RESIDENTIAL CONSTRUCTION WASTE MANAGEMENT AUDIT REPORT

An Edmonton Case Study

RESIDENTIAL CONSTRUCTION WASTE MANAGEMENT AUDIT REPORT *AN EDMONTON CASE STUDY*

Executive Summary

In the Fall of 1991, at a Canada Mortgage and Housing Corporation seminar in Edmonton, a challenge was issued to the building industry to improve waste management practices. From this and subsequent discussions, an audit was proposed under the direction of CMHC, the City of Edmonton, the Edmonton Home Builders Association (EHBA) and George Wimpey Canada.

The purpose of the case study was to review waste management practices specific to the Edmonton area and to effect change in those practices.

The amount of waste being generated by the building of eight homes in a new subdivision was audited over a one-year period. Steps were taken to increase the level of awareness of the trades persons to encourage them to reduce the amount of waste materials going into the waste stream. In addition, opportunities for recycling materials were actively explored.

A total of 22,399 kg of waste was collected, an average of 2,800 kg per house.

Dimensional lumber accounted for the largest portion of this waste, with drywall second. With the second four houses, waste in dimensional lumber use was reduced by 43 percent. The amount of drywall waste remained relatively unchanged, but all of the waste was recycled. All of the cardboard waste from the second four houses was recycled as well. The amount of waste in total was reduced by 20 percent.

If a residential builder hopes to practice good waste management practices, the case study illustrated the need to sort waste material thoroughly and to store it properly. Recycling requires uncontaminated material in sufficient quantity and of good quality in order to be acceptable to the recyclers.

The case study findings show that education to increase awareness of ways to reduce the amount of waste material being generated is an effective tool. Incentives and deterrents may also be effective in changing practices, but the study results indicate that involving people in the problem in a co-operative way brings about more viable solutions.

Recommendations

1. Promote education on waste management techniques to the widest possible audience of stakeholders in the residential construction industry.

2. Establish a waste management program with active support of CMHC, the EHBA and the City of Edmonton.

3. Encourage reuse and recycling opportunities.

4. Network and continue to explore the possibilities for better waste management.

RAPPORT DE VÉRIFICATION SUR LA GESTION DES DÉCHETS DE CONSTRUCTION RÉSIDENTIELLE ÉTUDE DE CAS À EDMONTON

Sommaire

À l'automne 1991, lors d'un séminaire de la Société canadienne d'hypothèques et de logement (SCHL) à Edmonton, l'industrie de la construction a été mise au défi d'améliorer ses pratiques de gestion des déchets. Par suite de cette proposition et de discussions sur le sujet, on a proposé de mener une vérification sous la direction de la SCHL, de la Ville d'Edmonton, de la Edmonton Home Builders Association (EHBA) et de la firme George Wimpey Canada.

L'étude de cas avait pour objectif d'examiner les pratiques de gestion des déchets propres à la région d'Edmonton et d'y apporter des changements.

On a procédé à la vérification de la quantité de déchets générés par la construction de huit maisons dans un nouveau lotissement, pendant une période d'un an. On a pris des mesures pour accroître le degré de sensibilisation des corps de métier en vue de les inciter à réduire la quantité de matériaux jetés. En outre, on a étudié les diverses possibilités de recyclage des matériaux.

Au total, on a recueilli 22 399 kg de déchets, ce qui représente une moyenne de 2 800 kg par maison.

La plus grande partie de ces déchets était composée de bois de construction de dimensions courantes; les plaques de plâtre arrivaient au deuxième rang. Dans le cas du deuxième groupe de quatre maisons, on a réduit les déchets de bois de dimensions courantes de 43 p. 100. La quantité de déchets de plaques de plâtre est restée relativement la même, mais l'ensemble des déchets ont été recyclés. Tous les déchets de carton du deuxième groupe de quatre maisons ont également été recyclés. La quantité totale de déchets a été réduite de 20 p. 100.

L'étude de cas a mis en lumière le fait que, pour avoir de bonnes pratiques de gestion des déchets, le constructeur résidentiel doit trier minutieusement les déchets de matériaux et les entreposer convenablement. Les matériaux à recycler doivent être non contaminés, en quantité suffisante et de bonne qualité pour être acceptables aux recycleurs.

