality and Innovation and Design Process ([www.usgbc.org](http://www.usgbc.org)). There are also many residential green building standards such as the Florida Green Building Coalition (FGBC) Green Home Standard ([www.floridagreenbuilding.org](http://www.floridagreenbuilding.org)). This standard uses the categories of Energy, Water, Site, Health, Materials, Disaster Mitigation, and a General category. The General category includes elements such as small house size, building on an urban parcel, and membership in the FGBC by the architect or builder.

Generally speaking, green building certifications require the building project to meet a minimum number of credits within an individual category, and then achieve a minimum number of total credits. Green building certifications often use either prescriptive or performance criteria to award credits. Prescriptive criteria detail exactly what must be built and how it is built, and performance criteria provide flexibility of means to achieve the ultimate goals of, for example, energy conservation performance over a “baseline” building configuration. In order to be as comprehensive as possible some criteria may be measurable outcomes, while others may depend upon processes. An example of a “process credit” is that one credit is awarded for using a LEED™ Champion, someone who has completed a training program for the LEED™ rating system. The LEED™ Green Building Rating System is also an example of the use of existing regulations and codes for sub-sets of the overall certification. As an example, the LEED™ Green Building Standard uses best-practice Federal and State-level building codes in the areas of energy-efficiency and indoor air quality.

One common approach for certification methods is the requirement for a certain number of prerequisites. A variation on this approach is adding a deficit of the minimum credits in one

category to the total number of credits required for certification (FGBC). Even though a minimum of credits in one category is not achieved, the project must then add more elements or strategies overall to achieve the rating. Green building certifications are useful as a market differentiation tool for the user, and can conversely be used as guides to achieve a more environmentally responsible building project even if the formal certification is not obtained. In this case, self-certification is an important aspect of the green building certification.

Self-certification by the building designer, builders and other consultants themselves increases the learning experience for the building team. In this manner, they learn by doing, and will be able to inculcate the practice of green design and building into their firms. Self-certification also has the potential to reduce costs, with the same person that is responsible for implementing the green strategy is also documenting their own activities. Another approach to manage the process is a certifying agent, similar to a building commissioning agent, who functions as a manager of the certification process.

A final characteristic of green building certifications is levels of achievement for the certification. One option is a pass or fail certification, and the other is a series of levels, such as one star, two stars, three stars, etc. The one problem with a pass-fail is that it would be similar to many environmental laws whereby the goal is compliance, not necessarily increasing improvement in effectiveness or efficiency over time. In all cases, certification credits must be open to revision over time.

## **PROPOSED GREEN DEMOLITION CERTIFICATION**

The Green Demolition Certification is earned through a credit system. Credits are awarded based upon compliance with a set of criteria. The initial proposal described here is based upon a pass-fail system in order. The criteria are categorized by 1) ***The Building***, 2) ***Planning***, and 3) ***Environmental Health and Safety***. There are also prerequisites within the Waste Reduction and Environmental Health and Safety categories for which no credits are awarded. Certification is awarded to any project meeting all prerequisites and earning twenty-five (25) or more credits from a total of fifty (50) maximum credits available. There are a variety of credit types, some are based on quantifiable measurements and others are based upon qualitative measurements, and may require further clarification as the process of developing the certification continues based upon stakeholder feedback.

### **Process**

The Green Demolition credit system is designed to make certification possible for any building type. Older buildings with high salvage value materials in poor condition can compete with newer buildings of low salvage value but in better condition. Demolitions that focus primarily on total waste disposal reduction can qualify as well as demolitions that focus on removing selected materials. Overall, “green” projects salvage a high proportion of building materials and excel in other aspects of community-building, environmental education, job-training, and local economic development.

The certification uses a series of forms listing the criteria and the points available in each category. There are prerequisites in the Waste Reduction category and in the Environmental Health and Safety category. The user of the certification can look at the credits they will achieve with minimal effort and then at the credits that they will achieve with some effort. If the preliminary analysis of the project does not appear to qualify it for the Green Demolition Certification then the score sheets can be used to look for other areas to achieve the necessary credits. The final certification is based upon documentation of the actual fulfillment of the credits as proposed. A background document provides detail on the credit, why it is included in the certification, how it can be achieved, and the documentation required for receiving the credit. The procedure for using the certification is as follows:

1. Complete score sheets for preliminary analysis of “easy” credits.
2. Look for additional credits if needed.
3. Use checklist to count proposed credits.
4. Implement proposed strategies, insuring proper documentation.
5. Document achievement of credits using certification form and appropriate documentation.

