

April 25, 2016

ADP #16115



Dear [REDACTED]:

Associated Design Partners, Inc. has completed an on-site visual review and follow-up engineering evaluation for the above referenced claim. You originally contacted my office requesting engineering investigation services on April 5, 2016. Richard Cochran, Associated Design Partners Technician, conducted a site visit on April 8, 2016, in order to measure the building for repair plans. I contacted the insured and arranged for a site visit, which was conducted on April 12, 2016.

You requested I investigate this tree hit claim and determine the extent of resulting damages caused by the tree hit on this residential building. I have defined and illustrated a recommended scope of repair work to restore the property to a pre-loss condition, or better, including code upgrade considerations in accordance with the adopted building codes.

This letter report summarizes my understanding of the nature and extent of damage, and provides recommendations for the appropriate required scope of repairs to restore this property to a pre-loss condition. This report, along with the attached conceptual repair plan, depicts the scope of required demolition and repairs to the structure.



## **PROPERTY DESCRIPTION**

The subject property can be described as a wood framed, single family, two story, colonial style, residential house. There is an attached garage to the right side of the house, and a screened-in porch at the rear, referenced when facing the house from the road.

## **NATURE OF CLAIM**

On March 31, 2016, a white pine tree fell in a northerly direction and hit the front left corner of the insured's house, referenced when facing the house from the road, at [REDACTED], [REDACTED], [REDACTED].

## **INVESTIGATIONS, OBSERVATIONS, AND FINDINGS**

During my site visit I made observations, collected photographs, took measurements, and documented my findings in my engineer's field book. Copies of the photographs have been attached for reference to this report.

I have not provided a detailed written narrative of all my investigations and observations for this claim. A more detailed written narrative of my investigations, observations, and follow-up research can be provided upon request. The following paragraphs provide a summary of the more significant observations and findings.

1. I received and reviewed a pre-purchase home inspection report authored by Perry Lemay of Keystone Home Inspections, dated August 14, 2015.
2. In the attic space, I observed the roof sheathing to be damaged at the front left side of the house, referenced when facing the house from the road. Six (6) rafters and coinciding ceiling joists were broken. Additionally, four (4) rafters and coinciding ceiling joists were displaced and distressed. (See plans for details. See photographs 1-4, 68-78.)
3. On the second floor, I observed cosmetic damage in the master bathroom (see photographs 22-24 & 57-63). The gypsum wallboard has several minor cosmetic cracks which will require crack repair and repainting throughout.
4. On the first floor, I observed some cosmetic wallboard cracking damage in the living room (see photographs 43-44). The gypsum wallboard has several minor cosmetic cracks, which will require crack repair and repainting throughout.
5. In the master bedroom, I observed extensive damage to the front exterior wall. I was unable to review the extent of damage to the left wall; therefore, the gypsum

wallboard on both exterior walls of the bedroom will need to be removed in order to allow full inspection. The front wall has sufficient visible damage to warrant replacement of the exterior wall from the top plate down to the second floor deck. The window framed opening, top plates, and some studs are displaced and broken in several locations. (See plans for details. See photos 9-15, & 56.)

6. I observed several gypsum wallboard pops in the master bedroom closet (see photographs 64-67).
7. In the upstairs stairwell I observed several gypsum wallboard pops, which were likely present prior to the tree hit event, but due to close proximity to the master bedroom could have been exacerbated (see photo 52). The same stairwell has a taped gypsum corner bead joint that is displaced. The displaced taped joint was painted over showing it to be pre-existing however to properly repair the nail pops in this stairwell, the entire stairwell should be patched and repainted (see photos 53-55).
8. There is some cosmetic cracking between the wall and ceiling in the kitchen next to the cabinets (see photos 33-34). The cracks appear mostly pre-existing, but may have been exacerbated and lengthened by the impact event because of the structural load path being next to the center bearing wall above that was somewhat proximal to the impact location above.
9. In the front right bedroom, referenced when facing the house from the road, I observed no damage.
10. In the basement, the sump pump reportedly failed and has been replaced (see photographs 83-84).
11. On the first floor, in the living and dining rooms, I observed several instances of door trim shrinkage and expansion due to seasonal fluctuation in temperature and moisture (see photographs 45-46, 50-51). These separations are not uniform and are not consistent with separation gaps caused by displacement of the door frame openings, but instead are consistent with typical and normal shrinkage.
12. In the living room, the windows were painted shut. I was able to break the seal and they are now in fully operable condition. The large picture window and two sidelights were not damaged by the tree hit.