D'après les résultats de l'étude de cas, il est efficace de sensibiliser davantage les différents intervenants à la nécessité de réduire la quantité de déchets. Les méthodes d'encouragement et de dissuasion peuvent aussi contribuer à changer les pratiques, mais selon les résultats de l'étude, en amenant les gens à coopérer à la résolution du problème, on arrive à des solutions plus viables.

Recommandations

1. Renseigner le plus grand nombre possible d'intéressés de l'industrie de la construction résidentielle sur les méthodes de gestion des déchets.

2. Établir un programme de gestion des déchets en collaboration avec la SCHL, la EHBA et la Ville d'Edmonton.

3. Encourager la réutilisation et le recyclage.

4. Collaborer avec les autres intéressés en vue de tenter de trouver des façons d'améliorer la gestion des déchets.

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RESIDENTIAL CONSTRUCTION
WASTE MANAGEMENT AUDIT REPORT
AN EDMONTON CASE STUDY

Introduction

Not so many years ago, Canadians threw away garbage with little concern. Backyard fires for leaves and garden refuse marked the beginning of Fall. Everything and anything went to the landfill. Today, people sort their garbage and place it in blue boxes. Canadians compost and they dispose of toxic paints and varnishes at annual round-ups.

Even with these changes, Canadians still produce more garbage per capita than any other industrialized country in the world; 1.7 kilograms per person per day. Our ability to dispose of this waste is becoming limited. Much of the waste contains pollutants and requires special handling. Landfill sites across Canada are reaching capacity and new sites are difficult to establish. If the experience in other centres is applicable, as local landfill sites fill up, we can expect bans for some materials such as is the case in Mississauga, Ontario. We can also expect higher charges for dumping.

The home building industry is a major contributor of waste. Estimates are that as much as five percent of landfill is made up of waste from this sector. However, careful attention to the four R's of Waste Management, that is Reduce, Reuse, Recycle and Review, will result in more efficient use of material and a significant reduction in landfill waste.

A Call for Action

In October 1991, Canada Mortgage and Housing Corporation's (CMHC) Edmonton Branch held a waste management seminar entitled "Making a Molehill out of a Mountain". At the seminar, CMHC challenged the building industry to find better ways to handle waste.

Following the seminar, a local developer, George Wimpey Canada, volunteered a new subdivision, Castlewood in north Edmonton, as the site for a project to study waste handling practices. Builders within the subdivision indicated an interest in participating in a program that would result in improved waste management.

A case study approach was proposed with the following objectives:

1. to audit residential construction waste management practices specific to the Edmonton area. How much waste is produced, what type of waste is produced and at what rate;

2. to identify the problems associated with managing waste from residential construction sites;

3. with the knowledge gained on the type, size and volume of waste materials, to investigate the possibilities of waste management programs other than landfilling; and

4. to change the waste management practices of builders through the provision of information and education, thereby reducing the amount of waste being generated.

CMHC, the EHBA, the City of Edmonton and George Wimpey Canada worked together on the study.

Methodology

The case study took place over a one-year period and involved eight homes from the beginning of construction to completion.

An audit of the first four houses began with minimal notice to the four builders. This ensured an accurate assessment of their current waste management practices. By contrast, for the audit of the second four houses, all of the builders' superintendents and trades were instructed in the objectives of the project so that the trades would be able to modify their practices. In addition, CMHC and the City of Edmonton worked to increase the level of awareness of ways and means to reduce the amount of waste being generated and sent to the landfill. Trades people were educated on ways to work smarter.

Throughout the entire length of the case study, CMHC and the City of Edmonton worked to find and to broaden the number of recycling opportunities for residential construction waste.

The audit process was as follows:

- each builder constructed a bin measuring 8' x 4' x 8' high, and placed it on site.
- waste was sorted by all the subtrades and placed in the appropriate slots in the bins.
- waste was collected weekly for the three month construction period.
- CMHC and the City of Edmonton were responsible for final sorting, retrieving, weighing and disposal of the waste.
- City of Edmonton and CMHC compiled the data for use as educational aides.

