

APPROVED JANUARY 12, 2016

The regular meeting of the Douglas County Planning Commission was held on Tuesday, November 10, 2015 in the Douglas County Commissioner Meeting Room of the Douglas County Administrative Building, 1616 8th Street, Minden, NV.

PLANNING COMMISSIONERS PRESENT: Frank Godecke; Kevin Servatius; Margaret Pross; Jo Etta Brown; James Madsen; Anje de Knijf and James Beattie.

STAFF PRESENT: Cynthea Gregory, Deputy District Attorney; Mimi Moss, Community Development Director; Hope Sullivan, Planning Manager; Heather Anderson, Associate Planner; Ted Kozak, Associate Planner; Jon Erb, Civil Engineer III; and Laure Penny, Clerk to the Board.

Call to Order and Determination of Quorum.

Chairman Godecke called the meeting to order at 1:02 p.m. and determined a quorum was present.

Pledge of Allegiance.

Member Madsen led the Pledge of Allegiance.

Public Comment. (No Action Can Be Taken)

Jim Slade stated it should have been anticipated there would be an overflow crowd today and other arrangements should have been made.

Public comment closed.

For possible action. Approval of Agenda.

No public comment.

MOTION by Brown/de Knijf to approve the agenda; carried unanimously.

For possible action. Disposition of the October 13, 2015 Meeting Minutes.

No public comment.

MOTION by Brown/Madsen to approve the meeting minutes of October 13, 2015; carried unanimously.

Public Hearings.

1. For possible action. Discussion on Development Application DA 15-067, a request for a Special Use Permit for a proposed 80 foot tall monopole telecommunications tower with six antennas and associated equipment. The

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subject property is located at the northeast corner of Hay Ewe Lane and Heybourne Road in the LI (Light Industrial) zoning district and in the Airport Community Plan area. The applicant is Complete Wireless Consulting, Inc. APN 1320-05-001-007

Heather Anderson, Associate Planner, provided the background on this project. She commented the past concerns have been alleviated with new conditions. She went on to discuss the powered traffic pattern; code provisions and landscaping requirements. The applicant is in agreement with all conditions except condition 13. The applicant has requested this be clarified. Staff is recommending condition 13 read: *The applicant shall sign and record with the Douglas County Recorder a legally binding agreement limiting any pertinent co-location capital costs assessed to other service providers to a pro rata share of the ground lease, site acquisition costs, design, capital costs for construction of the tower including associated permitting cost, and reasonable maintenance, repair and replacement costs.* Staff recommends approval of the Special Use Permit subject to recommended conditions of approval contained in the staff report and the recommended modification to condition 13.

Member Pross would like to see some money held in an escrow account just in case the site is abandoned and the County has to clean it up. Hope Sullivan, Planning Manager, responded at this time cell towers are not subjected to that requirement.

Member Pross asked if that requirement could be codified for cell towers. Ms. Sullivan responded if the Planning Commission would like to consider it then staff could prepare the text for them to review.

Vice Chairman Servatius wanted to make sure Bobbi Thompson, Airport Manager, was in agreement with the changes. Ms. Anderson responded that she is.

Member Madsen stated he would like to see the pole painted white. Ms. Anderson responded they could modify condition 18 to specify the paint color.

Member Brown asked if a light was required to be at the top of the pole. Ms. Anderson responded it is proposed to have a light on the top. In the conditions it says "if it's required by the FAA or the Airport" then there will be a light.

Maria Kim, of Complete Wireless Consulting on behalf of Verizon Wireless, stated since April 2015 they have been working diligently with planning staff and Chris Johnson, Airport Operations Manager, to reach a location, height and design everybody can agree on. Ms. Kim commented she could provide a picture of what the pole would look like painted white and they are willing to keep the light in place at the top of the pole.

No public comment.

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Member Pross asked Member Madsen if a light was necessary at the top of the pole. Member Madsen responded all the bells and whistle you can put on it are an aid not a detriment. He would like to see a light on the top of the pole and have it painted white.

Member de Knijf asked if it could be a steady light instead of a blinking light. Ms. Kim responded blinking obstruction lights where the standards set out by the FAA but will check into a steady light.

MOTION by Pross/Servatius to approve Development Application DA 15-067, a Special Use Permit, to allow a new 80 foot steel monopole and associated equipment; including wording added to condition 18 regarding the color of the pole that should be painted white; condition 10 that a steady light be installed on the pole and the modified condition 13; carried unanimously.

2. For possible action. Discussion on the selection of Redevelopment Area No. 2 within the Lake Tahoe Basin area of Douglas County, per the provisions of NRS 279.524-528, for evaluation and formulation of a preliminary redevelopment area plan to be considered by the Douglas County Redevelopment Agency.

Zachary Wadle, Deputy District Attorney, stated this item is before the Planning Commission pursuant to Resolution 2015R-068. The Resolution designated certain parcels in Stateline, Nevada, Douglas County, to be evaluated for purposes of possible redevelopment. He went on to explain the stages of designating a redevelopment area. Mr. Wadle commented the preliminary plan has been drafted and reviewed by staff. NRS 279.526 has four requirements for the preliminary plan and the drafted preliminary plan satisfies these requirements. Staff is recommending the Planning Commission move to select Redevelopment Area No. 2; find the preliminary plan is sufficient under NRS 279.526 and approve the preliminary plan for Redevelopment Area No. 2 including directing it be submitted to the Douglas County Redevelopment Agency.

PUBLIC COMMENT

Lew Feldman of STAR stated STAR has worked closely with the County Manager, the District Attorney's Office and staff in advancing this for the Planning Commission's consideration. He explained the Stateline area has suffered a down trend through the years and he believes a redevelopment area will invest them with the tools to help reverse the spiral. He encourages the Planning Commission to look favorably upon the staff recommendation.

Jim Slade stated he has general concerns about RDAs. They usually rely on tax increment funding taking monies that would otherwise go to the County and give them to the redevelopment area to spend as they see fit. Mr. Slade commented an

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RDA is for blighted areas. He doesn't believe the Casino corridor has blight and he doesn't feel it meets the NRS requirements.

Steve Teshara commented he believes the staff report does include a discussion of blight and the activities at Lake Tahoe have to be consistent with the adopted 2012 Lake Tahoe Regional Plan Update with the adopted area plan for Stateline and consistent with the Tahoe-Douglas Area Plan. He urges the Planning Commission to approve the proposal.

Public comment closed.

Member Pross asked Mr. Wadle to address the issues that were raised by Mr. Slade regarding NRS 279.526. Mr. Wadle responded a full study will be prepared on the conditions that may or may not constitute blight. This will be part of all the documentation going forward to determine if this does get formed as a redevelopment area.

Member Brown asked Mr. Wadle how they would work within the confines of NRS 279.470 to acquire property for the development project. Is eminent domain to be used and if so, how? Mr. Wadle responded at this stage it's too early to answer those questions.

Vice Chairman Servatius defined what he sees as blight and he implored his fellow commissioners to get behind this recommended motion.

MOTION by Brown/Beattie to select Redevelopment Area No. 2 as set forth in Resolution 2015R-068; find the preliminary plan is sufficient under NRS 279.526 and approve the preliminary plan for Redevelopment Area No. 2 including directing it to be submitted to the Douglas County Redevelopment Agency consistent with NRS; carried unanimously.

3. For possible action. Discussion on Development Application DA 14-064, a request for a Special Use Permit to allow an open and subsurface mining operation for the removal of aggregate and materials for processing, including a portable concrete batch plant and asphalt plant. The request also includes a variance to roadway improvement standards allowing asphalt grindings for Stockyard Road, Heybourne Road and Muller Parkway. The subject property is located at 2118 Stockyard Road in the PF (Public Facilities) zoning district and the East Valley/Pinenut/Johnson Lane Community Plan areas. The applicant is Douglas County Sewer Improvement District (DCSID). APN: 1321-00-014-026

Member Beattie disclosed for the record he is a resident of the Kingsbury General Improvement District. He also took a tour with Rob Anderson of the site but it will not affect his decision today.

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MOTION by Beattie/Madsen to continue this item to the December meeting at a location to be disclosed which can comfortably seat 200 people;

The applicant, Mike Bradford Chairman of DCSID, stated he would like to proceed today and not continue this until next month.

At this time a roll call vote was taken:

- de Knijf – Aye;
- Beattie – Aye;
- Brown – Aye;
- Madsen – Nay;
- Pross – Nay;
- Servatius – Nay;
- Godecke – Nay;

MOTION; fails with a vote of 4-3.

Vice Chairman Servatius disclosed for the record that in 1992 -1995 he sat as a board member of the Douglas County Sewer Improvement District (DCSID) representing the Gaming Alliance in Tahoe. He also has received numerous emails on this item and he has had discussions with the President of Harrah's and Mike Bradford.

Member Pross stated she has received over 300 emails and has had several residents approach her.

Member Madsen disclosed for the record that he, Chairman Godecke, Rob Anderson, Jeff Wass, Clarence Burr and Mark Neddenriep met in Mark Neddenriep's office on October 24, 2015. It will not affect any decision he makes.

Member Brown disclosed for the record she has received numerous emails, calls and visits from neighbors. She has also toured the site and none of this will affect her decision today.

Member de Knijf disclosed for the record she went on the October 31, 2015 bus ride that took the route that is being recommended for the trucks. This will not affect her decision.

Chairman Godecke disclosed for the record that he was in attendance at the meeting with Member Madsen and representatives of the applicant. He has received numerous emails and has gone to the site on his own and walked the perimeter. This will not affect his decision today.

Member Pross asked for clarification on page 21 of the application. Hope Sullivan, Planning Manager, responded design review is subject to review and approval by the

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Community Development Director. So the only items before the Planning Commission are the items for recommendation to the Board of Commissioners.

Ms. Sullivan provided history and background information and various maps for this project. She discussed some changes that have been made since it was brought forward in December 2014. Ms. Sullivan stated staff has received visits from various residents along with numerous emails. The opposition has noted the truck traffic, noise, lighting, degradation of the quality of life and the impact on property values. Those in support have focused on economic vitality, sewer rates and flood control. Ms. Sullivan commented the Planning Commission is acting in an advisory manner. They will review the Findings of Fact for both the Special Use Permit (SUP) and the variance and then they will make a recommendation to the Board of County Commissioners. Ms. Sullivan reviewed each Finding for the SUP.

Ms. Sullivan went on to discuss the variance request. She commented the County Engineer has reviewed the proposed requests for the variance and has found them to be acceptable from a safety perspective. Staff was able to make the Findings for the variance.

Ms. Sullivan stated they are recommending on the SUP that the Planning Commission recommend to the Board of County Commissioners that they approve the SUP based on the conditions that staff has identified in the staff report coupled with the modified language staff has included in the memo of November 9, 2015 to the Planning Commission. Additionally the staff is recommending approval of the variance to the roadway standards based on the conditions in the staff report.

Member Pross asked what kind of paving they would be using on Stockyard Road. Jon Erb, Civil Engineer III, responded they are proposing to use grindings on the road. It is recycled asphalt that is laid down, oiled and rolled.

Member Beattie asked if any controls or requirements for odor and oil particulates released from a batch plant had been considered. Ms. Sullivan responded she has not researched that. Member Beattie suggested having it as a consideration in the SUP.

Member Beattie commented he has concerns about the exhaust brake and how it can be heard from a distance. He felt it would be appropriate to apply the "no exhaust brake use" over the whole truck route. He also suggested adding a section to Chapter 10.060 applying NRS 484 to these roads.

Member Madsen commented he did not understand how staff has bumped the zoning up to heavy industrial use when it is zoned as communication, transportation and utility property of a local nature. He then asked to have "local deliveries" defined. Mr. Erb responded a local delivery is a delivery that is off a street that you cannot get to from any other street. Ms. Sullivan responded in condition 24 it does say any modification to haul route shall be subject to review

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and approval by the Board of County Commissioners. She commented she did meet with the Assessor to determine what the impact would be should the SUP be approved. The assessment would change, the property taxes owed would change and the equipment utilized on the site would be taxed.

Mimi Moss, Community Development Director, clarified the Bing Pit and its zoning. The Assessor Land Use Code does not necessarily reflect the actual zoning of actual use on the property and how that is taxed and assessed.

Member Brown asked how many times the trucks would pass Grandview when leaving the site. Mr. Erb responded there would be approximately 180 trucks passing during an 8 to 10 hour day.

Member Pross wanted clarification on condition 5. She wanted to know where the berm would be located. Ms. Sullivan responded she is suggesting from the southwest corner along the 1800 linear feet. This berm would be a sound mitigation measure.

Member de Knijf asked when the proposed stoplight was going to be installed. Mr. Erb responded he is currently working on the details with NDOT. Member de Knijf asked how much a traffic light costs. Mr. Erb responded he didn't know for sure.

Vice Chairman Servatius asked the cost of importing aggregate. Mr. Erb responded aggregate is a market driven commodity and it depends on the contractor and where they are getting the aggregate from. Vice Chairman Servatius asked if having local aggregate would lower the cost to the County. Mr. Erb responded it depends on the size of the project and if the contractor is local or not. Ms. Sullivan commented if we were to have local aggregate it would remove other truck traffic from the road.

Member Pross asked if the Planning Commission could condition this application that an ordinance regarding the haul route must be passed in order for it to go forward. Ms. Sullivan responded the applicant can't control if the Board of County Commissioners choose to adopt an ordinance. It will be up to the Board of County Commissioners if the ordinance is necessary to make the required Findings.

Member Pross asked if the non-use of the exhaust brake is enforceable. Cynthea Gregory, Deputy District Attorney, responded there are two forms of enforcement. You can enforce through the SUP or the Sheriff's Department through a criminal process. For the Sheriff to enforce you would need an ordinance in place.

Vice Chairman Servatius asked if Mr. Bing has a defined truck route. Ms. Sullivan responded yes he does. Ms. Sullivan is suggesting they use the same language for DCSID. Vice Chairman Servatius wanted to know what the requirements were for Mr. Bing in regards to noise, dust and lighting. Ms. Moss responded Bing's SUP was amended in the early 2000's to expand the area for the aggregate use. Ms. Moss

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discussed all the conditions that had to be met for the amended SUP. Ms. Gregory provided some more background and history on the Bing Pit.

Member Pross asked when Bing was issued their first SUP. Ms. Gregory responded the first formal SUP was issued in 1971. Member Pross and Ms. Moss discussed Temporary Use Permits and why staff was not requiring DCSID to have one.

