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Analyzing reasons behind the goals in ice-hockey

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Abstract

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Much of the conventional wisdom in ice hockey suggests that moving the puck forward, towards the opponent's goal, is the best strategy for producing goals.

Past research has lent credence to this wisdom. Studies have consistently shown that scoring chances in hockey are produced from turnovers and short possessions of less than 10 seconds.
In this research-oriented thesis analyzing methods are what has happened before scoring a goal and find out the "true" reasons behind the goals scored in SM-League.

Many coaches in Finland over preach a brand of hockey that puck control is smarter gameplan than constant forward motion.

History shows that teams exchange the puck back and forth until someone commits a fatal error and a goal is scored.
Previous studies have given only a partial picture of the nature of scoring. They have implied that the production of a chance is dependent only on the possession immediately prior to that chance.

This reseach is using all the different game situations involved in a game for finding the reason behind the goals.

> Goals scored in rushes are broken down in six categories,
>
> Goals scored in turnovers are broken down in three categories,
>
> Goals scored on offensive zone play are broken down in six categories,
>
> Power play goals are broken down in seven categories and
>
> Special situation goals are broken down in three categories.

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1. Introduction

The following research-oriented thesis analyzes and presents methods why and how goals are scored in SM-Liiga. (from here after SM-Liiga, SM-League, Liiga, League) In the following we have pointed out the main situations and types of goals that have been scored in the League. There were four issues, that we wanted find out the answers: 1. Reason behind the goals? 2. How many goals scored on equal strenth versus power-play? 3. Can you see a difference between three best teams versus three worst teams in a regular season? 4. How many goals scored in different game situations?

In the SM-Leaugue season 2011-2012 there were 420 games played and in those games a total of 2194 goals were scored. In this thesis we break down all the goals and the reasons behind all of them. There were 1349 even strength goals scored, 626 power play goals, and 219 'other special situation' goals. In percentics: 61% were scored on even strength; 29% during power play; and 10% special situations. The goal of the research is to find out patterns for goal scoring opportunities that have a higher probability of an actual goal scoring outcome than others. If such situations or plays may be pointed out, it may assist coaches to make their team more effective.

For the evaluation we had a form, which we filled out for each goal , wich lead us to an overwhelming data on goal scoring analysis.

There is a different ways to analyse how goals are scored in ice hockey, for example, Corsi, Fenwick and Royal Road. These methods are used mainly in the NHL. Lot of these different analyse tools are created by former goalies. Corsi is developed by Jim Corsi, goalie coach for St. Louis Blues, and Royal Road is developed by Steve Valiquette, former goalie for New York Rangers.
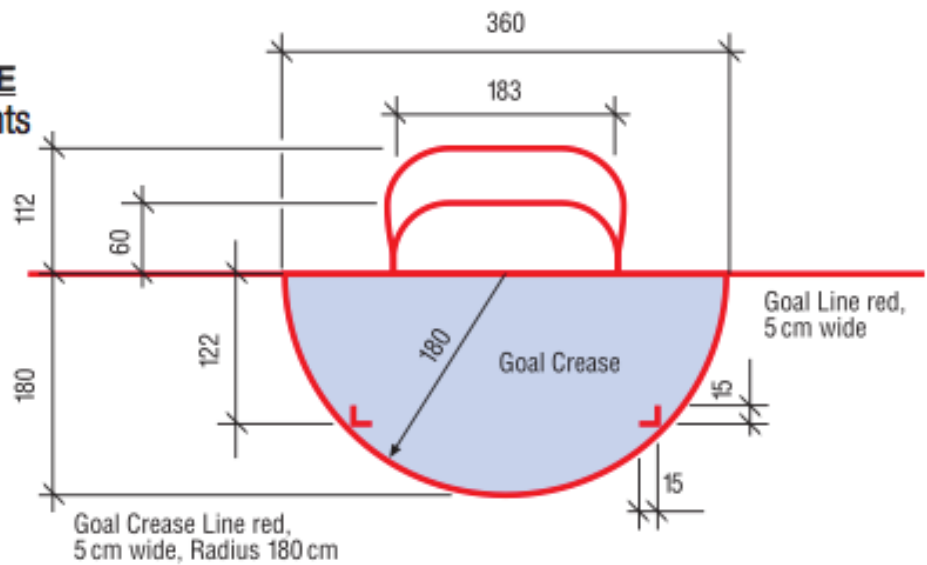
2. Ice hockey general introduction