13. The wainscoting joints in the living room are filled with caulking because they have experienced prior seasonal expansion and contraction due to seasonal moisture and temperature fluctuations. These caulked gaps were present prior to the tree hit and were not displaced or cosmetically altered by the tree hit (see photograph 47).
14. The large room off the kitchen has a sag in the ceiling and the floor of the bedroom has the same sag. This framing condition is likely due to over spanned floor joists and was not caused by the tree hit event. I did not open up the ceiling to verify framing sizes but the framing is distal to the hit location and structurally disconnected such that floor and ceiling displacement is not expected.
15. In the dining room, I observed multiple ridges in the ceiling gypsum wallboard joints (see photo 35 & 42). These ridges are unrelated to the tree hit.
16. In the front entry hallway, I observed multiple ridges in the ceiling gypsum wallboard joints (see photo 39). These ridges are unrelated to the tree hit.
17. The door between the dining room and the garage/mudroom appears to have loose hinges, which are unrelated to the tree hit (see photographs 36-37, 40-41).
18. The front door has a large gap and does not fit into the framed opening, while this gap was mostly a pre-existing condition it could have been widened because of the structural load path being next to the front bearing wall above that was somewhat proximal to the impact location above.
19. Outside, I measured the base of the tree to be approximately 30" in diameter (see photographs 28 & 29).
20. There is damage to the exterior vinyl siding on the left side of the house, referenced when facing the house from the road (see photograph 90); however, these damages are unrelated to the tree hit as they were reported and photographed by a pre-purchase home inspection report authored prior to the tree hit.
21. I noted inadequate passive ventilation and insulation conditions (only 6-8" of batts) and only small gable vents, inside the attic space. These pre-existing deficiencies were also pointed out by the pre-purchase home inspection report. Evaluation of these systems is beyond the scope of this report, but is encouraged to be passed along to the insureds to address separately from the tree hit repair scope.

22. The center chimney has no visible tree impact damage.

### **DISCUSSION OF BUILDING DAMAGES CAUSED BY FALLEN TREE IMPACT**

Buildings and other designed structures are expected to be strong enough to withstand reasonable effects from their environment. When different forces, such as a fallen tree impact occurs, which is clearly not a normal environmental condition, an assessment must be made by a qualified structural engineer to determine the extent of new damage related to the impact event. There are three primary factors that need to be considered when assessing damages related to impact forces.

1. How much impact force was imparted to the structure?
2. Where did the impact occur and what building components were involved?
3. What is the strength and preexisting condition of the elements being assessed?

The following provides some discussion for each of these factors.

1. How much impact force was imparted to the structure?

My opinions describe the most probable mechanism of the impact event and are based upon; my understanding of the tree impact event as described to me; physical damages as observed and documented by me; and a corresponding impact evaluation and resulting damage analysis. In this case, portions of a large white pine tree reportedly fell over onto the subject roof, causing limited damage to main house roof. The tree had been removed prior to my site visit. The roof structure and exterior second story wall absorbed most of the impact energy, which buffered the impact forces and limited the amount of interior cosmetic and structural damage distal to the immediate impact zone.

2. Where did the tree strike occur and what building components were impacted?

The most important and primary consideration is revealed by the immediate damage impact locations. Reviewing what was impacted, and how much damage was caused to the immediate impact location, is the primary consideration for assessing the amount of force imposed. In this case, several roof rafters were broken and/or displaced and the front exterior wall received and absorbed much of the impact force, resulting in significant damage to the stud framed wall. Through yielding and rupture, the rafters, roof deck, and wall studs absorbed most of the force at the impact and subsequently dissipated little force transfer to the remaining building structure.