### **Certification Categories**

There are three main credit categories in the certification method. The ***Building*** category includes issues related to the physical removal of the building, the building site and surrounding context, and the amount of reuse and recycling that takes place from the building removal. This category contains 50% of the total number of credits available, i.e. twenty-five (25) of the total fifty (50) possible credits. The Waste Reduction and Materials Recovery portions of the certification contain a possible twenty (20) credits, representing 40% of total possible credits.

The ***Planning*** category includes issues related to the broad context of the community, including enhancing the building materials recovery industry within the community, realizing the benefits of deconstruction for job-training opportunities, encouraging “smart” demolition that avoids the removal of historic building fabric, etc. The ***Environmental Health and Safety*** (EH&S) category addresses primary environmental and human health concerns related to hazardous materials and job-site safety. The EH&S category has the most number of prerequisites which also follow regulatory requirements. The intent of re-stating and making prerequisites for regulatory requirements is to facilitate best practices and continuing education for any entity undertaking selective demolition.

The categories of the certification are listed below with the accompanying credit amount or prerequisite.

### **Category 1: THE BUILDING**

#### **Site**

- Minimize damage to surrounding vegetation or recover plants, and protect heritage trees (1)
- Grade and re-seed site after demolition (1)
- Erosion and sedimentation control plan (1)
- Minimize impacts on surrounding context (2)

**Material Recovery** - Use Building Worksheet (10)

**Waste Reduction** - Use Building Worksheet (10)

Total Possible Credits for *The Building (25)*

**Category 2: PLANNING**

**Land Use**

Renovation / adaptation is not an option (1)

Contribute to urban infill or land restoration (1)

**Industry Building**

First time Green Demolition Certification (1)

Deconstruction with combined reuse store entity (1)

Makes use of local regulatory alternative waste management permit or incentive (1)

**Community Building**

Job-training program (1)

Donation of materials to Habitat for Humanity other community non-profit (1)

Not removal of National Register of Historic Places structure (1)

**Materials Management Plan**

Demolition is integral to renovation or construction project that will reuse salvaged materials (1)

Local redistribution of recovered materials (1)

Total Possible Credits for *Planning (10)*

**Category 3: ENVIRONMENTAL HEALTH AND SAFETY**

**Worker Health**

Team led by green demolition trained contractor (3)

Workers have completed green demolition training (3)

Worker Safety and Performance incentive plan and implementation (3)

**Hazardous Materials**

Asbestos abatement by licensed contractor and as per OSHA and EPA (Prerequisite)

Lead worker plan and implementation as per OSHA (Prerequisite)

No reuse of lead-based painted materials over 0.06 % content (3)

Other hazardous materials management plan and implementation (3)

**Job Safety**

Engineering survey completed prior to start of work (Prerequisite)

Job Safety Plan prepared and communicated to all workers (Prerequisite)

Designated Safety Officer for project (Prerequisite)

All utilities disconnected from building prior to start of work (Prerequisite)

Total Possible Credits for *Environmental Health & Safety Credits (15)*

## Description of Credits

### *The Building – Site*

#### *Intent*

Green Demolition is a holistic approach to the process of removing buildings. It is concerned with all of the impacts from the process, including impacts on the building site and surrounding properties, streets, and neighborhoods. Selective demolition has the capacity to inherently reduce these immediate environmental impacts through a reliance on hand labor and smaller equipment. An important goal of “green” demolition is the least possible disturbance or interruption of the non-building footprint site and surrounding areas.