Ice hockey is a contact team sport played on ice. Main purpose of the game is to score a goal in opponent's net. In Canada, the United States, and some European countries such a Finland and Sweden, it is known as "hockey". Ice hockey teams usually consist of four lines of three forwards, four pairs of defensemen and two goaltenders. Normally, each team has five players who skate up and down the ice trying to take the puck and score a goal against the opposing team. Goaltender is their sixth on-ice player, whose job is to prevent the puck from entering the goal.

A fast-paced physical sport (leading to the nickname "The Fastest Game on Earth"), hockey is most popular in North America and Europe. In North America, the National Hockey League (NHL) is the highest level for men's hockey and the most popular. The Kontinental Hockey League (KHL) is the highest level league in Europe. Ice hockey is the official national winter sport of Canada, where the game enjoys immense popularity. The International Ice Hockey Federation (IIHF) is the formal governing body for international ice hockey. The IIHF manages international tournaments and maintains the IIHF World Ranking. Worldwide, there are ice hockey federations in 73 countries.

Ice hockey is believed to have evolved from simple stick and ball games played in the 18th and 19th century United Kingdom and elsewhere. These games were brought to Canada.

Ice hockey match is played between two teams and unless there is a penalty, each team only has six players on the ice at the same time. Five players on ice and one on the net. The aim of the game is to shoot the hockey puck into the opposing net. The net is guarded by a goalie and it makes scoring very difficult. Ice hockey is the fastest team game and it is played on a ice surfface approximately 30 meters wide and 60 meters long. When player tryes to score the puck can move at speeds of more than 150km/h. The puck is 2.54cm thick and 7.62cm in diameter and must weigh between 156 and 170g.

GOAL CREASE
All measurements in cm

360
183
112
60
122
180
180
Goal Line red, 5 cm wide
Goal Crease
15
15

Goal Crease Line red, 5 cm wide, Radius 180 cm
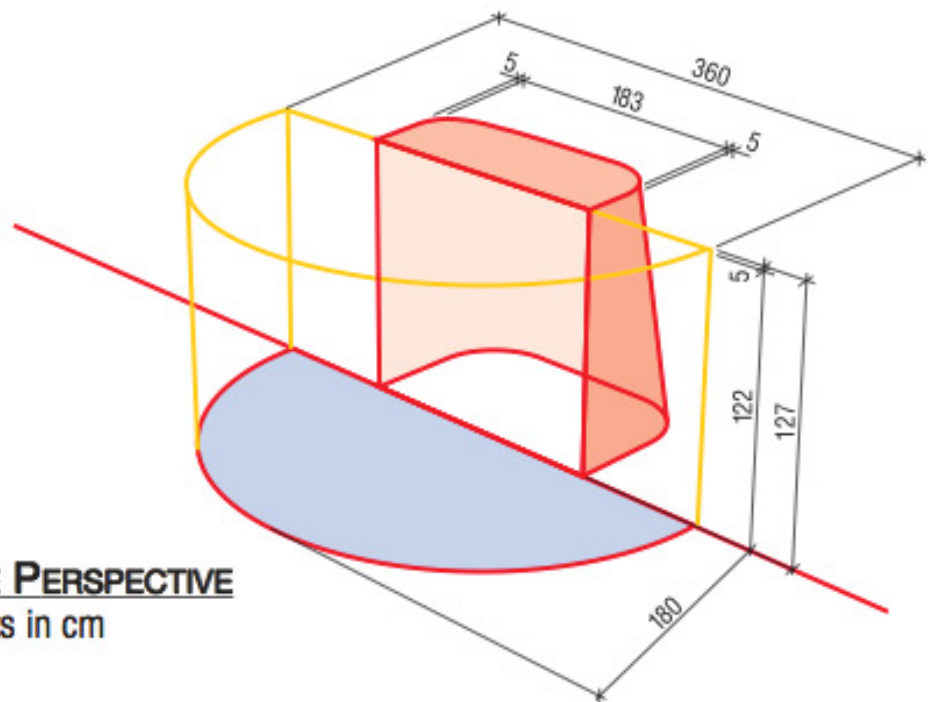
(IIHF rule book, 2010)