Chairman Godecke wanted to clarify if it was 60 decibels or 65 decibels. Ms. Sullivan responded it is 65 decibels. Chairman Godecke then asked about dust control. Does that fall under NDEP standards? Ms. Sullivan responded yes but grindings have been utilized for dust control by the County.

Applicant, Mike Bradford, President of DCSID gave a presentation on the Buckeye Creek Reservoir Project. He then provided some background on their application request.

Rob Anderson, R.O. Anderson Engineering, discussed the site plan, haul route map, road improvements, flood control, aggregate demand and needs and being able to use treated effluent water to wash the aggregate.

Mr. Bradford spoke on some of the misunderstandings and misconceptions by the public. He then discussed the community benefits of the project.

PUBLIC COMMENT

Rob Hopkins, General Manager for DCSID, stated he understands the emotions but the jobs this project will bring will support many people. Communities are built on good decisions.

Dan Morris commented he is glad the route was changed but he is worried about property values and is opposed to the gravel pit.

Phil Humphries stated the project will pay for itself and that's a benefit for the County. He doesn't believe the project is in conflict with Land Use Policies and he is in support of the project.

Jeff Monroe believes the project is a benefit for the County and he is in support of the project.

Leona Pchelkin commented she is the closest resident to the facility and she is worried about the truck traffic. She is opposed to the project.

Nick Pchelkin stated he is concerned about water usage and wanted to know what using effluent water would do to the gravel. He asked who would regulate the truck route. He is opposed to the project.

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Dr. Eldon DeVere Henderson stated he has written a paper that rebuts many of the points that are made in the memorandum written by staff. He believes this should be divided into three separate projects. He commented truck noise would be high and this project is not consistent with Land Use Policy 2.4. He is opposed to the project. (See Attachment A).

Dan Greenlee commented the project is not in compliance with the Master Plan and the traffic on Stockyard Road would affect him. He is worried about noise and health issues. He is opposed to the project.

Gail Durham stated she is worried about noise, dust, fumes and water. She is opposed to the project.

Paul Sandberg stated he is worried about Silicosis, traffic, noise, fumes and regulating traffic. He is opposed to the project.

Dick McCole stated he is worried about property values. He referenced a Virginia study which showed correlations between property values and gravel pits (there is a 5% to 15% reduction in property values).

Bob Ballou stated he is concerned about dust and Silicosis. He opposes the project because it violates the Master Plan.

Robert Pohlman stated he supports the project.

Jim Hillman stated he is concerned about traffic and the way the truck route signs will read. He's also concerned the signs don't cover return trips.

Dave McNeil stated he is concerned about noise, traffic and odor. He commented it will destroy their dream home they are in the process of building. He opposes the project.

Lee McKinney is in support of the project. She asked the Planning Commission to review the facts and not vote on emotions.

Karen Derso commented relining the reservoir was dismissed by the applicant and she'd like the Planning Commission make the applicant provide a reason. She is worried about dust, noise, traffic and fire. She is opposed to the project.

Bruce Cable is in support of the project and thinks it would be good for the County.

Cameron McKay commented the dust will blow towards the Pinenuts. He then discussed the quality of life: the traffic issue has been resolved and noise is not an issue. He stated an increase in the rates will affect the businesses up in Tahoe immensely. He is in support of the project.

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Jim Derson stated he is worried about traffic and doesn't think the Findings have been met. He opposes the project.

Sharon Kelly is concerned her quality of life will be destroyed and the project will cause financial and emotional distress to the residents. She is also worried about health issues, property values and tax increases. She opposed the project and believes the ponds should be lined and the cost be passed on to the Tahoe rate payers.

John Kelly reads a letter from the Winhaven Homeowners Association opposing the project. (See Attachment B).

Gary Griffith discussed a batch plan and a temporary permit for a batch plan. He is worried about quality of life and property values. He opposes the project.

Tony Crescimanno stated he had spoken with the Nevada EPD about their regulations for aggregate mining. He is concerned about air, soil, water and noise pollution. He believed it violates the goals and Land Use Policies.

Joe Hayes stated he supports the project.

Roy Clason stated he support the project.

Shele Pandl stated the project is incompatible with Land Use Policies 2.4 & 2.7. She is concerned about property values.

David Butcher stated he is opposed to the project and he is worried about quality of life and property values.

Tim Trenton, General Manager for the Mont Bleu Casino stated he supports the project. He believed it's best for the County moving forward. He hopes the Planning Commission doesn't make a decision based on emotion and they base their decision on the credence of the project.

Carol Chaplin stated she supports the project and can't understand why we are still discussing it. There is only an upside. The Planning Commission needs to separate facts from emotion.

Kelly Krolicki commented she thinks this is a good plan. She has listened to and considered all the comments from the public and is in support of the project.

Ann Grant read a letter into the record supporting the project.

Bill Kirschner stated he supports the project.

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Michael Davis stated he used to haul gravel for Bing and he has seen a lot of changes around the pit over the years. When traffic on Tillman got to be too much they implemented a new truck route. Ever since that implementation he has had no problem or complaints. He believed the gravel industry provides good jobs and he supports the project.

Stacy Noyes commented one community one economy. She believed it benefits the Lake and the Valley and supports the project.

Bobby King, General Manager of Edgewood Tahoe stated he supports the project. He believes it will stabilize costs for residents, businesses and employees.

Jan Heaton stated she doesn't believe the project meets the Master Plan, Goals or Land Use Policies. She is concerned about water and wants to know what the EPA says about the project. She is opposed to the project.

Andrew Strain, represents Heavenly Mountain Resort stated he supports the project. He believed there are multiple benefits for the entire county.

John Chiara stated he doesn't think the material meets concrete building code requirements. He is worried about his wife's health. He is opposed to the project.

Maryam Young stated she is concerned about water and their wells. She feels the applicant is being vague about the water use. She is opposed to the project.

John McLaughlin stated he supports the project and is happy it doesn't require any bonds.

Molly Coolidge, representing Barton Health stated she supports the project. She is impressed and believes it is innovated, economical, supports local material and provides jobs.

Brian Foster stated he supports the projects and feels it will help resolve some of the problems.

Michael May commented he is concerned about the Buckeye Creek which runs through his property. He stated he was asked to move off his property and return Buckeye Creek to its original state. He is in support of the project.

Robert Stewart commented he is worried about pollution and its impact on the Valley. He is opposed to the project.

Ben Johnson stated he was hired to evaluate if property diminish would occur. He commented he hasn't found that it will affect property values. He is in support of the project.

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Kristine DeMorris asked the Planning Commission to protect the Valley. She is opposed to the project.

Todd Poth stated he doesn't believe the project will have an adverse effect on the County. He is in support of the project.

Mr. Butler stated he supports the project and believes it will benefit everybody.

Natalie Yanish stated the residents of Douglas County all want the same thing. They want a responsible development for the County and they want infrastructure that benefits all the residents. She is disappointed that there are so many misconceptions floating around. She is in support of the project.

Peter Mileo stated he is worried about traffic and the trucks using his road instead of the haul route. He doesn't believe the project meets the Master Plan and he is concerned about the water.

Joe Nady commented forward thinking is good and that's the Planning Commission's job. He supports the project.

Chuck Scharer, President of Edgewood Companies stated he supports the project. He believes successful completion of this project will affect a large portion of Douglas County residents and businesses by stabilizing sewer rates. He also believed the project is consistent with Douglas County's history of intelligent progress.

Leslie Bergquist stated she is concerned about noise pollution, water and property values. She opposes the project.

Mark Ayers believes it's a trust issue; Tahoe wins and the Valley loses. He's worried about quality of life. He opposes the project.

Margaret Vanderlaan commented what might work in one neighborhood doesn't work in another neighborhood. She believes the policies of government should be neutral or beneficial to all constituents. She opposes the project.

Don Bird commented he doesn't believe a government entity should get into the commercial business. He opposes the project.

Kurt Cleek commented he doesn't believe that effluent water is going to be used. He's worried about contaminated wells and water. He opposes the project.

Jeff Wass stated he believes the concerns about traffic have been corrected and he supports the project.

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Eyrnn Dues stated she is worried about contamination, use and noise. She opposes the project.

Dan Spano stated he supports the project. He believes property values will not diminish and that flood mitigation and stable sewer rate will improve sales.

Kas Monson felt she will be very affected by the gravel pit. She is concerned about health issues, property values and water. She is opposed to the project.

Don Atwan stated he supports the project and thinks it will be great for Douglas County.

Mary Atwan stated she believes it's a win/win. She supports the project.

Don Caspary stated he supports the project.

Tamara Reid, representing SCM Homes of Nevada stated they don't oppose or support the project.

Bill Chernock, representing the Carson Valley Chamber of Commerce stated they support the project and feel all the concerns have been mitigated.

Carlo Luri read a letter into the record from the Bently Corporation regarding its agreement to DCSID to use their roads. He supports the project.

Greg Reed as District Manager for Round Hill GID and a Douglas County resident supports the project.

Bob Wage stated he doesn't believe the zoning is appropriate for the gravel pit and he opposes the project.

Matt Brady stated his home in Southern California was affected by a gravel pit. He is opposed to the project.

Jim Slade stated he doesn't believe the project meets the Findings and he believes it's inconsistent with the Master Plan. He opposes the project.

Dennis Thran wanted to applaud the growth in Douglas County so far but he does not support this project.

Bev McMahon stated she feels it would benefit the County and she supports the project.

Steve Teshara thanked everybody for their hard work and commented the animosity between the Valley and the Lake is hard on Lake residents. He supports the project.

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Steven Figueroa stated DCSID has had seven years to raise fund to line the ponds. He believes it would be detrimental to the Valley and people's health. He opposes the project.

Carl Rubaudo commented this is a regional issue and it will impact a lot of people in a lot of ways. He supports the project.

Greg Felton commented he believes the project will help flooding and it will offset costs by selling aggregate. He stated the water that is being pumped out of the Lake and sent down to the Valley is helping the ground table problem. He supports the project.

Bryan Davis stated he supports the project and he believes it will provide good jobs and benefits.

Michael Thomson stated he supports the project. He wants his children to have a bright future in Douglas County and believes the project will help with that.

Greg Brown commented local agencies are better at implementing local projects and handling local concerns. He supports the project.

Lew Feldman stated he is impressed by DCSID and how they have addressed all the concerns. Mr. Feldman commented we know Bing is going to run out of aggregate and having a local resource is important. He supports the project.

John Steinbach, General Manager of Lake Tahoe Resort Hotel stated the Lake provides a significant tax base and a sound plan offers benefits to the Lake and the Valley. He supports the project.

Steve Seelbinder thanked the Planning Commission and staff for all their hard work. He believes all concerns have been negated and the project is well defined and well discussed. He supports the project.

Klaus Utecht stated he supports the project. He went and looked at the site and believes it is invisible to most residents. He also believes the wind will carry the dust towards the Pinenuts.

Al Browne stated he supports the project. He used to live at the Lake and moved to the Valley and he loves it here. He commented change is being forced upon people because of limited supplies in the Valley.

John Koster, Regional President for Harrah's/Harvey stated if there is something DCSID missed while working on this project he asked people to bring it to their attention. He supports the project.

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Jeff Baschola stated he echoes all the concerns of the East Valley residents. He believes there should be a stipulation that a local pit operator be hired. They will be good stewards of the pit. He commented he is neither opposed or in support of the project.

Public comment closed.

Vice Chairman Servatius asked about the haul route and if DCSID has an easement through Bently. Mr. Bradford responded they do have a commitment through Bently for that but until they have project approval there is no signed agreement. Mr. Anderson responded this is an amendment to the existing agreement that DCSID has with Bently. It incorporates the changes, which is a formal agreement that will be structured as an easement when finalized.

Vice Chairman Servatius commented he'd like to add a condition to the SUP that DCSID and Bently have an agreement to use the road and he asked if DCSID is willing to accept that as a condition. Mr. Bradford responded yes and getting the agreement is necessary from the District's point of view to ensure this project goes forward.

Vice Chairman Servatius then asked DCSID to clarify their plan/intentions of water use. Mr. Anderson responded they will either use underground wells or effluent.

Member Beattie asked Mr. Anderson what the date of letter was that stated they could use effluent water. Mr. Anderson responded November 9, 2015. Member Beattie commented based on what the letter says DCSID cannot use effluent water until the State says it meets regulations. Mr. Anderson responded that is correct.

Member Beattie then asked if there was a condition on the SUP that said DCSID was to administer traffic control would they be willing to enforce or have their contractor enforce. Mr. Bradford responded they would do that. They have made a commitment to Bently to have truck speeds restricted on Bently roads.

Member Madsen asked if using effluent water will increase nitrate levels in the ground. Mr. Anderson responded the ground is not saturated with nitrates. We never saw 10 milligrams per liter of nitrogen in the groundwater. Also the ability to use effluent is predicated upon a modification to the discharge permit. Mr. Bradford responded the District is and has been proactive in responding to environmental issues and they have to comply with environmental need.

Member Madsen commented he thinks the fact the District is contributing \$68,400 to the roads is above and beyond what is required by the County. Per NRS developments can be taxed for their impact on the roads but the County has never done that. Mr. Anderson responded the money they are contributing is for maintenance of the roads. The Impact Fees in NRS is for funding Capital Improvements for Transportation related impacts from development. Mr. Bradford

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commented the money they are willing to contribute towards road maintenance demonstrates what they believe is good for the County.

Member Brown asked if the \$68,400 is a one-time occurrence or over the life of the project? Mr. Anderson responded it is a one-time fee distributed over a five year period.

Member Brown commented one of the resident's mentioned being concerned about hiring locally instead of hiring from outside; what is the District's response to that? Mr. Bradford responded the District is a public entity and they have to issue a request for proposals. Mr. Bradford believes there is great merit in relocating an existing operator, employees and equipment.

Member Brown asked who is responsible for monitoring noise, dust and any other environmental issues. Mr. Anderson responded the equipment is monitored by the Mine Safety & Health Administration (MSHA); dust and air quality is monitored by Nevada Division of Environmental Protection, Air Quality Bureau. Per the conditions of approval a noise study needs to be done in advance and then done periodically once the operation gets going to make sure they are meeting the 65 db.

Member Pross stated in Section 20.664.130 it states that all private access roads shall be paved with asphalt or concrete surfacing. Mr. Anderson responded he believed the condition of approval requires them to improve the intersection of East Valley Road with permanent pavement.