The builders participating in the audit were Encore Homes, Champagne Homes, Parkwood Homes, and Challenger Homes. The home styles were bungalows, split levels, and two storeys. All had attached garages and ranged in size from 130 m^2 in a bungalow, to 186 m^2 in a fully finished two-storey. Exteriors were finished in siding with some trimmed in brick. Two of the homes in the second group of houses were roofed in asphalt shingles and two in wood shingles.

The decision was made to measure the waste by weight. Measuring by volume would be too difficult given the variety of material being measured and the resulting problem in making valid comparisons. Data was compiled on the basis of kilograms per 100 m^2. Materials were weighed at the City of Edmonton weigh scale and the information recorded on a standardized form.

Results

A total of 22,399 kg of waste was collected. This averages 2,800 kg per house. Totals are illustrated by builder, below.

RESIDENTIAL CONSTRUCTION AUDIT						
COMPARATIVE WEIGHT SUMMARY[1]						
BUILDER / MATERIAL	1	2	3	4	AVERAGE	% <>
DIMENSIONAL						
First Four Houses	396	958	552	618	631	
Second Four Houses	315	441	406	266	357	43% <
PLYWOOD/OSB						
First Four Houses	324	273	334	183	279	
Second Four Houses	308	206	388	192	274	2% <
PLASTICS						
First Four Houses	41	55	39	85	55	
Second Four Houses	62	56	62	23	51	7% <
METALS						
First Four Houses	22	6	34	16	20	
Second Four Houses	26	22	26	9	21	0.5%
DRYWALL						
First Four Houses	334	474	338	409	389	
Second Four Houses	373	535	474	294	419	7%>
CARDBOARD						
First Four Houses	151	101	105	91	112	
Second Four Houses	92	69	109	124	78	30% <
SHINGLES						
First Four Houses	56	70	44	70	60	
Second Four Houses	96	_	73	_	85	41% >
MISC.						
First Four Houses	271	262	261	236	258	
Second Four Houses	172	149	174	181	169	34%<
TOTALS						
First Four Houses	1595	2199	1707	1708	1804	
Second Four Houses	1444	1478	1712	1089	1454	
REDUCTION	151	721	<5>	619	350	
	9.5%	32.5%	<0.5%>	36%	19.5%	

[1] Figures represent kg per 100 m^2.

NOTE: *During the construction of the first four houses, some of the subtrades did not clean their waste material nor did they place all of it in the bins.*

a. Dimensional Lumber

First four houses: average 631 kg/100 m^2 waste per house

Second four houses: average 357 kg/100 m^2 waste per house

The waste material from the first four houses consisted of 2" x 4", 2" x 6", and 2" x 10" lumber. It became waste primarily through poor cutting practices. Approximately one-third or more of this was considered to be usable lumber. At one site, 104 pieces of lumber, which were more than two feet in length were counted, with several pieces being full length studs. The only flaw in much of this material was that it had some nails in it. The remainder were one foot and shorter lengths.

With the second four houses, an overall reduction in dimensional lumber waste of 43 percent was achieved. One trades person reduced the amount of material going into the waste stream by 57 percent.

The quality of the waste improved as well. Virtually no usable material was evident in the bins.

Over-supplied lumber, that is lumber that remains stacked on the job site for long after it is needed, was an additional problem for builders. This material was not included in the above figures. All of the builders said that this material would be moved to other sites, but it is questionable whether this was done by the builders.