GOAL CREASE PERSPECTIVE
All measurements in cm

5
183
360
5
5
122
127
180

(IIHF rule book, 2010)

Ice hockey is a game, which includes an unlimited amount of changing game situations. The factors that have an effect on each situation are the amount of your own and the opponent's players on the ice, the place of the puck and the place where all players are

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positioned in each situation. Other changing factors are the movement directions. Where are players and the puck in relation to the rink and their movement velocity. The total amount of game situations in relation to the time is constant, but the amount of game situations divides differently for the two teams in relation to the skill levels of individual players. (Niemelä, 2011)

"Remember that a hockey game is like a game of tennis. The possession of the puck will change back and forth. Important is to give up the puck in the safe areas, and if possible take it back in a way which opens up a chance for you to score."

Björn Kinding, 1994

3. Scoring a goal

A goal is scored when the puck have been put between the goal posts by the stick of a player of the attacking side, from in front and below the crossbar, and entirely across a red line the width of the diameter of the goal posts drawn on the ice from one goal post to the other with the goal frame in its proper position. The goal frame shall be considered in its proper position when at least a portion of the flexible peg(s) are still inside both the goal post and the hole in the ice.

A goal is scored if a player of the defending side puts the puck into the goal in any way. If an attacking player has the puck deflect into the net, off his skate or body, in any manner, the goal will be allowed.

Should a player legally propel a puck into the goal crease of the opponent club and the puck should become loose and available to another player of the attacking side, a goal scored on the play will be legal. (IIHF rule book, 2010)

From goaltender perspective the scoring situations are divided into ten (or eleven) categories. For each type of situation, basic principles can be determined. In below do Koho & Luukkainen, 2012, SJL, 2008 and Tuononen, 2006, present actions the goaltender should play on different situation:

1. Regular shot – In these kind of situations goalie should usually position himself at the top of the crease and make the save by using appropriate fundamental saving technique according to the shot. Good puck control should be established in these kinds of situations. Goalie should be able to cover the puck or deflect it outside the dangerous scoring areas.
2. Shot from lateral movement – It is important for goalie to stay in controlled basic stance during the lateral movement and maintain readiness to make save motion at any time. Goalie should place himself at the top of the crease and stay in the middle line between the puck and center of the net during the movement.
3. Breakaway – Goalie needs to gain enough depth to match the puck carrier's speed while starting the backward motion. While matching the puck carrier's speed goaltender should stay in his basic stance. That allows goalie to patiently

wait the skater's decision, either to making a saving motion to a shot, or a lateral move if player dekes.

4. Shot from a lateral pass – For a shot coming above the top of the circle goalie should attempt to move on feet, and to stop his movement on top of the goalie crease by maintaining/gaining the depth before making a save. In situation occurring closer than top of the face off circles, goaltender most likely doesn't have enough time to move on feet, in order to gain the puck line. Therefore, goaltender should slide on the ice in order to gain the puck line and to be able to cover bottom of the net.

5. Pass from end boards - In order to adjust his movement and to gain the puck line. It is important for a goaltender to visualize the point where the shot is coming from. Shots taken further than the top of the face of circle line, and before making a save, goalie should attempt to move on feet, stop the motion on top of the goalie crease by maintaining/gaining his depth from the goal line. Scoring situation occurring closer than top of the face off circles, goal- tender most likely doesn't have enough time to move on feet, in order to gain the puck line. Therefore, goaltender should slide on the ice in order to gain the puck line and to be able to cover bottom of the net.

6. Shot from net drive starting above the goal line–Goalie needs to maintain his position according to the puck line. When puck carrier drives towards the net usually one defensive player forcing him goalie needs to stay ready for the possible shot at all times. If player with the puck skates closer to the net driving in, goaltender has to move laterally with the puck or try to intercept the puck.