Vice Chairman Servatius commented in December 2014 the Planning Commission approved a modification to an existing SUP to allow for construction of one lined reservoir and made a recommendation for the SUP. He then asked Mr. Bradford why at that time he didn't just take it to the Board of County Commissioners. Mr. Bradford responded the District had felt that was an option but they also recognized there were problems with how the project was perceived so they decided to make some changes and bring it back to the Planning Commission.

Member Beattie asked about the limitation of use of the exhaust brake while on the property. Ms. Sullivan responded in the zoning ordinance and Master Plan it discusses the noise that is created by a certain use and it looks at use on private property but it doesn't cover anything off property which is why staff is recommending where you have residential areas an exhaust brake cannot be used. Member Beattie asked Mr. Bradford if they would be willing to enforce the no exhaust brakes on site. Mr. Bradford responded absolutely.

Vice Chairman Servatius commented he is very impressed with the mitigation steps taken and the hard work staff has done. He feels all the Findings have been met; it's an important project for the community and he supports the project.

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Member Pross discussed the Findings, Goals and Policies she felt had not been met and why. Finding A is not met for the following reasons: Land Use Element Introduction; Land Use Policy 2.4; Land Use Policy 2.5; and the East Valley Community Plan – East Valley Goal 1. Member Pross felt it's not in an appropriate location because it will have a negative impact on the residential living environment. She felt this is a heavy industrial use and you cannot mitigate the noise from the trucks. She does not feel that the berm on Stockyard Road will help with this noise that instead it will draw attention to the problem. She stated the project would be visible to several homes in the area. Finding B: Member Pross commented she does not negate the mitigation the applicant has tried to do but there are some things the applicant can't fix, such as the homes that have a line of sight to the project. Finding H: She felt it will be detrimental to the properties surrounding and nearby. There is also a concern for the wells in the area. She is opposed to the project.

Member Madsen commented he commends everybody's efforts but it doesn't conform to the Master Plan; Land Use Policies 2.4, 2.7, 3.4, 4.1, 6.2 and 6.3 and Goals 1, 2, 3 & 4 – Specifically Rural Residential, Chapter 2, page 3 and page 26. He is opposed to the project.

Member Brown commented a lot has been done to mitigate the problems. She then discussed the Findings she felt had not been met. Finding B: Member Brown stated she is concerned about onsite impacts; including visual, noise and water use. Finding D: There is no current written agreement provided to guarantee that a private road will be available for use over long term; the Ordinance for truck usage is not yet created; she feels the \$68,000 for road maintenance is not enough for the time period proposed. Finding H: Member Brown stated she is concerned with onsite visual impacts particularly lightning and noise. She is opposed to the project.

Member Beattie commended the efforts of the staff and applicant. He suggested putting in an extra condition related to traffic control which would read: *the applicant directly or through its contractor shall administer and enforce reasonable speed limits and safe vehicle operating condition for all DCSID and DCSID contractor vehicles on all private traveled roads to the requirements of NRS 484 and Douglas County Code Chapter 10 providing that the Bently Organization concurred.* He supports the project.

Member de Knijf discussed the Findings, Goals and Policies she felt had not been met. They are Land Use Goal 2 and East Valley Goal 1. As for the Findings Member de Knijf felt having up to 100 trucks a day is inappropriate for the land use and material harm to property values. She is opposed to the project.

Chairman Godecke commented he was in favor of this in 2014. He appreciated the flood detention basin and feels there is a need to have a Storm Water Master Plan. The County also needs a source of aggregate. Chairman Godecke felt the Findings had been met. He supports the project.

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Vice Chairman Servatius stated he doesn't feel 100 trucks a day is an accurate number. He also stated you could not find a better place to put an aggregate plant in Douglas County and he thinks it's a shame the Planning Commission is back pedaling on this important decision.

First MOTION by Pross/Madsen to deny Development Application DA 14-064, Special Use Permit for Open and Subsurface Mining based on discussion and the Findings of the Planning Commission

At this time a roll call vote was taken:

- de Knijf – Aye;
- Beattie – Nay;
- Brown – Aye;
- Madsen – Aye;
- Pross – Aye;
- Servatius – Nay;
- Godecke – Nay;

MOTION; carried with a vote of 4 to 3.

Second MOTION by Madsen/Pross to approve the variance with conditions; carried unanimously.

4. For possible action. Discussion on Development Applications DA 15-049, a request for a Master Plan Map Amendment, and DA 15-050, a request for a Zoning Map Amendment to redesignate 10.03 acres adjacent to the Genoa Lakes Ranch Golf Course as follows: 1) Master Plan Map Amendment (ref. PC Resolution No. 2015-02) to change the land use designation from Commercial to Multi-Family Residential (6-16 du/acre), and (2) Zoning Map Amendment to change the zoning district from TC (Tourist Commercial) to MFR (Multi-Family Residential). The property is located at 420 Mountain Meadow Drive in the Genoa Community Plan Area. This application is being made concurrently with a request for a Planned Development (PD) Overlay, a Tentative Subdivision Map, and associated variances. The applicant is Sloan Gordon for Gordon Consulting, Inc. APN: 1419-26-202-001

Heather Anderson, Associate Planner, provided background information along with the existing Master Plan Map. She commented they had received several letters of opposition from the public; the primary concern being the density of the project. Ms. Anderson stated the staff recommends the Planning Commission adopt PC Resolution 2015-02 forwarding the recommendation of approval of the Master Plan amendment to the Board of Commissioners.

Ms. Anderson went on to discuss the zoning map amendment. She went over the code provisions and provided various zoning maps.

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Vice Chairman Servatius wanted to know if staff was addressing the density issue. Ms. Anderson responded the density, in this case, is dictated by the Master Plan. In a SFR zoning the density is dictated by the zoning. Vice Chairman Servatius asked what zoning was being recommended. Ms. Anderson responded the application is for Multi-Family Residence (MFR) for both the Master Plan and the zoning and that can be 6 to 16 dwellings per acre. Hope Sullivan, Planning Manager, wanted to add to Ms. Anderson's response. She stated the land use description and zoning identify a scope of density from X to Y. In approving a Master Plan or Zoning Map amendment the Planning Commission is not allowed to change the density. If this is approved staff will be considering a Planned Development (PD). As part of the PD the Commission could look at some type of limitation on density because with a PD you can modify the dimensional criteria.

Cynthea Gregory, Deputy District Attorney, stated the PD is an overlay zoning which would set it at 7.5 dwellings per acre. Vice Chairman Servatius asked if they could make density a condition. Ms. Gregory responded with regards to the PD you would set the density but you couldn't set it less than 6 dwellings per acre.

Chairman Godecke asked Ms. Sullivan if in the event the Planning Commission approves this Master Plan and Zoning Map amendment to its current level and then they look at the PD and they approve the PD there is no guarantee that in a few years the applicant couldn't come back and say he wants 16 units per acre. Ms. Sullivan responded that is correct. Chairman Godecke then commented or the property could sell and somebody could change the density. Ms. Gregory responded what you need to remember is the PD is an overlay zoning and it would still be setting the density. Two things could happen Community Development could come forward and request removal of the PD overlay zoning or whoever came in and bought the property would have to take it with the PD zoning that set the density. If they wanted greater density they would have to come forward and request it. Chairman Godecke commented the Master Plan amendment allows them to be able to come forward and ask for a change in density.

Member Madsen asked staff how they came up with the Land Use Policy for MFR zoning.

Member Brown asked why Multi-Family Residential (MFR) and not Single Family Residential (SFR)? Ms. Anderson responded the applicant is requesting MFR because of the density they are asking for. And within the MFR single family dwellings are allowed.

Vice Chairman Servatius asked if any of the adjacent properties had this sort of density. Ms. Anderson responded no, not with this exact density.

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Mimi Moss, Community Development Director, wanted to clarify the zoning in terms of the intensity of use. The property to the south is zoned Tourist Commercial. Tourist Commercial allows for retail and lodging.

Member Pross commented the MFR zoning is more compatible with the surrounding area than the Tourist Commercial zoning. Ms. Moss responded it is viewed as less intense use.

The applicant, Rick Gardner, provided some background and history on the property and his family. Mr. Gardner discussed what they had planned for the project. He then went on to explain the process that brought them to this point. Mr. Gardner provided information on the lots and the lot sizes.

Member Pross asked if there was room in the back of the house for a patio. Mr. Gardner responded yes they can be used as backyards but nothing requiring a building permit could be put back there.

Chairman Godecke asked Mr. Gardner if the property to the south is zoned Tourist Commercial and if it was owned by Mr. Gardner. Mr. Gardner explained how the property was divided when they bought it.

Member de Knijf wanted to know if a buyer would be purchasing just the footprint of the house. Mr. Gardner responded yes.

PUBLIC COMMENT

Jim Glaser stated he doesn't think the density of this project fits the area and asked the Planning Commission to deny the amendment.

Ted Thronson commented he believes there would be no opposition to the project if there wasn't a density issue.

Doug Slack stated he is supportive of a single family development on the property but they are opposed to a density of 7.5 dwellings. He urged the Planning Commission to deny the amendment.

Martin Hubbard commented he doesn't understand how you can build a single family residence on Multi-Family Residential zoning. He's also concerned that if this amendment is approved then the other property that is zoned commercial will build multi-family homes.

John McDonald believed Mr. Gardner's building skills would be better applied to a lower density community. He feels it should be zoned SFR 12,000.

Jim Slade commented he is always concerned about Master Plan amendments and increasing density that isn't wanted. Mr. Slade doesn't feel this project meets the required Findings.

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Public comment closed.

Member Pross commented if the Planning Commission approves this they are improving the zoning to what is already there.

Ms. Moss explained the history of how this property became zoned as Tourist Commercial and the approved density for the surrounding areas. Ms. Moss explained the MFR is a down zoning from TC.

Member Beattie asked if Douglas County has Duplex zoning or just MFR. Ms. Sullivan responded Douglas County has SFR and MFR. If there was a duplex it would be considered MFR. Member Beattie then asked if character of the surrounding area has anything do with zoning decisions. Ms. Moss responded the character is single family ownership; single family lots. It's not a multi-family apartment complex. It is similar in character because it is single family ownership; homes that are similar in size and the difference is the common area surrounding it.

Ms. Anderson added Finding C under the zoning map amendment is the proposed amendment and it is compatible with actual and Master Plan use of adjacent properties.

Member de Knijf asked if the applicant would be phasing the development. Mr. Gardner responded yes.

First MOTION by Brown/de Knijf based on the discussion and Findings in the staff report to adopt Resolution 2015-02 forwarding a recommendation of approval for the Master Plan amendment DA 15-049 from Commercial to Multi-Family Residential for the Board of County Commissioners;

At this time a roll call vote was taken:

- de Knijf – Aye;
- Beattie – Aye;
- Brown – Nay;
- Madsen – Nay;
- Pross – Aye;
- Servatius – Nay;
- Godecke – Aye;

MOTION; does not pass with a vote of 4 to 3.

(Some of the members on the Planning Commission wanted it noted that if this had been a request for SFR they would have approved the amendment)

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Second MOTION by Brown/Servatius to deny approval of the zoning map amendment DA 15-050 from Tourist Commercial to Multi-Family Residential;

At this time a roll call vote was taken:

- de Knijf – Aye;
- Beattie – Aye;
- Brown – Aye;
- Madsen – Aye;
- Pross – Aye;
- Servatius – Aye;
- Godecke – Aye;

MOTION; carried unanimously

5. For possible action. Discussion on Planned Development PD 15-001, a request for the following: 1) a Planned Development Overlay zone, changing the zoning from MFR (Multi-Family Residential) to MFR (Multi-Family Residential) Planned Development (PD) Overlay; 2) a Tentative Subdivision Map to subdivide 10.03 acres into 75 parcels, the smallest being 1,600 square feet in area (building envelope) with 2.9 acres of open space; 3) approval of three private roads; and 4) a variance to improvement standards for the road right-of-way width, roadway improvements, and allowing the utility easements to be located within the road right-of-way. The property is located at 420 Mountain Meadow Drive within the Genoa Community Plan area. This application is being made concurrently with a request for a Master Plan Map Amendment (DA 15-049) and a Zoning Map Amendment (DA 15-050). The applicant is Sloan Gordon of Gordon Consulting, Inc. APN: 1419-26-202-001

Heather Anderson, Associate Planner, provided information for Item 5 in Item 4. She then stated since Item 4 did not pass the Findings cannot be made for Item 5.

PUBLIC COMMENT

Jim Glaser urges Planning Commission to deny the PD. He doesn't think the project belongs in Genoa Lakes.

Ted Thronson commented he wanted to support the project but couldn't because of the density.

Jim Slade commented the issue is density and it's not consistent with the surrounding area or Genoa as a community. Mr. Slade also mentioned that he did not hear any Findings when the Planning Commission made their decision on Item 4.

Public comment closed.

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MOTION by Pross/Brown based on the discussion and Findings in the staff report to recommend denial of the Planned Development Overlay, Tentative Subdivision Map and requested variances subject to the conditions included in the staff report; carried unanimously.

6. For possible action. Discussion on Land Division Application LDA 15-026, a request for a Tentative Subdivision map, Tahoe Shores, LLC, for 15 lots for multi-family units on 19.73 acres, the smallest lot being 8,227 square feet. The subject property is located at 346 Eugene Drive in the R-077 and R-070A zoning districts in the Lake Tahoe planning area. The applicant is also requesting a variance to roadway standards so as to yield a road width of less than 60 feet. The applicant is Kara Thiel of Feldman, McLaughlin & Thiel LLP. APN 1318-22-002-002 and 1318-22-002-001

Ted Kozak, Associate Planner, provided background information on the project along with various maps. Mr. Kozak mentioned they had received one phone call from the public regarding the project and that individual had no opinion. Mr. Kozak then stated the staff has found the Tentative Map is consistent the Douglas County Code and NRS; the Findings are in the affirmative and they are recommending approval based upon those Findings. Mr. Kozak went on to provide information on the requested variance. The staff has made Findings in the affirmative and recommends approval of the variance.

Member Beattie disclosed for the record that he has dealt with Kara Thiel, Attorney on the project, but it was seven or eight years ago. He stated it will have no effect on his decision today.

Member Brown asked if the land had been cleared of the trailers and was ready for build out. Mr. Kozak responded not yet.

Member Beattie asked about the language in condition 13. Hope Sullivan, Planning Manager, responded that "in perpetuity" is now being added to the condition and she was sorry they missed fixing this one.