#### Possible **SITE** Credits

- 1 Building is removed without damage to vegetation beyond building footprint and minimum clearance for roll-offs and equipment required for work. This excludes ground cover, shrubs, and trees that are salvaged and transplanted before work commences. Heritage trees (as defined by local ordinance or cooperative extension service) must be maintained on site. Submit pre- and post demolition photographs and/or site plan with tree survey and protection plan. Tree protection measures include barricades and snow fence placed at a perimeter line of the drip line.
- 1 Building site is filled, graded, and seeded with ground cover after building removal to insure drainage and soil retention commensurate with pre-building conditions. Submit site plan for post-demolition and photographs for verification. This requirement excludes projects where the foundation or slab-on-grade will remain indefinitely.
- 1 An erosion and sedimentation control plan is developed and followed to minimize the loss of topsoil from the site during building removal. Submit erosion and sedimentation plan outlining measures taken.
- 2 The environmental impacts from the building removal such as noise, dust, and equipment/material placement and storage, upon surrounding properties and streets are minimized. Submit site plan of deconstruction or demolition project with adjacent buildings, sites and streets indicating immediate context. Site plan will indicate ingress/egress routes for vehicles, workers/visitors parking, placement of roll-offs, site trailer and equipment, materials storage, work areas, fencing, etc. to illustrate best attempts to minimize negative environmental impacts on surrounding areas.

### *Materials Recovery*

#### *Intent*

The intent of this credit is to measure the value of resource conservation when considering the types of materials that are recovered. In general, this is measured by how well the green demolition succeeds at the “maintenance of embodied energy” (Primdahl, 2001). Materials that require a large amount of energy to produce, exact a larger toll on the environment. Therefore, reclaiming high-embodied energy materials increases environmental benefits of reuse and recycling.

Using the Materials Recovery Worksheet, the user will input the total weight of each building material in the building. A computer-based building deconstruction assessment tool is under development by the University of Florida that will allow the user to inventory an existing building and to produce a materials report that is compatible with the materials input for the Materials Recovery Worksheet. The inventory will produce a listing of all components of the building and the resulting constituent base materials. The total weight of each material is entered into the Materials Recovery worksheet in the Existing Inventory column. The recoverable quantity is estimated using the deconstruction assessment tool, as a percentage of recoverable materials when the initial building examination is conducted. This percentage is a factor that is then multiplied by the total existing inventory to determine the “recoverable” amount of materials. The possibility of an excessively low and conservative estimate of recoverable materials is offset by the fact that there is a prerequisite for a minimum mass of waste diversion in the Waste Reduction credit category. If the actual amount of materials that are recovered (achieving waste reduction credits) is more than estimate of recoverable materials, then recoverable materials would have to be revised. The difference between the existing inventory and the recoverable portion of materials is the estimated disposal amount. Upon completion of the project, the total amount that is actually recovered for reuse or recycling can be used to validate the recoverable percentage.

The total amount of materials by type that are actually recovered is multiplied by the respective embodied energy figure for that material to calculate a total embodied energy that is maintained, or in other words, is not disposed of in a landfill. The differentiation of maintenance of embodied energy between reuse and recycling is beyond the scope of the green demolition certification. This factor depends on the end use and percentage of recycled content in the new product as a substitute for virgin materials. No matter what percentage of materials are used as recycled content in a new product, the recovery of the materials at the job-site achieves the same demolition diversion goal whether the end use is reuse or recycling.

The Materials Recovery Worksheet calculations will produce several pieces of information that are used to determine the Materials Recovery credits that are awarded. In order to account for different building types and local reuse and recycling infrastructure, the Materials Recovery credits are based upon the percentage of recoverable materials rather than the total amount of materials, whether recoverable or not.

## Materials Recovery Worksheet

Material	Existing Inventory (Tons)	Recoverable (Tons)	Recovered (Tons)	Embodied Energy (BTU/Ton)	Embodied Energy (BTU)	Disposal (Tons or C.Y.)
Acoustic ceiling tile				4.5		
Aluminum				44.7		
Asphalt shingle roofing				3.1		
Brick				1.3		
Carpet				30.0		
Ceramic tile				4.4		
Clay tile				1.3		
Concrete				0.4		
Concrete masonry unit				0.4		
Copper				10.4		
Drywall/plaster				0.8		
Engineered wood				0.8		
Fiberglass				5.3		
Glass				3.9		
Glu-lam				2.9		
Gypsum drywall				0.9		
Metals				8.0		
Particleboard				0.8		
Plastic laminate				21.8		
Plywood				1.8		
Polystyrene				21.0		
Terrazzo				0.5		
Vinyl/linoleum flooring				7.5		
Vinyl siding				2.6		
Wood				1.2		
<b>Total</b>						
Recovered / Recoverable (%)			X			
Embodied Energy Recovered /Recoverable (%)				X	X	
Diversion from Landfill (%)						X