It should be mentioned that when waste management efforts result in lumber being saved, there is potential for a greater over-supply problem. As part of an effective waste management program, a builder must review his lumber purchasing practice as well.

b. Oriented Strand Board (OSB)/Plywood

First four houses: average 279 kg/100 m^2 waste per house

Second four houses: average 274 kg/100 m^2 waste per house

The vast majority of materials in this category consisted of OSB. The audit of the second four houses revealed virtually no reductions in waste generated. With present building designs and practices, it was not possible to effect any significant reduction in this category.

c. Drywall

First four houses: average 389 kg/100 m^2 waste per house

Second four houses: average 419 kg/100 m^2 waste per house

Suppliers and installers of drywall products work hand-in-hand and therefore waste is minimized. All of the waste from the second four houses in this audit was recycled with a pilot project and Domtar. The industry standard of eight to nine percent waste material was maintained for the case study.

d. Corrugated Cardboard

First four houses: average 112 kg/100 m^2 waste per house

Second four houses: average 78 kg/100 m^2 waste per house

Most of the waste corrugated cardboard was clean. A reduction in waste was realized from the first four to the second four houses. All of the corrugated cardboard from the second four houses was recycled.

e. Asphalt Shingles

First four houses: average 60 kg/100 m^2 waste per house

Second four houses: average 85 kg/100 m^2 waste per house

Two of the homes in the second group of houses used wood shingles and waste for these is reflected in the dimensional wood waste figures.

Although there was a slight increase in the waste in this category, the total amount of waste was not deemed to be excessive.

f. Plastics

First four houses: 55 kg/100 m^2 waste per house

Second four houses: 51 kg/100 m^2 waste per house

The majority of the products were:

- vinyl, primarily siding;
- poly-vinyl chloride (PVC), primarily water pipe;
- acrylonitrile-butadiene-styrene (ABS), primarily plumbing drain and vent lines; and
- polyethelene film, primarily vapour barrier.

Very little change was seen between the first and second four houses. No usable nor reusable waste was noted.

g. Metals

First four houses: average 20 kg/100 m^2 waste per house

Second four houses: average 21 kg/100 m^2 waste per house

This small volume of metals encompassed a mixture of materials, such as tin spools, copper wire cutoffs and steel banding.

h. Miscellaneous

First four houses: average 258 kg/100 m^2 waste per house

Second four houses: average 169 kg/100 m^2 waste per house

This category included such things as:

- carpet and linoleum scraps;
- contaminated materials;
- paint cans partially full and empty; and
- containers (eg. glue and caulking tubes)

A significant reduction in waste was realized from the first four to the second four houses, as the separation of materials was better managed, resulting in less contaminated material. There were also more frequent pick ups with the second four houses, reducing the amount of time during which materials could become contaminated.

Conclusions

1. Education in waste stream generation and waste handling has a positive effect on minimizing waste at building sites. This was the most important finding in the audit.

2. Based on the audit results, it is estimated that a 50 percent reduction of dimensional lumber waste is possible by educating trades persons on careful cutting practices and by having effective on-site supervision. A "think twice, cut once" motto was valuable. Some of the waste pieces of lumber could be used for purposes such as blocking while other pieces could be recycled into chips for other commercial uses.

3. Not all waste from construction is presently reusable or recyclable. Such material would benefit from a reduction program.

   For example, at the present time, the recycling possibilities for OSB/plywood are non-existent in the Edmonton area. The adhesives used preclude the use of this material for chipping and many other possibilities. Because of the difficulty in recycling of this product, emphasis should be placed on reducing the amount going into the waste stream, by paying more attention to efficient building design.

4. Of those materials that are recyclable/reusable, some are insufficient in quantity, some are poor quality and some have been contaminated. In order to realize maximum recycling possibilities, materials must be fully sorted and properly stored. Sufficient uncontaminated volumes are needed to make it economically feasible to recycle.

   The recyclers will not accept contaminated material; they all demand clean, sorted material. As separation is expensive and labour intensive, it pays to keep sorted material clean. Strict attention to source separation and contamination is required for any type of conservation program to work.

5. Oversupply of many materials encourages theft. More careful management by builders of their material supply practices will go a long way to minimize the expense of theft.

6. There is a growing potential for reusing/recycling through local businesses and recycling plants and depots.

7. Corrugated cardboard is easily recyclable. Clean corrugated cardboard is recyclable seven to 10 times before the fibres become too short to recycle. There are an increasing number of depots willing to accept and pay for clean, dry corrugated cardboard. The challenge is to collect and store it until there is a sufficient quantity to make it economical to transport to the depots.