Member de Knijf asked what the process is for removing the people from their trailers. Cynthea Gregory, Deputy District Attorney, responded there are certain steps you have to go through with the State of Nevada Real Estate Division and the applicant can address that further.

Member Brown asked Ms. Gregory if eminent domain was going to be used. Ms. Gregory responded the property is already owned by the applicant.

Chairman Godecke asked if pedestrian traffic was being addressed. Mr. Kozak responded that is not being addressed at this time but the applicant can answer any questions about their future plans.

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The applicant, Lew Feldman, provided some background information on the project and how it came about. He commented this project will capture sediment going into Lake Tahoe. Mr. Feldman stated there are about 20 trailers that still need to be purchased from the owners. They are required to give six months' notice to any remaining residents. Mr. Feldman mentioned they had no problem with changing the language in condition 13 and maintaining all the improvements.

Member Beattie asked if there are any unresolved issues between the Beach Club and the KGID. Mr. Feldman responded there are no unresolved issues.

Member de Knijf asked which of the buildings is designated for the low to moderate housing. Mr. Feldman responded none of these buildings are designated. It is off site.

PUBLIC COMMENT

Jim Slade wanted to know if this property was designated to be included in the Redevelopment Area discussed earlier today. If it was would it affect this application and are any units going to be designated as affordable housing. Mr. Slade commented he has no position one way or the other.

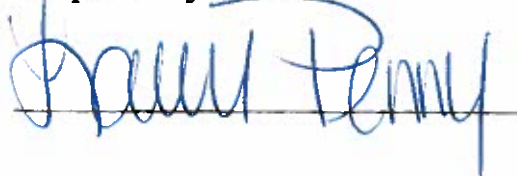
John Grisby commented he is concerned about all the people that will be displaced by this project.

Public comment closed.

MOTION by Brown/Servatius based on the discussion and Findings in the staff report recommend approval of the Tentative Subdivision Map and requested variance subject to the conditions included in the staff report and to include the following language in Condition 13 – The applicant shall provide a recorded copy of CC&R's for the maintenance of the private road in the development to be in effect for the duration of the existence of the development; carried unanimously.

There being no further business to come before the Planning Commission, the meeting adjourned at 11:27 p.m.

Respectfully Submitted:

A handwritten signature in blue ink, appearing to read "Paul Penny", written over a horizontal line.

Approved:

A handwritten signature in blue ink, appearing to read "Frank Godecke", written over a horizontal line.

Frank Godecke - Chairman

Rebuttal of Recommendation to Approve Development Application DA 14-064

Written and Submitted By

**Eldon DeVere Henderson, PhD System Engineering, MS Aeronautical Engineering
1365 Rabbitbrush Drive, Gardnerville, NV 89410**

Development Application DA 14-064 is a request for a Special Use Permit to allow an open and subsurface mining operation for the removal of aggregate and materials for processing, including a portable concrete batch plant and asphalt plant. Planning Commission Staff recommends approval of the application and alleges that the application is not contrary to Douglas County Master Plan provisions. Specifically the Staff alleges in its findings that the application does not conflict with Master Plan Land Use Policy: "LU Policy 2.4: Douglas County shall use its planning and development regulations to protect residential neighborhoods from encroachment of incompatible activities or land uses which may have a negative impact on the residential living environment."

This Finding is not supported by robust analyses and presentation of supporting facts. There is evidence that Staff has not done due diligence in investigating the science and engineering factors that are relevant to the proposed mining and batch plant operations and the impact those operations will have on the community. The quantitative analyses are deficient on addressing the scientific and engineering phenomena associated with: 1) sound, atmospheric attenuation, effects of low frequency traffic noise; 2) water consumption for proposed mining, batch and dust-control operations; 3) ground and atmospheric reflection and attenuation of light.

This paper demonstrates in a limited way that science-based robust analyses would provide ample evidence that the proposed mining and batch operations are NOT consistent with LU Policy 2.4.

ACOUSTIC NOISE: Staff acknowledges that the ambient noise level in East Valley is approximately 30 Decibels (dB). This figure matches that of Attachment 1 which depicts the sound pressure level in dB of a "Country park" to be 30 dB, and Attachment 2 which depicts a "Quiet rural setting" to be 30dB. Staff notes that the proposed batch plant will operate at a level of 119 dB, a level as shown by attachment 2 to be comparable to a 747 airliner on takeoff. Staff apparently accepts the premise offered by the applicant that this noise level will be abated to a level of 65dB. That premise is not supported by robust analysis.

At the top of page 11 in the Memorandum, Staff pays lip service to the noise issue by saying it has reviewed a table from a Construction Noise Impact Assessment obtained from the State of Washington that shows that a sound source of 95 dB will be attenuated to 53 dB at a distance of 6400 feet. It is not clear from Staff presentation whether or not the use of the table from the Washington Construction Noise Impact Assessment (WCNIS) is appropriate. The attenuation of sound in the atmosphere is dependent on

many factors. These include: 1) atmospheric pressure; 2) temperature; 3) humidity; and 4) frequency. Are those factors and their values in the WCNIS table relevant to the issue at hand?

There is nothing in the Staff report to indicate that the WCNIS table that was used is applicable to the proposed geographic location and prevailing conditions at the proposed site. Moreover, since the applicant does not have a clue as to what the properties of the mining and bath operations will be e.g., what the frequencies of the propagated sound will be, one must question how Staff could have possibly determined that the noise produced by these operations is not contrary to LU Policy 2.4. Corollary to that, without that information how could Staff responsibly recommend approval of the application?

The Staff also states "since the applicant will be contracting out the mining operation it is difficult for the applicant to predict the potential noise." Staff's unjustified dismissal of requiring the applicant to provide detailed data on the physical properties and sound production characteristics of the mining operation constitutes dereliction on the part of the Staff; it is incumbent on the Staff to require the applicant to exercise due diligence to define and include in the application what the requirements for noise control will be when writing the requirements for a contract that will ensure the noise levels in East Valley will not be contrary to LU Policy 2.4.

Frequency of the sound emitted is an important factor affecting the rate of attenuation in the atmosphere. Table 1 shows the difference in attenuation between 100 Hz and 500 Hz. Note that there is roughly an order of magnitude difference in the atmospheric attenuation of these two frequencies. Depending on atmospheric conditions, 100 Hz is attenuated only at about .5 dB per kilometer while sound at 500 Hz is attenuated at about 5 Hz per kilometer varying somewhat with temperature and humidity.

Pressure (Pascals) Newton/square meter	Temperature Celsius	Relative Humidity %	Frequency Hz	Attenuation dB/Km
84330 Pa (Approx 5000' elevation)	5 (41F)	15	500	8.578
84330	5	30	500	3.843
84330	5	15	100	.601
84330	5	30	100	.406

TABLE 1.

Estimates vary as to the number of truck-trips will be made; numbers has high as 100 have proposed. Staff has not done due diligence on the noise impact the transportation level of the proposed enterprise will have on the rural community lifestyle.

Attachment 2 shows that heavy trucks emit sound at about 90 dB. This sound is at relatively low frequencies, generally in the range of 100 Hz. Table 1 shows that the attenuation of sound at this frequency is only about .5 dB per kilometer (3280 feet or .6214 miles).

At a radius of 5 miles the total attenuation would be about 8 dB; the noise pressure level at that distance would remain at about 80 dB, which according to Attachment 2 would be the noise of a medium truck. Multiple trucks operating simultaneously would compound this noise level.

Low Frequency Noise (LFN) is generally associated with urban and industrial environments and is an issue due to health concerns over increased fatigue, reduced memory efficiency, increased risk of high blood pressure, and heart ailments. Attachment 3 is the first page (abstract) and last pages (references) of a paper that analyzes LFN effects and impacts. *The content of the paper suggests that LFN effects on East Valley residents must be studied in detail to determine the potential health impacts of the proposed mining, batch, and transportation in the East Valley.* It is incumbent on the Staff and the Planning Commission to study the potential mental and physical health effects, effects that transcend simply being an annoyance.

Again, it is difficult to fathom how the Staff could justify recommending approval of the application absent due diligence on noise, especially LFN.

WATER CONSUMPTION: The top of page 12 of the Planning Commission Memorandum makes the gratuitous statement “Mining utilizes substantially more water than a single family house. The question has been posed regarding the proposing [sic] mining operation on the aquifer and wells. The allocation of water is within the purview of the State Division of Water Resources. Christopher Thorson, PE, Division of Water Resources has advised that when there is request for a new appropriation, the agency will look at impacts to existing rights and existing wells as part of the analysis....”

There is nothing in the foregoing that relieves the Planning Staff of its obligation to perform due diligence and require the applicant to define what the water consumption will be and how that consumption, if supplied from within the Valley, will impact the ground water levels and aquifer volume. The Planning Commission should require the applicant to provide a reasonable definition of the concept of the entire operation, what the demands on water resources will be and how those demands will be met. The applicant should be required to articulate what the contract solicitation will include as requirements for contract performance vis-à-vis water consumption and water sources. If, given those requirements, the application is approved it then, of course, will be within the purview of the Division of Water Resources to determine if and how those water requirements are met.

The Planning Commission should be aware that there are dire predictions for the Western United States and a drought continuing for decades. NASA scientists have done extensive work that the Commission must consider in this matter. The Planning Staff and Commission are referred to the following article:

“Unprecedented 21st century drought risk in the American Southwest and Central Plains,” in *Science Advances*. 12 Feb 2015:Vol. 1, no. 1.

ABSTRACT: “In the Southwest and Central Plains of Western North America, climate change is expected to increase drought severity in the coming decades. These regions nevertheless experienced extended Medieval-era droughts that were more persistent than any historical event, providing crucial targets in the paleoclimate record for benchmarking the severity of future drought risks. We use an empirical drought reconstruction and three soil moisture metrics from 17 state-of-the-art general circulation models to show that these models project significantly drier conditions in the later half of the 21st century compared to the 20th century and earlier paleoclimatic intervals. This desiccation is consistent across most of the models and moisture balance variables, indicating a coherent and robust drying response to warming despite the diversity of models and metrics analyzed. Notably, future drought risk will likely exceed even the driest centuries of the Medieval Climate Anomaly (1100–1300 CE) in both moderate (RCP 4.5) and high (RCP 8.5) future emissions scenarios, leading to unprecedented drought conditions during the last millennium.”

The Planning Commission must surely be aware that Valley residents have already been forced to deepen their wells. It is well known that the deeper a well goes the higher the concentration of heavy metals. The costs of deepening wells and installing filtering systems to remove heavy metals are not burdens East Valley citizens should bear in order to line the coffers of the DCSID. These burdens are not consistent with LU Policy 2.4.

Absent details on water consumption for mining, batch, and dust control operations, it is impossible to comprehend the logic and rationale of the Staff and Commission recommending approval of the application. Due diligence has not been done.

LIGHT POLLUTION: Staff has made recommendations regarding lighting. These recommendations are not supported by engineering analyses and system design that define lighting system attributes, attributes that will ensure direct and reflected light will not be transmitted into the surrounding East Valley community. Following robust analyses, findings on lighting of the site should be incorporated into the Memorandum as specific requirements and conditions for approval of the application.

OPERATING HOURS: Staff provides no basis or justification for the recommended operating hours. Industrial operations after 6PM and on Saturdays are not justified. Proposed operations during these hours are contrary to a rural life style associated with dark quiet nights when people have returned from work, or are wanting to enjoy the quiet of the rural outdoors on the week end.

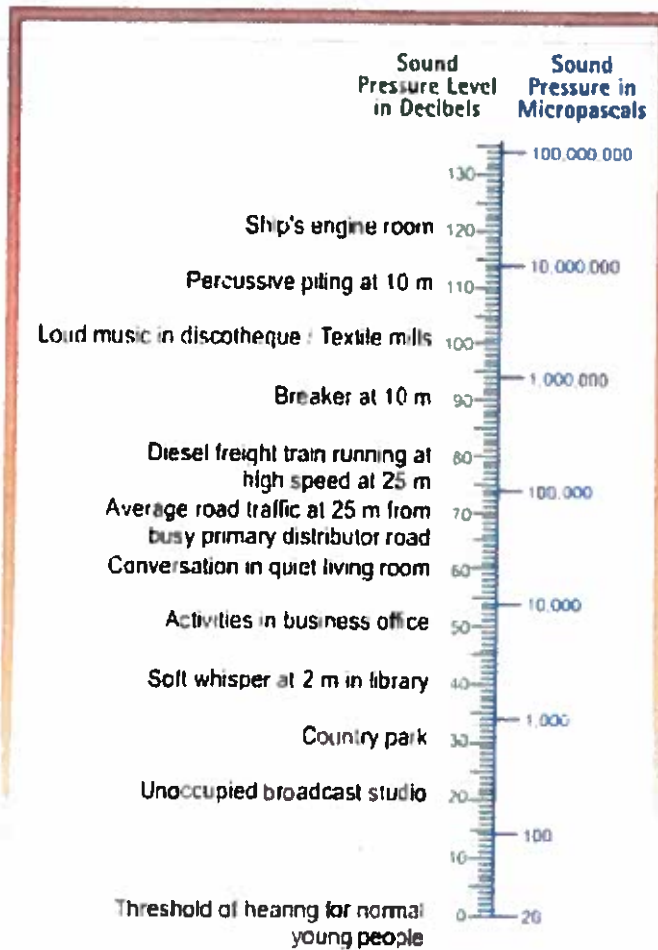
SUMMARY: Staff has not done due diligence on many critical issues. Staff has not obtained an environmental impact statement from an independent entity qualified to do a complete environmental impact assessment. Staff has not required the applicant to provide details on concepts of operation, requirements that will be levied on contractors. It is unacceptable nonsense for Staff to sidestep critical issues and proffer the excuse that the performance properties of the proposed enterprise “depend on what the contractor does.” Instead, it is incumbent on the Planning Commission to stipulate conditions that

the applicant must translate into contractor requirements for all work that is to be done under the Special Use Permit.

It is premature and imprudent for the Planning Commission to promulgate the Memorandum to the County Board of Commissioners for approval.