There are three sub-sets of credits available in the Materials Recovery category. These are:

- The percentage of recovered to recoverable materials (3 credits)  
25-50% = 1 credit, 51-75% = 2 credits, 76-100% = 3 credits
- The percentage of recovered to recoverable embodied energy (3 credits)  
25-50% = 1 credit, 51-75% = 2 credits, 76-100% = 3 credits
- The percentage of total materials diverted from landfill (4 credits)  
25-50% = 1 credit, 51-75% = 2 credits, 76-100% = 4 credits

Each of these credits is based on quantifiable numbers that are dependent on local recovery infrastructure, the type of building and materials, and the building condition. Credits up to a total of 10 credits are possible in the Materials Recovery category

### *Waste Reduction*

#### *Intent*

Green Demolition is foremost the diversion of debris from landfills in order to avoid the economic and environmental costs associated with disposal. These costs include tipping fees, the loss of habitat and biodiversity, groundwater or soil contamination from debris, and the ongoing costs to maintain, close, monitor and open landfills.

Waste Reduction Credits are determined by two main factors; the total volume of the building before demolition, and the percentage of diverted materials. Credits are given on a relative basis, combining the total volume and the percentage of diverted materials for a particular size of building. A minimum of 20% diversion from landfill by weight or volume of the mass of building materials is a prerequisite for any building of any size. As the size of the building increases, the percentage of diversion required to obtain the maximum of 10 credits is less. This acknowledges the benefits of diverting a larger total amount of materials due to the size of the building.

#### *Method*

1. Complete Materials Recovery Worksheet.
2. Calculate the total existing building volume and find the row in the Waste Reduction Worksheet that is associated with that total volume.
3. Find the column associated with the percentage of materials recovery to the total building materials mass (by weight or volume).
4. A minimum of 20% of total building materials mass by volume or weight must be recovered in order to receive the green demolition certification.

## Waste Reduction Worksheet

Total Building Volume (length x width x height = C.Y.)	>15,000	P	6	8	10	10	10
	<15,000	P	4	6	8	10	10
	<9,000	P	2	4	6	8	10
	<4,500	P	1	2	4	6	8
	<1,500	P	0	1	2	4	6
	<500	P	0	0	1	2	4
		20	20-35	36-50	51-65	66-80	81-100
		Recovery (%) to Total Mass (weight or volume)					

P = prerequisite

### *Land-Use*

#### *Intent*

A green demolition is undertaken in the context of efficient land use. This can be either for urban infill to make use of existing urban infrastructure or where removal of the building allows for the creation of green space, or mitigates future disaster damage by removing buildings in areas that are prone to disaster. A serious negative consequence of “demolition by neglect” is the social and economic costs of blighted conditions and hindrance of urban revitalization. When a selective dismantling is undertaken to allow rebuilding in an urban setting, this more aggressive approach can prevent the long-term stagnation of leaving buildings in place that are no longer serving a healthy function for the community. Damaged buildings in rural areas will inevitably pose human and environmental hazards and prevent the reintroduction of native flora and fauna at the building footprint site. If hazardous materials are present, an aggressive approach to removing these materials for safe disposal is preferable to allowing them to leach into soils and groundwater over time from the decay of the building(s).

Possible Credits **LAND USE**

1 If relocation or adaptive reuse of the structure is not an option based upon documentation provided by the Owner on company or personal letterhead then one credit is awarded for the “necessity” of the building removal over other options. Extending the life of buildings through rehabilitation or adaptive reuse is more sustainable in terms of the maintenance of embodied energy than a demolition in which even 100% of the materials are recovered. The Green Demolition Certification promotes this concept by rewarding projects in which selective dismantling is the “best” solution after rehabilitation and relocation options are deemed infeasible.