3. What is the strength and preexisting condition of the elements being accessed?

Cracks in existing construction components such as sheetrock, plaster, concrete and masonry foundation walls develop when the level of induced strain exceeds the critical strain, or strain tolerance of the material. Normal everyday environmental conditions can cause cracking in most, if not all, homes. Some of the normal everyday environmental factors include.

- Chemical changes in mortar, bricks, plaster, and stucco
- Excessive structural live loads for snow, wind or other external forces
- Differential foundation settlement caused by a number of possible conditions
- Normal shrinking and swelling of construction materials in response to changes in moisture and temperature
- Higher than normal moisture conditions, water intrusion activity
- Gravitational loads from the self-weight of the structure
- Fatigue and age deterioration of construction materials and finishes
- Differential response of construction materials to variable environmental conditions
- Human activity such as; everyday use, maintenance, construction, jumping, slamming doors, etc.
- Renovations to the building that change the way forces are handled by the structure

Strains in plaster walls that result in cosmetic cracking are most commonly caused when gypsum wallboard, or lathe and plaster, span between two or more components of the building's structural frame that move relative to each other. The same is true for wood trim seams. Differential movement of the structural frame is commonly caused by the normal everyday environmental conditions listed above. The geometry and location of door and window openings or structural corners are significant factors for crack generation. These points are referred to as stress risers because stresses in the structural system are concentrated at these points. When a crack occurs it relieves the stress on the wall system or variable trim components. After a crack occurs, any subsequent movement in the building causes the crack to expand and contract. This is referred to as an active crack. Attempts to patch an active crack without reducing the differential movement and reinforcing the wall across the crack will cause the crack to reflect through the patching material. This is because differential movement is still stressing the wall and the crack is located at the weakest point in the system, like the weakest link in a chain, the weak point is where the failure will occur.

## **CODE UPGRADES AND CONSIDERATIONS**

I later conducted some code research to determine what, if any, code upgrades and improvements would be required, mandated, and/or enforced. My staff contacted the Code Enforcement Department for the Town of Merrimack, New Hampshire, and spoke with the Town's building code inspector, Rick Jones, to verify if the code currently in use is applicable to this existing single family structure.

The State of New Hampshire has adopted the current 2009 IBC/IRC codes, and the City of Merrimack enforces these codes. The State of New Hampshire Building Code Review Board has adopted amendments that are listed under part bcr 308 *Amendments to the International Residential Code* 2009 effective April 1, 2010 bcr 308.01, ratified June 18th, 2012. In these amendments Appendix "J" has been adopted. Therefore, Appendix "J" of the IRC "*Existing Buildings and Structures*" is the code of jurisdictional authority that is enforced for single family dwellings in Merrimack, New Hampshire.

This single family residential house suffered a tree impact event. Resulting damages were primarily limited to the upstairs master bedroom and the front left attic/roof structure. These damages require removal and replacement of interior finishes, damaged structural rafters and exterior wall stud framing.

For the purpose of completing a damage assessment and code study, after the extent of structural and cosmetic damages was accurately defined, the building code was referenced in order to classify the restoration work into a specific code defined category. Per section *AJ101.2 Classification of Work*, "*all work in existing buildings shall be classified into the categories of repair, renovation, alteration, and reconstruction*". The general scope of restoration work specifically induced by this tree hit event does require some structural member replacements. Reconfiguration of interior spaces, constructing additions, and/or elimination of doors and windows, was not required for restoration of this property to a pre-loss condition.

Therefore, it is my opinion that the restoration work at this house should be classified as a *Renovation*. Per Section *AJ201 Definitions* "*RENOVATION. The change, strengthening, or addition of load bearing elements; and/or the refinishing, replacement, bracing, strengthening, upgrading or EXTENSIVE REPAIR OF EXISTING MATERIALS, elements, components, equipment and/or fixtures. Renovation involves no reconfiguration of spaces*".