Attachments:

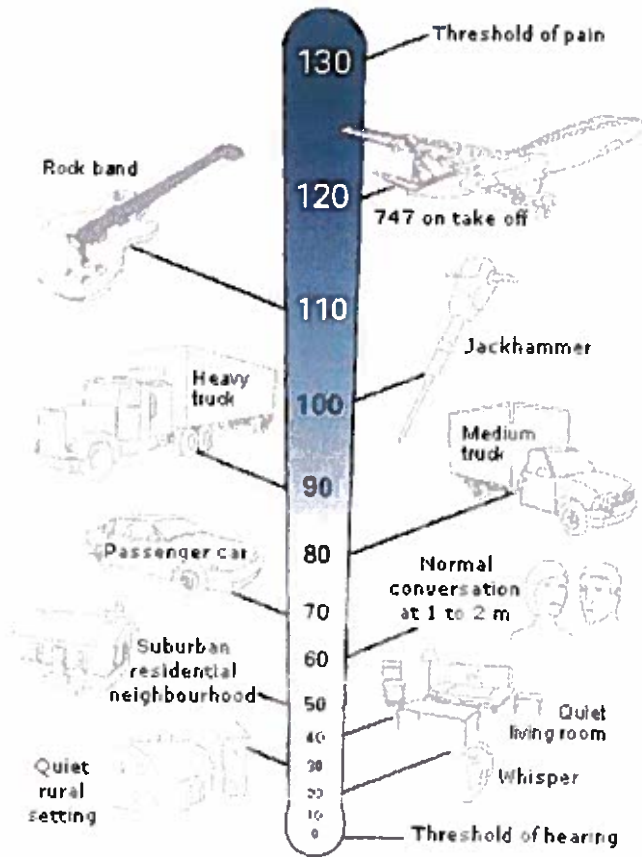
1. Sound Pressure Levels.
2. Decibel Scale for Sound Sources.
3. "Low Frequency Noise Transportation Sources" {first page (abstract) and last two pages (conclusions and references) of paper}.



Relation between sound pressure in micropascals and sound pressure level in decibels re 20 µPa

ARCH 1
SOUND PRESSURE
LEVELS

DECIBEL SCALE (dBA)



ATCH 2
DECIBEL SCALE
FOR SOURCES

Low Frequency Noise from Transportation Sources

Cedric Roberts, Principal Advisor (Noise, Air and Airborne Vibration Management)

Road Planning and Design, Design, Environment and Stewardship, Department of Transport and Main Roads, 477 Boundary Street, Brisbane, Queensland 4000, Australia Tel: +61 7 38342036 Fax: +61 7 38342998

PACS: 43.50.Rq or 43.50.sr

ABSTRACT

Low frequency noise (LFN) is common as background noise in urban environments and as an emission from many artificial sources: road vehicles, aircraft, industrial machinery, artillery and mining explosions, and air movement machinery including wind turbines, compressors, and indoor ventilation and air conditioning units (Tempest, 1976; Leventhall, 1988 from St Pierre and Maguire [1]). LFN may also produce vibrations and rattles as secondary effects. The effects of LFN are of particular concern because of its pervasiveness due to numerous sources, efficient propagation and reduced efficacy of many structures (dwellings, walls, and hearing protection) in attenuating LFN compared with other noise.

Current transportation noise impact assessments are usually based on broadband A-weighted noise indicators. Over the past 50 years, the A-weighted sound pressure level (dB(A)) has become the major measurement descriptor used in noise assessment. This is despite the fact that many studies have shown that the use of the A-weighting curve underestimates the role that LFN plays in loudness perception, annoyance, and speech intelligibility. The de-emphasizing of LFN content by A-weighting can also lead to an underestimation of the exposure risk of some physical and psychological effects that have been associated with low frequency noise.

As a result of this reliance on dB(A) measurements, there is a lack of importance placed on minimizing LFN impacts. A more complete picture and better correlation with annoyance and health effects may result from indicators that include temporal aspects and frequency character. This paper presents an overview of some examples of low frequency indicators applied to transportation sources.

INTRODUCTION

Low frequency noise (LFN) is common as background noise in urban environments and as an emission from many artificial sources: road vehicles, aircraft, industrial machinery, artillery and mining explosions, and air movement machinery including wind turbines, compressors, and indoor ventilation and air conditioning units (Tempest, 1976; Leventhall, 1988 from St Pierre and Maguire [1]). LFN may also produce vibrations and rattles as secondary effects. The effects of LFN are of particular concern because of its pervasiveness due to numerous sources, efficient propagation and reduced efficacy of many structures (dwellings, walls, and hearing protection) in attenuating LFN compared with other noise. Current transportation noise impact assessments are usually based on broadband A-weighted noise indicators. Over the past 50 years, the A-weighted sound pressure level (dB(A)) has become the major measurement descriptor used in noise assessment. This is despite the fact that many studies have shown that the use of the A-weighting curve underestimates the role that LFN plays in loudness perception, annoyance, and speech intelligibility. The de-emphasizing of LFN content by A-weighting can also lead to an underestimation of the exposure risk of some physical and psychological effects that have been associated with low frequency noise.

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- More audible at night than during the day
- Having a throbbing and rumble characteristic

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Acoustic Technologies evaluated 96 recordings against the Sonus 'Rise and Fall' method as well as a range of other algorithms namely:

- root mean square (RMS);
- tonal; and
- harmonic content.

It was concluded that RMS of the modulation characteristic was best at distinguishing the level of annoyance of a noise event. The RMS algorithm also has other advantages in terms of repeatability, certification and the availability of software and instruments.

The identification of the modulation characteristic as a way to identify engine brake noise annoyance is supported by previous studies commissioned by Austroads from Vipac. Vipac Report No. 34950-2, 1991[22] references a 1981 Vipac study [23] which concluded that:

- A-weighted peak engine brake noise level was not an adequate predictor for assessing the changes in noise emission due to brake operation; and
- the annoyance due to engine compression brakes was the result of a change in the spectral characteristic of the noise emission rather than due to an increase in the overall A-weighted peak noise level.

Following the Sonus work and the later Acoustic Technologies investigations, it was clear that while modulation is the key, there were at least two ways of capturing modulation and identifying a quantifiable measure of the degree of annoyance of the 'bark' associated with engine brake:

1. By measuring the RMS of the modulation characteristic (Acoustic Technologies); and
2. By measuring the number and amplitude of rises and falls of the noise over a certain period (Sonus)

COMPARISON WITH AUSTRALIAN STANDARD AS3657

Australian Standard AS3657: *Acoustics - Expression of the subjective magnitude of a sound or noise*, provides methods for expressing the subjective magnitude of a sound as a single number. The Standard takes account of the frequency spectrum of the sound and is identical to the internationally accepted method of assessing the annoyance a sound would be likely to create.

The calculations for AS3657 are too complex to allow routine analysis of engine brake noise, but AS3657 provides a benchmark to compare with the candidate algorithms.

CONCLUSIONS

A literature search of research carried out by various countries on LFN from motor vehicles has revealed that the major frequency content of motor vehicle emission in terms of one third octave bands is in the range of 63 Hz to 125 Hz depending on vehicle speed and engine size. A lower frequency peak of 16 Hz has been identified from the firing

rate of a pair of cylinders from a V8, 8 litre, four stroke diesel configuration [10].

The Netherlands has seen the value of producing LFN maps in addition to the traditional A-weighted approach. Modelling in the Netherlands study [15] using the C-A method indicated that areas behind noise barriers and motorways with a large amount of heavy vehicle traffic show high C-A levels. This may indicate that these areas are exposed to noise with a strong low frequency characteristics.

This C-A level approach appears to be popular in establishing low frequency content. Recently the Z-weighting is being proposed to replace C-weighting [6] for low frequency industrial noise immission and there is no reason why Z-A could not be used for transportation noise sources. Recent research seems to suggest an application of two equal loudness contours (A- and B- weighting) (dynamically based on the overall sound pressure level) and Zwicker's method for loudness determination although this is a laborious process. There is even a suggestion that the loudness of transportation sources can be best represented by the phased out B weighting than the A-weighting due to its resemblance to the 70 phon contour more representative of the level and frequency of transportation noise sources.

LFN auditory threshold curves in one third octave bands have also been successfully applied for indoor spaces after correcting outdoor measurements for sound transmission loss through building facades.

The German study [14] indicated that a limitation to $L_{Amax} < 45$ dB(A) as suggested by WHO (2000) [3] does not protect against awakening due to low frequency truck noise.

There has been extensive research undertaken to identify the characteristic 'bark' of engine brakes. The 'bark' can be clearly seen as modulation when engine brake noise is recorded and graphed. There are two methods of measuring the modulation of the waveform and both offer potential as a means of identifying engine brake noise annoyance. Relying on traditional A-weighted measurements will not capture the modulation nor would it offer the potential to distinguish engine brakes from other traffic noise.

The technology is available, especially with digital methods, to use much more complex filters and calculations in the measurement of low frequency sound, and studies have shown that these methods yield results that are more useful. However, until the acoustic community begins to seriously question the use of A-weighting measurements, more accurate measurements will continue to be ignored by both engineers and manufacturers.

In order to provide policy makers with the best information regarding noise exposure, a thorough knowledge of the various types of noise exposure and a better understanding of the relation between exposure and effects is needed. In particular, the present knowledge of the influence of time and spectral characteristics of the noise on human perception should be improved.

REFERENCES

- [1] Richard L. St. Pierre, Jr, Daniel J. Maguire "The Impact of A-weighting Sound Pressure Level Measurements during the Evaluation of Noise Exposure". Noise-Con 2004, Baltimore, Maryland July 12-14 2004.

- [2] Leventhall, G. 2003. A Review of Published Research on Low Frequency Noise and its Effects. *Prepared for Department for Environmental Foods and Rural Affairs. (United Kingdom).*
<http://www.defra.gov.uk/environment/noise/research/lowfrequency/pdf/lowfrenoise.pdf>
- [3] Berglund, B., Lindvall, T. and Schwela, D. 1999. *Guidelines for Community Noise*. World Health Organization.
<http://www.who.int/docstore/peh/noise/guidelines2.html>
- [4] Kjellberg, A., Tesarz, M., Holberg, K., and Landström, U. 1997. Evaluation of frequency-weighted sound level measurements for prediction of low-frequency noise annoyance. *Environment International*. Vol. 23, pp. 519-527. Cited in Leventhall, G. 2003.
- [5] Kelley, N.D. 1987. *A Proposed Metric for Assessing the Potential of Community Annoyance from Wind Turbine Low-Frequency Noise Emissions*. Colorado: SERI, U.S. Department of Energy.
- [6] Draft Ecoaccess Guideline 2010 'Assessment of Low Frequency Noise' Department of Environment & Resources Management (DERM), Queensland.
- [7] Poulsen, Torben and Rysgaard, Frank. 2002. *Laboratory Evaluation of Annoyance of Low Frequency Noise*. Prepared for the Danish Environmental Protection Agency. Working Report.
- [8] Solar Energy Research Institute (SERI). 1985. *Acoustic Noise Associated with the MOD-1 Wind Turbine: Its Source, Impact and Control*. Colorado: SERI, U.S. Department of Energy.
- [9] A Study on the Sound Power Level of Queensland road vehicles, Daniel Naish, Design, Environment and Stewardship, Road Planning and Design, Engineering and Technology, Department of Transport and Main Roads, Paper to be presented at ICA 2010, Sydney August 23 – 27.
- [10] Chapter 12, Low Frequency Traffic Noise and Vibration, H.G. Leventhall, MSc, PhD, FINSTP, FIOA, Atkins Research and Development, Epsom, UK.
- [11] Transportation Noise Reference Book, Edited by P.M. Nelson, BSc, PhD, FIOA.
- [12] Hollingsworth, G.H. and Gilbert, D.A.M. An exploratory study into the prediction of low frequency traffic noise, *Applied Acoustics*, 15, 79-95 (1982).
- [13] Influence of Low Frequency Noise on Health and Well-Being, Martin van den Berg, Ministry of Environment, The Hague, Netherlands, 11 February 2005.
- [14] Hartmut Ising, Rheinstr. 69. D 14612 Falkensee, PMID 12537837.
- [15] E. Schreurs, T. Koeman and J. Jabben, RIVM, "Low frequency noise impact of road traffic in the Netherlands" *Acoustics '08 Paris* June 29-July 4, 2008.
- [16] Nederlandse Stichting Geluidhinder, "NSG -- richtlijn laagfrequent geluid", www.nsg.nl, 1999.
- [17] B. Ingelaere, "geluidisolatie van vensters", http://www.bbrj.be/antenne_norm/akoestiek/media/pdf/files/akoestiek/bcglazing_98_inl.pdf
- [18] Paul D. Schomer, 'Loudness-level Weighting for Environmental Noise Assessment', *Acustica - Acta Acustica*, Volume 86, Number 1, pp. 49-61, 2000.
- [19] Paul D Schomer, et al, 'Evaluation of loudness-level weightings for assessing the annoyance of environmental noise', *J. Acoust. Soc. Am.*, 110 (5), pp. 2390-2397, 2001.
- [20] Sonus Pty Ltd, Engine Brake Noise: Development of a Roadside Test Procedure; Prepared for the National Road Transport Commission, August 2003.
- [21] Acoustic Technologies, Test Procedure: Roadside Measurement and Evaluation of Heavy-Vehicle Engine Brake Noise. Prepared for the National Road Transport Commission 2004.
- [22] Vipac (1991). Study into Engine Compression-Brake Noise and the Feasibility of a Roadside Test, Vipac report number 34950-2.
- [23] Vipac (1981). Noise Emission and Braking Efficiency of Engine and Exhaust Brakes on Heavy Vehicles, Vipac report number 30/799.

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Low Frequency Noise from Transportation Sources

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PACS: 43.50.Rq or 43.50.Br

ABSTRACT

Low frequency noise (LFN) is common as background noise in urban environments and as an emission from many artificial sources: road vehicles, aircraft, industrial machinery, artillery and mining explosions, and air movement machinery including wind turbines, compressors, and indoor ventilation and air conditioning units (Tempest, 1976; Leventhall, 1988 from St Pierre and Maguire [1]). LFN may also produce vibrations and rattles as secondary effects. The effects of LFN are of particular concern because of its pervasiveness due to numerous sources, efficient propagation and reduced efficacy of many structures (dwellings, walls, and hearing protection) in attenuating LFN compared with other noise.

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As a result of this reliance on dB(A) measurements, there is a lack of importance placed on minimizing LFN impacts. A more complete picture and better correlation with annoyance and health effects may result from indicators that include temporal aspects and frequency character. This paper presents an overview of some examples of low frequency indicators applied to transportation sources.