1 If the demolition contributes to sustainable urban planning by making room for in-fill or redevelopment of blighted areas, OR conversely the building removal is undertaken for the purposes of mitigation in natural areas or disaster debris removal where rebuilding will not take place and conservation lands are created. This is documented by a letter and or map indicating the site and future plans for construction at an urban site, or preservation at a rural site.

*Industry Building*

*Intent*

The Industry Building credits of the Green Demolition Certification are intended to validate the infrastructure that will make materials salvage economically viable. This is because the success of deconstruction and materials recovery is highly dependent upon revenues from the recovered materials. This infrastructure includes the reuse and recycling business development that provides the market for recovered materials, and regulatory incentives for demolition debris management.

Possible Credits **INDUSTRY BUILDING**

1 A first time application for a Green Demolition Certification is rewarded by one credit as an encouragement to contractors who are willing to explore Green Demolition as an alternative to standard practice.

1 If the building removal project is undertaken by a combined deconstruction and used building materials resale business or recycling one credit is awarded. Documentation is achieved by providing proof of the reuse or recycling business as a component of the demolition contractor business.

1 If the Green Demolition Certification is used to validate a construction and demolition (C&D) waste management permitting process then one credit is awarded. This provides an internal incentive for making the certification an integral part of the C&D permitting process. Documentation is provided by a copy of local ordinance or regulation that requires C&D recycling or management as part of permitting process.

## *Community Building*

### *Intent*

Green Demolition can support the economic development of communities by providing jobs and job-skills training, and affordable building materials. At the same time, not removing a community's irreplaceable historic fabric should be rewarded. The certification provides a credit for removal of buildings that are not on the National Register of Historic Places, as an important component of a community's architectural and building fabric.

### Possible **COMMUNITY BUILDING**

#### Credits

- 1 If the project makes use of a job-training program and/or apprenticeships one credit is awarded.
- 1 If a portion of the recovered materials is donated to a non-profit providing or using affordable reused building materials such as Habitat for Humanity, one credit is awarded. This credit also supports the benefits of non-profit tax deductions for the donation of materials by the building Owner or Contractor to a non-profit organization.
- 1 If demolition does not remove a building that is listed on the National Register of Historic Places one credit is awarded. As demolition should be considered a necessity over rehabilitation and historic urban character is a community value to be preserved, this credit is intended to balance the interests of preservation and building removal through an established third-party standard.

## *Materials Management Plan*

### *Intent*

Careful planning is essential to the success of a Green Demolition. Ensuring that the demolition contractor and all workers are aware of the techniques and goals for material recovery will improve recovery rates. Material flow away from the building is as complicated and needs to be as carefully coordinated as material flow onto the site during a construction project. The most fundamental green demolition planning strategy is having a use or market for the recovered materials before work begins. The development of sales strategies for the recovered materials such as on-site sales, bulk sales, use of media, design for reuse of materials into new projects all provide the foundation for a high recovery rate for the proposed project.

Possible Credits **DEMOLITION PLAN**

- 1 If the green demolition is directly associated with a renovation or construction project that utilizes the recovered building materials one credit is awarded. Green Demolition is a method for mining existing building stock for raw materials for new building projects. Materials reuse on-site is the most efficient form of reuse and the additional effort required to incorporate recovered materials into new building design is rewarded by this credit. This is documented by a listing of materials that are recovered and that are reused within a one-year time frame at the same site or other projects
- 1 One credit is awarded if fifty (50) percent of all recovered materials are redistributed within a 50-mile radius of the project site. The recovered materials distribution radius will be dictated by the market for, and the value of, the recovered materials. The reuse of materials within the community is preferred over the export of materials to other communities for both social and environmental benefits. This may be difficult to document. One method is the use of on-site sales and the use of a local reuse retail store.

*Worker Health*

*Intent*

Supervision and training are prerequisites for a safe and efficient project and work place. Treating accident prevention as both a top down and bottom up activity will insure full communication and shared responsibility amongst all members of the entity undertaking the green demolition. Although safety has its own reward of no injuries, an incentive program for workers to exceed minimums and receive rewards for best practice is common in the construction industry. Some incentive programs are based upon company spirit and others are more pragmatic using salary bonuses or other kinds of in-kind benefits such as meals, goods, T-shirts, preferred parking spaces, and awards, as examples. Worker health and productivity are the basis of any successful enterprise and since Green Demolition Certification is based upon exceeding the minimums, credits for training and safety rewards are important components of the certification.