   Installing commercial bins in several locations has been tried but the major problem is the need for compaction. A corrugated cardboard compactor/baler is cost prohibitive except where high volumes of waste corrugated cardboard are available. However, with the increase in surcharges/dumping fees for corrugated cardboard, a compactor/baler becomes cost effective. Many companies are developing plans for recycling this material. This may soon be the case for home builders as well.

   Many packaging materials, such as corrugated cardboard boxes with styrofoam packing, render recycling difficult or even impossible. The federal government has established a national packaging protocol to reduce packaging by 50 percent by the year 2000. This initiative should help to alleviate the problem.

8. Drywall is an inert material that remains in the landfill sites indefinitely. An Edmonton plant will recycle clean, dry, uncontaminated drywall with the paper stripped. Although a processing plant to strip the paper from drywall does not exist in Edmonton, efforts are moving to develop one.

   At some building sites (but not at this one), drywall cutoffs have been placed in the interior wall cavities. It increases the thermal mass of the home, helping to smooth out temperature fluctuations and aiding in the reduction of sound passing between rooms.

9. Plastics and metals require specialized sorting and transportation prior to any recycling possibilities.

10. Separation of wastes is relatively easy if trades people collect and carry materials to secondary users or storage depots.

11. It appears that having a knowledgeable site superintendent and builder committed to a waste management program are the keys to successful reduction in waste generated on a construction site.

12. Having waste collected and separated on-site by those who generated the waste is effective. Involvement by those generating the waste encourages participants to devise better ways to reduce or dispose of waste.

13. In most cases, there may not be a clear economic argument for recycling waste. It may cost the builder as much to sort, store and dispose of waste in alternative ways as it does in dumping fees. Nevertheless, it is only through continued efforts in recyling that more economical possibilities will emerge. Economic considerations aside, there is a "good will" value in being known as environmentally responsible.

14. The most immediate cost savings can be realized through reduction of material used.

    By reducing waste, less material needs to be ordered thereby lowering material costs to the builder.

    Reduction in waste creates an oversupply of material, particularly lumber. An overall reduction in lumber supplies leads to significant cost savings and therefore serves as an incentive to participants.

Recommendations

1. **Promote education in waste management techniques to the widest possible audience of stakeholders in the residential construction industry.**

   The information gained from this case study and other studies on the amount and type of materials that are in the residential construction waste stream, and the options for properly managing that waste, should be passed on to those who are in a position to change the situation. Education is a very effective tool to bring about change.

   - Encourage the development of waste management education programs in trade schools, training centres and through industry associations.
   - Develop an awareness program for new home sales personnel. Such a program would assist new home buyers in making wise decisions on home design alterations. These decisions often have a significant impact on waste generated.
   - Develop additional educational resources for builders, and their trades.

2. **Establish a local waste management program.**

   The momentum generated by this audit process should continue with the establishment of a waste management or conservation program.

   - Under the auspices of CMHC, the EHBA, and the City of Edmonton, form a consortium of interested parties to develop a waste management protocol and plan. The plan should identify goals, timeliness, and costs.
   - Given that waste from construction is an industry-wide problem, there should be further investigations into waste management opportunities in the commercial construction industry. Due to the size and length of commercial construction projects, there are special considerations in this sector for waste management. These need to be identified and opportunities for waste management explored. Opportunities for waste management in the demolition and renovation sectors should be explored as well.

3. **Encourage reuse and recycling opportunities.**

   Much of the work in this audit involved searching out and contacting various companies regarding recycling opportunities.

   - Encourage other Edmonton land developers to undertake waste management audits and studies.
   - Initiate a pilot project on depot systems on a subdivision basis. Such a project would provide much needed data regarding controls and disposal of all separated materials.
   - Identify potential market opportunities for stockpiled waste where they exist and continue to investigate and document recycling prospects with a view of creating new markets for material.

4. **Network and continue to explore the possibilities.**

The impetus for this audit came from people talking to each other and recognizing common problems. Only by working together will solutions to these problems be developed.

- Continue discussions with other builders and allied organizations to maintain the momentum in waste management programs.