INTRODUCTION

Low frequency noise (LFN) is common as background noise in urban environments and as an emission from many artificial sources: road vehicles, aircraft, industrial machinery, artillery and mining explosions, and air movement machinery including wind turbines, compressors, and indoor ventilation and air conditioning units (Tempest, 1976; Leventhall, 1988 from St Pierre and Maguire [1]). LFN may also produce vibrations and rattles as secondary effects. The effects of LFN are of particular concern because of its pervasiveness due to numerous sources, efficient propagation and reduced efficacy of many structures (dwellings, walls, and hearing protection) in attenuating LFN compared with other noise. Current transportation noise impact assessments are usually based on broadband A-weighted noise indicators. Over the past 50 years, the A-weighted sound pressure level (dB(A)) has become the major measurement descriptor used in noise assessment. This is despite the fact that many studies have shown that the use of the A-weighting curve underestimates the role that LFN plays in loudness perception, annoyance, and speech intelligibility. The de-emphasizing of LFN content by A-weighting can also lead to an underestimation of the exposure risk of some physical and psychological effects that have been associated with low frequency noise.

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For those who are sensitive to low frequency sound the effects can be dramatic. Complainants often describe the noise as:

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- More audible at night than during the day
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Also, research relating to the effects of low frequency noise, including increased fatigue, reduced memory efficiency and increased risk of high blood pressure and heart ailments, were analyzed. The results showed a need to develop and utilize other measures of sound that more accurately represent the potential risk to humans. Kjellberg and Goldstein in St Pierre and Maguire [1] showed that dB(A) measurements can underestimate loudness by as much as 14 dB when the noise primarily consists of low frequency components (below 400 Hz). In reviewing studies comparing annoyance to dB(A) measurements, Leventhall [2] points out that dB(A) underestimates annoyance for frequencies below about 200 Hz. Brambilla et al from St Pierre and Maguire [1] when analyzing the noise produced by a skid steer loader, concluded "from the results obtained the A-weighted L_{Aeq} appears to not be adequately correlated with the perception of the noise at the operator's seat in an earth moving machine, as it does not properly take into account the distribution of sound energy in the frequency, predominantly in the low-medium frequency range (40-315 Hz)." Finally, in surveying research into low frequency noise, Alves-Pereira et al from St Pierre and Maguire [1] concludes that "it is invalid to compare acoustical environments based on dB level measurements because, despite comparable dB level measurements, the distribution of the acoustic energy over the low frequency spectra can be substantially distinct.

MEASURING AND REGULATING LOW FREQUENCY NOISE

When prominent low-frequency noise components are present, noise measurements based on A-weighting are inappropriate. A-weighting has the effect of reducing measured levels of low and very high frequencies, but has less filtering effect on most mid-range sound frequencies where speech and communication are important.

Many jurisdictions measure both dB(A) and dB(C), and take the following steps (or something similar) to determine whether or not there is a low frequency noise problem:

Step 1: Determine difference (Δ) between dB(C) and dB(A).

The difference between dB(C) and dB(A) provides crude information about the presence of low frequency components in noise. Research suggests that when the difference (Δ) is great enough that further investigation or action related to the presence of low frequency noise is warranted.

- In Germany, $\Delta > 20$ dB is used as an initial indication of the presence of low frequency noise, and the need to conduct further investigations. (Leventhall, 2003 [2])
- If $\Delta > 10$ dB the World Health Organization (1999) [3] recommends that a frequency analysis of the noise be performed
- Kjellberg and co-workers (1997) [4] have suggested that when $\Delta > 15$ dB, an addition of 6 dB to the measured A-weighted level is a simple procedure for addressing the annoyance.

Step 2: Conduct frequency analysis of low frequency noise and compare to criteria.

There are numerous methods for determining the significance of low frequency noise. Over the past 25 years, many European countries (Sweden, the Netherlands, Germany, Denmark and Poland) have developed national criteria for

environmental low frequency noise. According to Leventhall (2003) [2], the move to develop criteria was driven by specific problems, "particularly gas turbine installations, which radiate high levels of low frequency noise from their discharge." Low frequency threshold curves for the European countries mentioned above are shown in Figure 1.

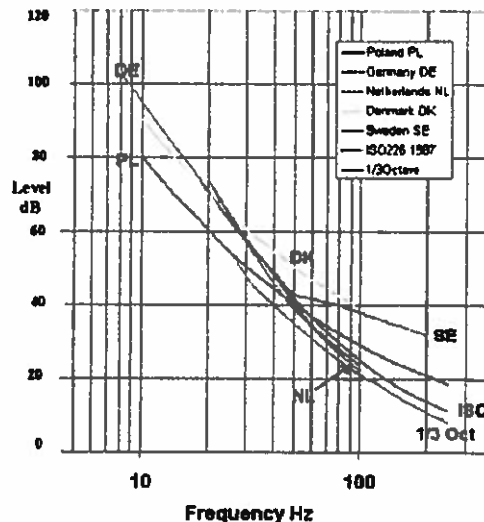


Figure 1. Low frequency threshold curves for various European countries Source: (Leventhall Powerpoint)

In Sweden and Germany, low frequency noise may be considered a nuisance if its level exceeds a criterion in any third-octave band. In the United States, a standard for low frequency noise from wind turbines has been developed for the U.S. Department of Energy. (Kelley, 1987) [5] Also, some counties in northern Michigan have developed ordinances that reference low frequency noise as separate to other noise issues. Denmark has taken an entirely different approach. Queensland in their draft Ecoaccess Guideline 'Assessment of Low Frequency Noise' 2010 [6] has applied a combination of the German and Danish guidelines.

LOW FREQUENCY NOISE SOURCES AND IMPACTS

Low frequency noise and infrasound are produced by machinery, both rotational and reciprocating, and all forms of transport and turbulence. Typical sources include pumps, compressors, diesel engines, aircraft and fans.

Combustion turbines are capable of producing high levels of low frequency noise generated by the exhaust gas.

Burners can emit broadband low frequency flame roar.

Structure borne noise, originating in vibration, is also of low frequency, as is neighbourhood noise heard through a wall, since the wall attenuates higher frequencies more than lower frequencies.

Low frequency noise can be noise or vibration from traffic or from industries, totally or partly transmitted through the ground as vibration and re-radiated from the floor or the walls in the dwelling.

Low frequency noise creates a large potential for community annoyance. It is most often experienced inside of homes and buildings where resonance amplifies the sound. It is a general

observation that indoor noise is perceived as more "low-frequency-like" than the same noise heard out of doors. (Torben Poulsen, and Frank Rysgaard, 2002 [7]).

Also, low frequency noise can be a factor at much greater distances than audible noise sources. A case study in Northern Carolina near a wind turbine documented low frequency noise problems at residences located more than 1/2 mile from the turbine. (SERI, 1995 [8]).

The firing rate of many diesel engines is usually below 100 Hz, so categories of road vehicle noise can be regarded as low frequency. Similar considerations can be made for engines or compressors in industries or co-production plants.

Further analysis in this paper is based on the frequency content of LFN from motor vehicles close to the source and at distant receptor locations, the particularly annoying character of engine brake noise and the low frequency indicators applied to transportation sources by various countries.

MOTOR VEHICLE EMISSIONS

Netherlands

In the Netherlands many complaints about LFN from traffic are reported. When specific complaints are mentioned then these relate to accelerating and stationary conditions.

Specific sources include:

- Exhaust systems
- City buses
- Motorcycles; and
- Heavy traffic

An example of a city bus is given where complaints were investigated from residents living close to bus stops and at traffic lights.

The bus company had received a number of complaints about the introduction of a new bus model and an investigation was commenced.

Measurements were taken on two different types of bus (old and a newer version). Both were correctly approved according to the R51 drive by test. The new model emitted more low frequency noise: slightly during R51 acceleration and stand still and significantly during pulling away from stand still in the 50-70 Hz range. As a result the manufacturer was requested to optimize the exhaust system and the bus company introduced 'bus stop' noise criteria for all newly purchased buses.

Exhausts normally emit the firing frequency and higher harmonics.

In this case: A 6 cylinder 4 stroke line engine at 500 rpm has a firing frequency = $500/60 * 6 / 2 = 25$ Hz with higher harmonics: 50 Hz, 75 Hz and so on.

A V8 engine produces four exhaust pulses per revolution, a V6 or straight six produces three, and a four cylinder produces two. At 2,200 rpm, which is a typical highway cruising speed, a V8 engine is spinning at 37 times a second and is producing a frequency of 148 Hz. Such low frequency tones can also easily penetrate the passenger compartment

and create harmonics in the entire exhaust system, resulting in a droning, moaning or booming noise.

Germany

In considering vehicle noise regulations and sound filtering via weighting networks it was observed that:

"Vehicle test results are generally in the range of 70-80 phon and measured in dB(A). However, if dB(A) is used for noise levels of 70-80 phon, the influence of low frequencies is underestimated as low frequencies are filtered out. The question was raised as to the justification for the use of dB(A) in vehicle noise certification tests".

Australia [9]

A sound power level survey was conducted during 2010 of vehicles on Queensland, Australia roads to produce a database of vehicle sound power levels categorised on vehicle classification, speed, pavement surface type and driving conditions. The purpose of this study was to compare the local vehicle sound power levels with similar surveys conducted in Europe in application of the Nordic and Harmonoise prediction methods.

The sound power level of individual vehicles in-situ traffic was measured generally following the Nordtest Method 109 (NT ACOU 109).

The L_{eq} and L_{max} in 1/3 octave bands from 20Hz to 20kHz of an individual vehicle was measured with a known microphone distance and were recorded directly into a spreadsheet database with details of the vehicle classification and speed for each of the different pavement surface types investigated.

The final L_w using the Nordtest method for each 1/3 octave band was the highest L_w obtained from the 0.2m and 4.0m microphones.

The spread of sound power level across the assessed vehicle categories was compared with the mean Harmonoise sound power level from 80km/hr to 110km/hr.

Comparisons were made only with Harmonoise major classifications as follows: Category 1 = Light (eg cars), Category 2 = Medium (eg. trucks and buses) and Category 3 = Heavy (eg. trucks and buses).

With category 1 vehicles the notable features was the relatively larger variability in the 80Hz and 100Hz 1/3 octave bands which was attributed to faulty or modified exhausts (based on site observations).

Queensland's mean sound power levels in terms of overall, dB(A) and overall -- dB(A) as well as the sound pressure levels at predominant 1/3rd octave bands for various vehicle categories are illustrated in Table 1.

Category	Description of vehicle	Overall dB	A* dB	Δ dB(C)-dB(A)	1/3 rd octave band centre frequency & level (dB)
1	Light	108	106	2	100 @1000 Hz
2	Medium	113	110	3	103 @ 800/1000 Hz
3	Heavy	120	115	5	110 @ 80 Hz (tonal)

Table 1: Queensland mean sound power levels and 1/3rd octave band centre frequencies for various vehicle categories

In all three vehicle categories, the influence of the exhaust system was clearly observable, in particular for category 3 vehicles. The largest variability in heavy vehicles is in the 80Hz band, and the mean for Queensland was found to be significantly higher than the mean for Harmonoise.

The initial summary of the observations were:

1. Queensland vehicle sound power levels generally follow the same spectral characteristic trends as the Harmonoise calculated sound power levels.
2. Exhaust noise in Queensland tends to dominate the 80Hz 1/3 octave band whereas it dominates the 63Hz 1/3 octave band in the Harmonoise method.

Transportation Noise Reference Book [10]

Chapter 12 [11] from the reference book considers the generation and propagation of low frequency noise and ground borne vibration from traffic.

Hollingsworth and Gilbert [12] predicted low frequency noise from traffic streams. They used the indicator L_{Aeq} (15 min)(40-125 Hz) to predict the LFN from a mixed traffic stream at a height of 1.2m and reference distance 10m from nearside kerb.

At this distance:

$$L_{Aeq} (15 \text{ min})(40-125 \text{ Hz}) = 53.0 + 9.43 \log (Q1 + 10Q_{MCV} + 40Q_{HCV}) + \text{gradient correction}$$

where: L_{Aeq} (40-125Hz) = energy equivalent level over frequency range stated. This covers effects of chest resonance and floor vibrations.

$Q1$ = total hourly vehicle flow , veh/hr

Q_{MCV} = flow of medium commercial vehicles , veh/hr

Q_{HCV} = flow of heavy commercial vehicles , veh/hr

Typical values for L_{Aeq} (15 min)(40-125 Hz) for four different hourly vehicle flows, 60 % medium, 5 % heavy commercial vehicles and 3 ranges of gradient correction are shown in Table 2.

Total vehicle flow, veh/hr	200	1000	1750	2200
Gradient, 0-3%	85	92	94	95
Gradient, 3-4%	86	93	95	96
Gradient, 5-6%	87	93	96	97

Table 2: L_{Aeq} (15 min)(40-125 Hz) for different vehicle flows, % vehicle mix and gradients

Classification of vehicles:

- a) Includes motor bikes (all types), cars (all types), light commercial vehicles (car-based vans and/or two axle commercial vehicles) with unladen vehicle weight ≤ 3000 kg
- b) Medium vehicles (commercial vehicles with two axles and unladen vehicle weight > 3000 kg, including all buses and coaches
- c) Heavy vehicles (all commercial vehicles where the number of axles ≥ 3)

MOTOR VEHICLES IMMISSIONS

Netherlands [13]

The increase in power ratings and dimensions of cars, trucks and other equipment makes low-frequency noise an increasing concern. In van den Berg's paper [13] the impact of low-frequency noise or the share of low-frequency in noises from various sources on human health and well being was investigated.

For annoyance, however the influence of low frequency content has been well studied. Most of these studies come from studies of the effects of heavy artillery. The main finding is that the relation between rating level and effect improves substantially if the difference between A-weighted and C-weighted levels are taken into account. Preliminary results for road traffic indicate that this is also valid in this area. The current best estimate for an adjusted low-frequency level is based on the difference between C-weighted and A-weighted levels, in the general form:

$$L_{LF,adj} = L_A + \alpha(L_C - L_A)^\beta$$

where $L_{LF,adj}$ = adjusted low-frequency level, L_A = the A-weighted level and L_C = C-weighted level and α and β are empirical correction factors. The best estimate for $\alpha = 0.015$ and $\beta = 47$.

Table 3 shows the low frequency adjustment ΔL_{LF} for various $L_C - L_A$ differences.

L_C	L_A	$L_C - L_A$	$L_{A,LF}$	ΔL_{LF}
115	90	25	106.1	16
105	85	20	96.4	11.4
95	80	15	87.4	7.4
85	75	10	79.2	4.2
75	70	5	71.7	1.7

Table 3: Low frequency adjustment ΔL_{LF} for various $L_C - L_A$ differences

The large scale study showed that for many sources large differences between A-weighted and C-weighted levels do occur in practice. Table 4 shows typical results for different sources.