A formal evaluation by a registered design professional under the classification of Renovation is not required prior to the start of work on this residence. Per Section *AJ104 Evaluation of an Existing Building*, and *AJ104.1 General*, "*The building official may require an existing building to be investigated and evaluated by a registered design*

*professional in the case of proposed RECONSTRUCTION of any portion of a building".* The section then provides an exception, *Exception: "Detached one-or two- family dwellings that are not irregular buildings under Section R301.2.2.2.5 AND ARE NOT UNDERGOING AN EXTENSIVE RECONSTRUCTION shall not be required to be evaluated"*.

Given that the classification of work is *Renovation* and not *Reconstruction*, no formal evaluation process is required at this time. However, because some structural roof rafter damage was disclosed, I believe it was appropriate to prepare a written repair scope and also provide a concept repair plan, which have both been done.

### **Summary of findings from code study**

In summary, these code provisions require the following; systems that were damaged and demolished are to be replaced in accordance with current applicable codes; systems that are not demolished, but are to be salvaged and *repaired* may remain non-compliant to the current code in accordance with the provisions of IRC Appendix "J", and do not require upgrading beyond provisions of the original construction date code, unless an *unsafe condition* is disclosed and requires remedy.

This code study should be understood in the context provided. It is based upon my interpretation of the codes, which I believe have been supported by ICC along with my understanding of the project requirements. If varied conditions are disclosed, or differing opinions are imposed by the Authority Having Jurisdiction (AHJ), Associated Design Partners Inc. reserves the right, without prejudice, to reconsider and alter our conclusions and findings.

### **CONCLUSIONS**

My conclusions are based upon my observations, evaluation, experience, and understanding of conditions as represented in this report. My conclusions are provided with reasonable engineering certainty.

### **DEMOLITION REPAIR AND TEMPORARY SHORING**

My conceptual repair scope is based upon my observations, evaluation, experience, and understanding of conditions as represented in this report. Conceptual repair plans titled "O'BRIEN RESIDENCE, MERRIMACK, NH" have been prepared by Associated Design Partners, Inc. and have been attached to this report. Below is a brief outline of the demolition and reconstruction scope.

The scope of repairs to this building includes, but is not limited to, the replacement of the front left quarter roof structure over the master bedroom, the south-facing exterior



master bedroom wall, and cosmetic damages to the upstairs bathroom and gypsum wallboard nail pops in the master bedroom closet. Temporary weather protection of the interior finishes during the roof replacement must be carefully considered and accounted for as part of the repair project.

Conceptual Repair Scope as follows. Repairs to the roof comply with all current state and local building codes.

### **BUILDING REPAIR SCOPE**

1. Provide temporary weather protection of all interior finishes and building structure during the roof replacement project.
2. Remove all personal items from interior work areas and place in storage.
3. Temporarily shore and brace the ceiling to allow for removal of the exterior stud walls to the extent indicated on the plans.
4. Demo ceiling finishes, strapping, and ceiling insulation throughout the master bedroom.
5. Demo wall finishes, and wall insulation throughout the master bedroom.
6. Repair gypsum wallboard nail pops in master bedroom and bathroom, stairwell, and living room:
  - a. Use 1-5/8-inch drywall screws, 1-5/8-inch drywall nails, drywall compound, and a putty knife.
  - b. Drive new drywall screws a couple of inches on either side of the nail pop. Be sure to put the screws into the wall stud or ceiling joist. The screws will tighten the drywall. The new screws should barely dimple into the drywall.
  - c. Drive a new nail immediately adjacent to the popped nail using the hammer and nail set. Try to nail the new nail as close to the original hole as you can. The head of the new nail will overlap the old nail, preventing the old nail from slipping out again. Slightly recess the new nail (about a 1/16 of an inch).
  - d. Apply a coat of compound over the new fasteners and the old nail. With the 6-inch taping knife, make the coating smooth and flat. Let the compound dry completely.
  - e. Sand the patch. Lightly sand the patch with the fine-grit sandpaper.
  - f. Apply a second coat of compound. Let the compound dry, and then lightly sand it again.
  - g. Paint over the patch with primer. Don't skip this step otherwise the final paint job will not likely be uniform.