Possible Credits **WORKER HEALTH**

- 3 If the contractor or job supervisor has been trained in Green Demolition Certification three credits are awarded. A well-managed project with consideration for the elements that make-up a green demolition will insure a successful overall effort and the completion of the other elements of the certification. Certification that the job supervisor or contractor has received green demolition training as per The Deconstruction Institute guidelines is required for the credits.
- 3 If workers have completed Green Demolition Certification training or training approved by the National Association of Demolition Contractors and/or OSHA, for demolition safety, three credits are awarded. Safety and industry training are critical to a safe and healthy project, and worker training is rewarded with multiple credits. Training plan for green demolition and training log for workers as prepared by the contractor is required for submittal.
- 3 Three credits are awarded if a worker safety and performance incentive plan that exceeds minimum safety and contract requirements is created and implemented on the green demolition site. Record of safety incentive plan or record of accident free days by company to indicate no serious accidents reportable under OSHA Form 200 requirements within the last 6 months can both be used to qualify for this credit.

*Hazardous Materials*

*Intent*

Green Demolition Certification requires the correct and safe handling and disposal of all hazardous materials. Since Green Demolition can involve more hand labor than traditional mechanical demolition, workers may be subjected to a greater exposure to hazards. For the health of workers and the environment, the most prudent standard of care should be followed, including all Federal and State regulations.

Possible Credits **HAZARDOUS MATERIALS**

- P Asbestos survey and abatement as per OSHA and NESHAPS regulations using certified and licensed asbestos survey and abatement contractor(s). A copy of survey and clearance are required for this credit.
- P Lead work plan is developed and implemented as per OSHA CFR 29 1926. If the building is surveyed and does not contain any lead-based paint (LBP) then the lead work plan is fulfilled by the LBP survey. If the building contains LBP, then the plan must include all OSHA requirements for worker protection in a lead environment as required.
- 3 Any lead-based painted materials exceeding 0.06 % lead content are either disposed of, or abated prior to redistribution to the general public. As some materials are redistributed with lead content inadvertently, it is important to raise awareness of the issues of LBP materials reuse. Acknowledgement by the green demolition entity that it understands and addresses LBP issues is rewarded with three credits.
- 3 The hazardous materials management plan includes proper recycling and disposal of all other hazardous materials besides asbestos and lead-based paint, including refrigerants, chemicals and paints, mercury, PCBs, etc. and is rewarded with three credits. This credit is intended to reward the site separation of all hazardous materials including those that may be left where only a partial removal of salvageable materials takes place. This is documented by descriptions of hazardous materials and/or invoices and receipts from hazardous materials disposal facilities.

*Job Safety*

*Intent*

Providing a safe environment for all workers involved with Green Demolition is essential. Therefore the Job Safety elements of the Green Demolition Certification are all prerequisites.

Possible Credits **JOB SAFETY**

- P A pre-demolition engineering survey is required before the start of work and to be used in the preparation of the project work plan.
- P A Job Safety Plan is a requirement and to be prepared and communicated to all workers and supervisory personnel before commencement of project.
- P A designated safety officer to monitor all job-site safety concerns and enforce the job safety plan is a requirement.
- P Although deconstruction may be accomplished with a partial utilities cut-off, insuring the highest standard of care outside the building prior to the start of work.

**CONCLUSIONS**

This paper is the description of a proposed Green Demolition Certification similar to many green building standards. The Green Demolition Certification can be used alone or as a component of an overall green building rating system where a project involves the removal of an existing

building. As trends towards inner city revitalization increase and the reuse of urban lands, including Brownfields, continues, it will be important to carry out these revitalization efforts in ways that minimize building materials waste and support community economic and social revitalization. The goal of the certification is an educational document, a guide to the many elements of a green demolition, and a means to validate regulatory and market-based differentiation of higher standards of materials recovery, community benefit, and environmental health and safety for a building removal project. The certification as it is proposed makes use of common practices found in many green building certification methods and is based upon a pass-fail certification as a means to encourage use of the certification. As the certification method is tested for effectiveness and ease of use, it can be modified to use a series of levels of achievement.

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