Difference between A-weighted SEL and C-weighted SEL for different sources in dB		
Source	Average	Maximum
Rail traffic	5.3	15
Road traffic	7.1	15
Aircraft	9.1	13
Industry	13.2	24
Ships	13.8	21

Table 4. Differences between A-weighted SEL and C-weighted SEL for different transport sources

These results are based on outside measurements. As houses attenuate higher frequencies much better than lower frequencies, the differences inside may be 5-15 dB higher.

The conclusions arrived at by van den Berg were that low frequency sound can have far reaching biological consequences which scientists are just beginning to understand. In view of this the precautionary principle demands that at least further increase of low frequency should be limited. Relatively simple methods are available.

Germany [14]

There was minimal road traffic prior to 1990 in villages near the border of the former German Democratic Republic. As a result no by-pass roads were built, but after the reunification of Germany the situation changed dramatically in some villages. One example is Barbis, Bad Lauterberg, near the Harz Mountains. Heavy goods traffic from the Hanover region to the Halle-Bitterfeld industrial area flows day and night through the narrow streets. On average every 2 minutes during the night, a heavy truck passes by the houses within a distance of 1-3 m. Complaints from the community were referred to the Federal Environmental Agency for investigation and a pilot study was planned to investigate potential health effects.



Figure 2. Heavy vehicle traversing rural area entering village
Source: (Cedric 2006)

About 40 families living in the vicinity of street B 243 and after an additional invitation 10 families from a quiet village agreed to cooperate.

Medical checks were made of 56 children aged 7 - 10 and they and their mothers completed questionnaires. The main purpose of this study was to test the hypothesis that noise generally causes more cortisol increases in the first half of the night, because some of the exposed persons reacted with cortisol decreases in the second half of the night. The children lived either at a busy road with 24 h truck traffic or in quiet areas. At the side of the road the noise level was registered during five nights. In the bedrooms representative measurements of the short-term maximum sound pressure level (L_{Amax} and L_{Cmax}) and of the frequency spectrum were taken. During the night on average every 2 minutes a truck with $L_{Amax} > 80$ dB(A) passed by the houses.

The indoor levels of the higher exposed half of the children were $L_{Amax} = 33-52$ dB(A) and 55-78dB(C) with a range of $\Delta = 22$ to 26 dB. The frequency spectrum had its maximum below 100 Hz.

The study indicated that a limitation to $L_{Amax} < 45$ dB(A) as suggested by WHO (2000) [3] does not protect against awakening due to low frequency truck noise. It is necessary, therefore, to develop safer limits for low frequency night-time noise.

During the field phase the sound pressure level was recorded as 4sec mean levels (L_{Aeq}) and maximum level (L_{Fmax} , time constant "fast") for five days and nights. In the noise exposed sleeping rooms of the participating children representative short term measurements of the indoor L_{Fmax} of passing trucks were carried out with frequency weightings "A" and "C".

Results

The maximum free field sound pressure level of trucks passing by reached 90 dB(A) at a distance of 3m from the roadside kerb and at a distance of 8 m from the nearest house. The mean level at night (10 pm till 6 am) varied between 65 and 70 dB(A) and resulted in an average of 67.1 ± 1.7 dB(A). The number of passing lorries with $L_{Fmax} > 80$ dB(A) was found to be 220 ± 72 .

Most of the highly exposed houses were fitted with special sound insulating windows. Nevertheless the low frequency noise of passing trucks could be clearly heard. A third octave spectrum of the mean L_{Fmax} and the L_{Aeq} was taken in one of the highest exposed rooms. The mean L_{Fmax} amounted to 78 dB(C) and 53 dB(A) with $\Delta = 25$ dB. The mean indoor L_{Fmax} varied between 55 and 78 dB(C) and 26 and 53 dB(A) with Δ

= 29 dB and Δ = 25 dB respectively in the higher exposed group.

Netherlands [15]

In the Netherlands, transport activities from roadways, airports and railways are major noise sources. The resulting noise levels have a severe impact on the environmental quality. Noise from roadway traffic causes the highest rate of annoyance: 29% of the Dutch population above the age of sixteen are severely annoyed by this source.

Because complaints due to LF noise are often difficult to resolve, these complaints take up a disproportionate amount of time. To address this, RIVM has modelled and mapped the LF noise from motorways. The research program aimed at extending knowledge on noise exposure from the usual A-weighted noise exposure indicator ($L_{d,m}$) to other noise indicators such as background noise levels and low frequency (LF) noise.

After modelling LF noise, RIVM used two methods to evaluate the scope of the LF noise exposure, namely the guidelines proposed by the Dutch Association for Noise Annoyance (NSG) [16] and a method based on the difference between C-weighted and A-weighted noise levels.

NSG guideline [16]

In the NSG guideline the reference values are based on the hearing threshold for a group of 50 to 60 year old people, of which 10% are just able to hear the sound.

In order to objectively evaluate the complaint, the sound levels of the frequencies in the defined region are compared to the reference values. If these reference values are exceeded, it is assumed that the complaint is objectively attributable to a LF source.

C-A method

In order to apply the NSG method, the sound pressure levels in dB had to be assessed for each of the 1/3 octave bands. Since measuring noise for specific frequencies requires specialized equipment, RIVM proposed to assess the LF content in the total spectrum of the noise by assessing the difference between average C-weighted and A-weighted values.

Noise Maps

Using traffic data from the Dutch motorways, LF noise maps for the major motorways were set up according to the two methods outlined above. All calculated outdoor levels were converted to indoor levels before testing, using the isolation from Table 5 [17].

Frequency (Hz)	20	25	31.5	40	50	63	80	100
Reference (dB)	74	62	55	46	39	33	27	22
Assumed isolation (dB)	8	9	10	11	12	13	14	16

Table 5. Reference threshold values (NSG) for LFN assessment and assumed isolation

Isolation is based on the sound isolation characteristics of 4mm glass. All indoor levels were calculated for average

night-time exposure from 23:00 to 07:00 hours. In order to apply the NSG assessment, the RIVM model was used to calculate the noise exposure for single octave band frequencies. For the low frequency region, this means that calculations for the 31.5 Hz, 63 Hz and 125 Hz octave bands were made. The noise exposure levels were subsequently weighted with the isolation values from Table 5. Taking the maximum of the three weighted levels resulted in a measure of low frequency noise exposure caused by road traffic.

For the C-A weighting method, the RIVM model was applied to calculate C-weighted and A-weighted noise exposure for the entire frequency range. The result of the subtraction of the two exposure levels (Δ) revealed the low frequency characteristic of the noise exposure.

The noise map of the 'Randstad' region for the dwellings where the NSG guideline was applied demonstrated exceedences up to 15 dB (classified as high). The noise map for the same area using the C-A method gave exceedences as high as 28 dB and as low as 10 dB.

When observing the entire noise map for both methods, two problem areas emerge where the noise exposure contains unusually high levels in the lower frequencies. These turned out to be areas behind noise barriers, and motorways with a large amount of heavy vehicle traffic.

Table 6 shows the number of households situated in areas where the limits proposed by the NSG were exceeded, or where C-A weighted noise levels exceeded 15 or 20 dB. As can be seen, the number of households where these limits were exceeded can be substantial. Table 6 shows that the frequency of 125 Hz is important when looking at the number of exposed households.

Guideline	Number of households (min)	Percentage of total (%)
NSG guideline 63 Hz	3.0	43
NSG guideline 125 Hz	5.6	79
NSG guideline 63 or 125 Hz	5.6	79
C-A \geq 15 dB	4.2	59
C-A \geq 20 dB	0.64	9

Table 6. Number and percentage of households exceeding two guidelines for LF noise in Dutch study

Almost 80% of households in the Netherlands showed a LF noise exposure exceeding the NSG guideline. In the Randstad this guideline was exceeded almost everywhere. From the results it seems that the frequency of 125 Hz is the determining factor in the amount of exposure. However, in more than half of those households the limit for 63 Hz was also exceeded.

Other Noise Evaluation Methods [18] [19]

In looking to alternative methods of evaluating sound, one needs look no further than the original 1936 sound level meter standard. In that standard, the B-weighting scale was introduced and since has drifted into obscurity, even though its inclusion in sound level meters is still required to meet full ANSI S1.4 - 1983 standards. Several studies have shown that the B-weighting scale correlates much better to subjective responses than the A-weighting scale, most likely because it is based on the 70 phon equal loudness curve which is more applicable to most typical transport noise events.

Aarts from St Pierre and Maguire [1] compared dBA, dBB, dBC and dBD and both ISO 532 loudness measurements to subjective responses using pink noise. The surprising result was that dBB correlated best to the subjective response with the Zwicker loudness method (ISO 532B) close behind. Only dBD (which was originally devised for aircraft fly over noise) performed worse than dBA. In every case tested, the dBA measurement underestimated the subjective loudness. It was stated that it is unfortunate that the B-weighting filter is no longer used or studied.

Recently, Schomer [18] has devised a method of noise assessment that uses the same equal loudness contours (ISO 226, 1987) used for the A- and B- weighting scale. However, he uses these contours dynamically based on the overall sound level present. As a result, the weighting filter is adjusted based on the overall level to the closest approximation to the correct equal loudness contour. In his first comparison, Schomer showed that this method, called the loudness-level-weighted equivalent level (LL-LEQ), provided a better assessment of various transportation noises than A-weighted measurements [18].

In a later study, Schomer compared LL-SEQ to the ISO 532b loudness measurement and found them to be very well correlated and in some cases, especially with impulsive noise, there is a benefit to using the LL-SEQ method [19]. Compared with A-weighting, loudness level weighting better orders and assesses transportation noise sources, and it better assesses sounds with strong low frequency content. Once again, the technology is readily available to incorporate this type of dynamic filter into sound level meters.

Engine Brake Noise – Draft Regulatory Impact Statement developed in Australia [20]

Engine brake noise is the greatest source of community complaint against the heavy vehicle industry in Australia. Not only does it adversely affect a large part of the population in all areas of the country, but it also has the potential to adversely affect heavy vehicle productivity because of demands for curfews and other restrictions arising from affected populations.



Figure 3. Jakes exhaust brake muffler fitted to a large truck

Source: (Cedric 2007)

Engine brake noise is generally low frequency (i.e. less than 200 Hz). Understanding the nature of low frequency noise is important in properly addressing engine brake noise, recognising that customary approaches to traffic noise: constructing roadside noise barriers or sound proofing houses, do not adequately address the low frequency characteristics of engine brakes.

One method of controlling engine brake noise is to fit a Jakes muffler as shown in Figure 3.

An in-service engine brake noise standard that will target excessively annoying engine brakes has been developed using the research undertaken in Australia.

The National Transport Commission (NTC) has addressed the situation by undertaking research to determine the feasibility of a regulatory solution to engine brake noise.

A critical part of the problem is that there is no internationally accepted measure of engine brake noise. The characteristic 'bark' of an engine brake is the source of most complaints. However, the standard A-weighted scale will not identify the annoying pulses or variations in noise that people often find more annoying than the decibel level alone as the pitch (or frequency) of the sound also contributes to the sensation of loudness of the sound.

NTC commissioned Sonus Pty Ltd [22] to investigate a means of detecting noisy engine brakes via a roadside test using robust methodology.

Sonus found that there are few reports in the literature that go beyond using a traditional maximum noise level to describe engine brake noise and that traditional maximum noise measurements do not identify the annoyance of engine brakes. Sonus found that the modulation of engine brake noise at low frequencies was the cause of annoyance and an assessment of the modulation characteristics of the waveform was necessary. Figure 4 shows an engine brake noise trace. It clearly shows many 'up and down' movements referred to as 'modulation'.

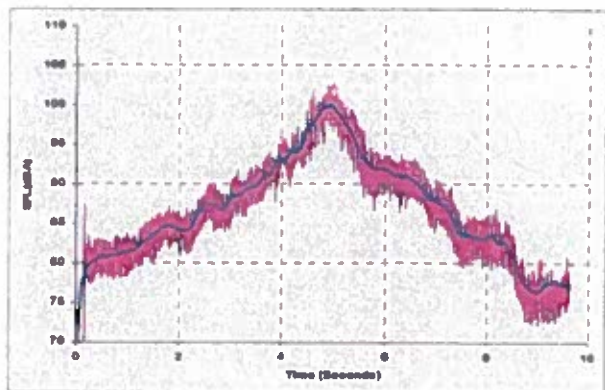


Figure 4. An Engine Brake Noise Trace Showing Modulation Characteristics Source: (NRTC 2003 [20])

Sonus took about 600 roadside measurements of engine brake events. From these investigations Sonus recommended a 'Rise and Fall' criterion for the identification of excessive heavy vehicle engine brake noise within a traffic stream. The 'Rise and Fall' criterion specified that the noise should not exceed a minimum of three modulations of 3 dBA over a 0.5 second period with each modulation exceeding 80 dBA.

In addition, the overall maximum instantaneous L_{Amax} for excessively noisy engine brakes is not to exceed 95 dB(A) at a reference distance of 7.5m.

Subsequently, at the request of the NTC, Acoustic Technologies [21] conducted further investigations, with a view to establishing a criterion that could not only reliably identify an excessively noisy engine brake but a criterion which could be readily adopted using existing instrumentation and certification procedures.

Acoustic Technologies evaluated 96 recordings against the Sonus 'Rise and Fall' method as well as a range of other algorithms namely:

- root mean square (RMS);
- tonal; and
- harmonic content.

It was concluded that RMS of the modulation characteristic was best at distinguishing the level of annoyance of a noise event. The RMS algorithm also has other advantages in terms of repeatability, certification and the availability of software and instruments.

The identification of the modulation characteristic as a way to identify engine brake noise annoyance is supported by previous studies commissioned by Austroads from Vipac. Vipac Report No. 34950-2, 1991[22] references a 1981 Vipac study [23] which concluded that:

- A-weighted peak engine brake noise level was not an adequate predictor for assessing the changes in noise emission due to brake operation; and
- the annoyance due to engine compression brakes was the result of a change in the spectral characteristic of the noise emission rather than due to an increase in the overall A-weighted peak noise level.