- h. Apply touch up paint to the patch in your wall color.
7. Route and patch cosmetic damages in the second floor bathroom. Paint the entire bathroom.
8. Inspect exterior wall framing after finishes have been removed, remove and replace any damaged stud framing.
9. Disconnect and salvage electrical wiring, lights, and outlets within the ceiling throughout the master bedroom.
10. Demo all roof shingles and roofing accessories, area of roofing demolition is shown on the plans.
11. Demo roof rafters and associated roof sheathing at the southwest corner.
12. Install new replacement rafters and sheathing to match existing. Rafters to be designed for all current applicable loads per IRC 2009. Double 2x6s will comply.
13. Install new 30-year architectural shingles, underlayment, ice/water shield, chimney flashings, new ridge vent, and roofing accessories to match existing.
14. Install new eave trim, siding, soffits and rakes trim to match existing.
15. Install electrical rough-in at ceiling to match existing lights and receptacles.
16. Install ceiling insulation (R-38 fiberglass – Code Upgrade), strapping, and ½” gypsum drywall. Fire tape and coat GDW joints (1) coat.
17. Prime and paint (2 coats paint) portions of the two sidewalls that were replaced, patch and paint remainder of bedroom, master bath, and living room, below to match pre-existing.
18. Reinstall salvaged electrical finishes and devices.

### **LIMITATIONS OF THIS REPORT AND ATTACHED REPAIR PLANS**

Recommendations for improvements, repairs, and remediation provided in this report and on the restoration plans are; issued for pricing only, provided in a conceptual sense, and lack the required level of detail typically included on construction documents that would be needed to ensure successful performance. Accordingly, the insured is required to commission professional assistance from a qualified design professional for design and oversight of any such improvements, repairs, or remediation efforts. Failure, on behalf of the insured, to hire Associated Design Partners, Inc. or another qualified professional for services to fully design and oversee implementation of any recommended improvements, repairs and remediation work, may result in unacceptable performance or failure of the final systems due to a lack of sufficient detail. In no way

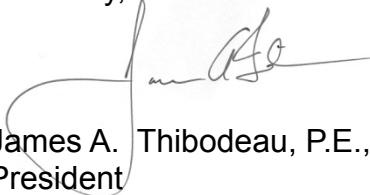
should the conceptual recommendations within this report be followed or utilized unless a registered professional engineer is hired to provide the necessary specifications, details and direction. Furthermore, the owner or other users of the information provided herein, by use or implementation of any of this information, without further direction and development from Associated Design Partners, Inc., agree to indemnify and hold harmless, Associated Design Partners, Inc. and the Insurance Carrier from any and all claims.

The attached plans are intended to be used for cost estimating and adjusting purposes only at this time, and are not yet intended to be used for construction or permitting. These *issued for review and pricing* plans reveal the extent of structural repairs and related general project requirements for restoration of this property, inclusive of code upgrade considerations. Stamped construction documents intended for use in permitting and reconstruction can be provided upon request at a later date and may include additional detail. Also, construction administration and observation services will be needed through completion of the repair work.

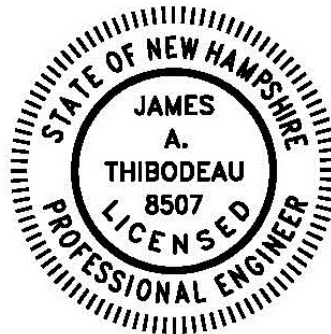
This letter report should be understood in the context provided. It is based upon visual observations, and understanding of conditions as represented. If varied or unforeseen conditions are disclosed, Associated Design Partners Inc. reserves the right, without prejudice, to reconsider and alter our conclusions and findings.

Your questions and comments regarding this report are welcome.

Sincerely,



James A. Thibodeau, P.E., S.E., DFE  
President  
Associated Design Partners Inc.



Attachments: Photographs  
Conceptual Repair Plans