Following the Sonus work and the later Acoustic Technologies investigations, it was clear that while modulation is the key, there were at least two ways of capturing modulation and identifying a quantifiable measure of the degree of annoyance of the 'bark' associated with engine brake:

1. By measuring the RMS of the modulation characteristic (Acoustic Technologies); and
2. By measuring the number and amplitude of rises and falls of the noise over a certain period (Sonus)

COMPARISON WITH AUSTRALIAN STANDARD AS3657

Australian Standard AS3657: *Acoustics - Expression of the subjective magnitude of a sound or noise*, provides methods for expressing the subjective magnitude of a sound as a single number. The Standard takes account of the frequency spectrum of the sound and is identical to the internationally accepted method of assessing the annoyance a sound would be likely to create.

The calculations for AS3657 are too complex to allow routine analysis of engine brake noise, but AS3657 provides a benchmark to compare with the candidate algorithms.

CONCLUSIONS

A literature search of research carried out by various countries on LFN from motor vehicles has revealed that the major frequency content of motor vehicle emission in terms of one third octave bands is in the range of 63 Hz to 125 Hz depending on vehicle speed and engine size. A lower frequency peak of 16 Hz has been identified from the firing

rate of a pair of cylinders from a V8, 8 litre, four stroke diesel configuration [10].

The Netherlands has seen the value of producing LFN maps in addition to the traditional A-weighted approach. Modelling in the Netherlands study [15] using the C-A method indicated that areas behind noise barriers and motorways with a large amount of heavy vehicle traffic show high C-A levels. This may indicate that these areas are exposed to noise with a strong low frequency characteristics.

This C-A level approach appears to be popular in establishing low frequency content. Recently the Z-weighting is being proposed to replace C-weighting [6] for low frequency industrial noise immission and there is no reason why Z-A could not be used for transportation noise sources. Recent research seems to suggest an application of two equal loudness contours (A- and B- weighting) (dynamically based on the overall sound pressure level) and Zwicker's method for loudness determination although this is a laborious process. There is even a suggestion that the loudness of transportation sources can be best represented by the phased out B weighting than the A-weighting due to its resemblance to the 70 phon contour more representative of the level and frequency of transportation noise sources.

LFN auditory threshold curves in one third octave bands have also been successfully applied for indoor spaces after correcting outdoor measurements for sound transmission loss through building facades.

The German study [14] indicated that a limitation to $L_{Amax} < 45$ dB(A) as suggested by WHO (2000) [3] does not protect against awakening due to low frequency truck noise.

There has been extensive research undertaken to identify the characteristic 'bark' of engine brakes. The 'bark' can be clearly seen as modulation when engine brake noise is recorded and graphed. There are two methods of measuring the modulation of the waveform and both offer potential as a means of identifying engine brake noise annoyance. Relying on traditional A-weighted measurements will not capture the modulation nor would it offer the potential to distinguish engine brakes from other traffic noise.

The technology is available, especially with digital methods, to use much more complex filters and calculations in the measurement of low frequency sound, and studies have shown that these methods yield results that are more useful. However, until the acoustic community begins to seriously question the use of A-weighting measurements, more accurate measurements will continue to be ignored by both engineers and manufacturers.

In order to provide policy makers with the best information regarding noise exposure, a thorough knowledge of the various types of noise exposure and a better understanding of the relation between exposure and effects is needed. In particular, the present knowledge of the influence of time and spectral characteristics of the noise on human perception should be improved.

REFERENCES

- [1] Richard L. St. Pierre, Jr, Daniel J. Maguire " The Impact of A-weighting Sound Pressure Level Measurements during the Evaluation of Noise Exposure", Noise-Con 2004, Baltimore, Maryland July 12-14 2004.

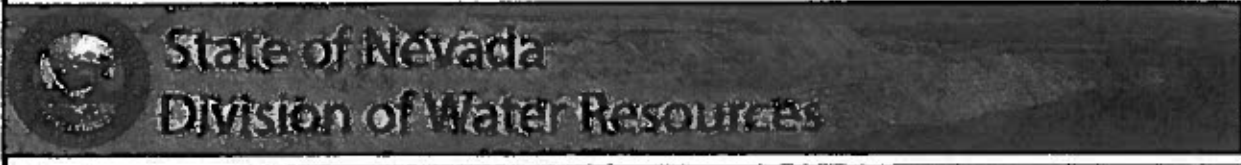
- [2] Leventhall, G. 2003. A Review of Published Research on Low Frequency Noise and its Effects. Prepared for Department for Environmental Foods and Rural Affairs. (United Kingdom).
<http://www.defra.gov.uk/environment/noise/research/lowfrequency/pdf/lowfrequency.pdf>
- [3] Berglund, B., Lindvall, T. and Schwela, D. 1999. *Guidelines for Community Noise*. World Health Organization.
<http://www.who.int/docstore/peh/noise/guidelines2.html>
- [4] Kjellberg, A., Tesarz, M., Holberg, K., and Landström, U. 1997. Evaluation of frequency-weighted sound level measurements for prediction of low-frequency noise annoyance. □ *Environment International*. Vol. 23, pp. 519-527. Cited in Leventhall, G. 2003.
- [5] Kelley, N.D. 1987. *A Proposed Metric for Assessing the Potential of Community Annoyance from Wind Turbine Low-Frequency Noise Emissions*. Colorado: SERI, U.S. Department of Energy.
- [6] Draft Ecoaccess Guideline 2010 'Assessment of Low Frequency Noise' Department of Environment & Resources Management (DERM), Queensland.
- [7] Poulsen, Torben and Rysgaard, Frank. 2002. *Laboratory Evaluation of Annoyance of Low Frequency Noise*. Prepared for the Danish Environmental Protection Agency. Working Report.
- [8] Solar Energy Research Institute (SERI). 1985. *Acoustic Noise Associated with the MOD-1 Wind Turbine: Its Source, Impact and Control*. Colorado: SERI, U.S. Department of Energy.
- [9] A Study on the Sound Power Level of Queensland road vehicles, Daniel Naish, Design, Environment and Stewardship, Road Planning and Design, Engineering and Technology, Department of Transport and Main Roads, Paper to be presented at ICA 2010, Sydney August 23 – 27.
- [10] Chapter 12, Low Frequency Traffic Noise and Vibration, H.G. Leventhall, MSc, PhD, FINSTP, FIOA, Atkins Research and Development, Epsom, UK.
- [11] Transportation Noise Reference Book, Edited by P.M. Nelson, BSc, PhD, FIOA.
- [12] Hollingsworth, G.H, and Gilbert, D.A.M, An exploratory study into the prediction of low frequency traffic noise, *Applied Acoustics*, 15, 79-95 (1982).
- [13] Influence of Low Frequency Noise on Health and Well-Being, Martin van den Berg, Ministry of Environment, The Hague, Netherlands, 11 February 2005.
- [14] Hartmut Ising, Rheinstr. 69. D 14612 Falkensee, PMID 12537837.
- [15] E. Schreurs, T. Koeman and J. Jabben, RIVM, "Low frequency noise impact of road traffic in the Netherlands" *Acoustics '08 Paris* June 29-July 4, 2008.
- [16] Nederlandse Stichting Geluidhinder, "NSG – richtlijn laagfrequent geluid", www.nsg.nl, 1999.
- [17] B. Ingelaere, "geluidisolatie van vensters", http://www.bbri.be/antenne_norm/akoestiek/media/pdf/files/akoestiek/beglazing_98_1_nl.pdf
- [18] Paul D. Schomer, 'Loudness-level Weighting for Environmental Noise Assessment', *Acustica-Acta Acustica*, Volume 86, Number 1, pp. 49-61, 2000.
- [19] Paul D Schomer, et al, 'Evaluation of loudness-level weightings for assessing the annoyance of environmental noise', *J. Acoust. Soc. Am.*, 110 (5), pp. 2390-2397, 2001.
- [20] Sonus Pty Ltd, Engine Brake Noise: Development of a Roadside Test Procedure; Prepared for the National Road Transport Commission, August 2003.
- [21] Acoustic Technologies, Test Procedure: Roadside Measurement and Evaluation of Heavy-Vehicle Engine Brake Noise. Prepared for the National Road Transport Commission 2004.
- [22] Vipac (1991). Study into Engine Compression-Brake Noise and the Feasibility of a Roadside Test, Vipac report number 34950-2.
- [23] Vipac (1981). Noise Emission and Braking Efficiency of Engine and Exhaust Brakes on Heavy Vehicles, Vipac report number 30/799.

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Measure Date	Water Level	Status	Method	Comments
12/10/2014	20.37	Atmos. Pressure	Electric Tape	
09/15/2014	134.91	Atmos. Pressure	Electric Tape	
06/30/2014	133.1	Atmos. Pressure	Electric Tape	
03/28/2014	132.13	Atmos. Pressure	Electric Tape	
12/30/2013	133.38	Atmos. Pressure	Electric Tape	

Site Details

Site Name:
 105 N13 E20 26DADD1
USGS Site ID:

Status:
 A
Well Name:
 1780 Amber Way
Owner:
 Dick Garren
Elevation:
 4838.20
Permit Number:

Well Log:
 13992
Depth:

Perforations From:
 300
Perforations To:
 240
Latitude (Decimal Degrees NAD 83)
 38.95837
Longitude (Decimal Degrees NAD 83)
 -119.69634
Location Accuracy
 10

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Measure Date	Water Level	Status	Method	Comments
10/01/2015	38.98		Electric Tape	
04/02/2015	36.98		Electric Tape	
10/01/2014	38.86		Electric Tape	
04/01/2014	34.16		Electric Tape	
10/02/2013	40.83		Electric Tape	
04/02/2013	33.18		Electric Tape	
10/02/2012	36.47		Electric Tape	
04/03/2012	32.34		Electric Tape	

Site Details

Site Name:
105 N12 E21 05BCAC1

USGS Site ID:

Status:
A

Well Name:
FISH SPRINGS FIRE STATION

Owner:
EAST FORK FIRE DISTRICT

Elevation:
5060.00

Permit Number:
45739

Well Log:
90731

Depth:
212

Perforations From:
210

Perforations To:
130

Latitude (Decimal Degrees NAD 83)
38.93581

Longitude (Decimal Degrees NAD 83)
-119.65617

Location Accuracy
5

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Measure Date	Water Level	Status	Method	Comments
02/28/2015	56			Status/Method Not Specified
12/31/2014	62.5			Status/Method Not Specified
09/30/2014	70.1			Status/Method Not Specified
06/30/2014	67.1			Status/Method Not Specified

Site Details

Site Name:
 105 N13 E20 27BDAD1
USGS Site ID:
Status:
 A
Well Name:
 Well #7
Owner:
 Town of Minden
Elevation:
 4828.70
Permit Number:
 81146
Well Log:
 26592
Depth:
Perforations From:
 290
Perforations To:
 175
Latitude (Decimal Degrees NAD 83)
 38.96354
Longitude (Decimal Degrees NAD 83)
 -119.72411
Location Accuracy
 10

KAWCHACK
PUMP & WELL SERVICE, INC.

P.O. Box 901 ■ MINDEN, NV 89423 ■ (775) 267-2150

NEVADA LICENSE #0021268

20 January 2011

Northern Nevada Title Company
Attn: Tracy
Fscrnw #1095698
Fx: 783-1449

Copy to:
Remax Realty
Attn: Jan Bergman
Fx: 782-3039

FLOW TEST INSPECTION

Well Location: 1365 Rabbit Brush Court, Gardnerville NV

Pump System: 2HP Pump (date code 93) set on 1 ¼" drop pipe.
Model 119 Well Rite Pressure Tank
6" Diameter Cased Well

Static water level in well at the start of flow test – 171' below the top of well casing.

Pump system produced a steady flow rate of 20 gallons per minute.

Static water level drew down to 222' below the top of the well casing in 40 minutes and remained stable at that level for a period of one hour and test was ended.

Pump system was inspected at the time of this flow test. We recommend replacement of the pressure tank as it is waterlogged. Our estimate for this - \$1200.00 which includes a new tank, plumbing fittings, tax, labor and old tank disposal.

Respectfully,

KAWCHACK PUMP & WELL SERVICE, INC.

*Note – Data above reflects conditions observed this date. We disclaim any responsibility for any changes in water levels, water flow, water purity, mechanical failure or any other conditions beyond our control.

KAWCHACK

PUMP & WELL SERVICE, INC.

P.O. Box 901 ■ MINDEN, NV 89423

(775) 267-2150

CONTRACTOR'S LICENSE # 0021268

Invoice

Date	Invoice #
11/9/2015	16003

Bill To
Henderson, Devere 1365 Rabbitbrush Gardnerville NV 89410

Job Site
Henderson, Devere 1365 Rabbitbrush Gardnerville, NV 89410 devere.henderson63@gmail.com

Well Dia/Depth	Pump Set/Static	Pump Motor/GPM	Pump Mfg.	Pipe Dia/Type	Tank	Wire # /Type
	173' static					

Description	Qty	Rate	Amount
Measure static water level on domestic well. Static water @ 173'.		60.00	60.00

TERMS OF SALE AND PAYMENT:

Seller requires payment by check or cash. Payment in full is due upon receipt of this invoice. Failure to pay in full within 10 days of receipt of invoice will result in a finance charge of 2% per month (24% per annum) PLUS any other collection costs incurred. There is a \$40 charge for returned checks. Seller, for security purposes, retains title to described goods until PAID IN FULL in case of buyers default in payment. Seller or his agents may take possession of, and remove, described goods from Buyer's premises without prior notice. In default, buyer waives all rights of action for trespass, damages or other cause resulting from repossession.

Subtotal	\$60.00
Sales Tax (7.1%)	\$0.00
Total	\$60.00



WINHAVEN
C·O·L·L·E·C·T·I·O·N

HOMEOWNERS ASSOCIATION

November 9, 2015

**Hope Sullivan Douglas- County Planning Manager
Mimi Moss-Community Development Director
Frank Godecke
Kevin Servantis
James Beattie
JoEtta Brown
Anje de Krijt
James Madsen
Margaret Pross**

Re: Proposed Gravel Pit

The Winhaven Homeowners Association opposes the GRAVEL PIT MINING PROJECT and its server impact to our Community our Residents and our Local Commerce.

Water consumption, release of dangerous toxins and fragile road infrastructures will turn these thriving Communities of Minden and Gardnerville into a dust bowl over the next 30 to 50 years.

The Winhaven Homeowners Association urges you to reject this plan entirely.

Sincerely

**John Caulkins-President
Executive Board of Directors**

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P.O. Box 789 • Minden, NV 89423 • (775) 782-4646*

ATTACHMENT B