7. Shot from net drive starting behind the goal line–When puck is behind the goal line goalie needs to position him on the puck side post. After puck comes over the goal line, goalie needs to rotate his body to square up to the puck. If shot is released from small angle goalie should execute stand up- or one knee down save. If player skates across the crease with the puck goalie must fol- low the lateral movement either on feet with quick lateral shuffles or sliding on the ice. Sliding on the ice is considered being the most efficient technique.

8. Rebound – Goaltenders actions in rebound situations depend on what technique was used to make the save for the previous shot. Important factor is also the time that goalie has for moving, and/or recovering between the initial- and

rebound shot. Whether there is a rebound or not readiness for the next situation should always been maintained. Goaltender must try to maintain good balance and control after the save causing the rebound to have best possibility to play the next shot. If there is a high rebound and goalie has enough time, should recover movement back on feet to basic stance behind the puck line be used. If rebound stays close following movement should be done by sliding on the ice whether the initial save was made staying on feet or by using butterfly technique. Rebounds that stay close to net mouth goalie should try to cover or play the puck away from the dangerous area.

9. Deflection–Goaltender needs to read and anticipate the possible threat of a deflection in order to be ready for it. If deflection occurs in front of the net area goalie must move behind, and as close as possible of the point of deflection, to maximize the net coverage. Getting closer to the point of deflection is important because it is almost impossible to make a reaction save when puck changes its direction. If point of deflection is on the side or diagonally behind the goalie, it may be hard to get close to it. More important for a goalie is to move towards the puck side post in order to reach the puck line.

10. Screen shot – Goalie should always fight for the sight in order to see the shot. Desired way trying to see the shot is done by looking from the side of a screening player. By doing that basic goalie stance can be maintained. Other option is to look over the screening player but in this case the basic stance is lost and readiness to move is reduced. If shot cannot be seen caused by the screening players, coverage´goalie should look for best possible coverage of the net and to position himself close to the screen

3.1. Corsi

Corsi is an "advanced" stat used in the NHL, it describes shot differential. This differential is used to measure offensive zone possession. Offensive zone possession reflects to scoring chances and predictive of success over the long-term. In general, the higher the Corsi differential or ratio, the more dominant the team or player. Logically, the team that has the puck more is going to make more shot attempts. Generally this has been shown to be the case in studies of actual puck possession time, scoring chances, and general shot attempts. The correlation is very high amongst these variables. So ba-

sically, what this means is - players with high Corsi numbers are on the ice for a higher number of shot attempts for their team than the other team. That is to say, their team has the puck more when they're on the ice. While a certain player may not see a positive Corsi result in an individual game, their cumulative Corsi over time should indicate their overall possession.

3.2. Fenwick

Fenwick is almost the exact same as Corsi, but it doesn't count blocked shots-the reason for this is that it is entirely possible that blocking shots is a skill, and not just a series of random events.

3.3. Royal road

The Royal Road is considered a line that goes directly through the middle of the ice from one net to the other. It separates the ice into two equal parts. A puck crossing this imaginary line immediately preceding a shot increases a shooters scoring opportunity by over 10 times. This is because goalies have limitations to their movements and while laterally tracking they are forced to open up. Chris Boyle reviewed NHL footage and found a pattern.

These high percentage opportunities were labeled Green goals because they do not allow the goaltender to gain half a second of clear sight prior to the release.

Green goals account for 76% of all goals reviewed. These shots are high percentage opportunities and fit into seven different criteria: passes across the Royal Road, screens, one-timers on the same side of the Royal Road, broken plays, possession across the Royal Road, deflections, green rebounds. A pass across the Royal Road below the top of the face-off circles account for 22% of all goals.

If a goaltender cannot view the puck it decreases his chances for success, 10% of green goals are scored with a screen.

One-timers on the same side of the Royal Road These are plays that generally originate from behind the net and are quick passing plays to a shooter in the slot on the same side of the royal road. Broken plays can cause havoc for goaltenders because they set for a situation that can be altered by a quick change in puck direction. Passes or shots that deflect off a skate/stick into the net. Both situations consists 9% from green goals. Remaining green goals are scored from possession across the Royal Road, deflections, and green rebounds. Each of these categories contains 8% fro green goals.

Possession across the Royal Road, a shot from above the face-off circles and no lateral movement will results in around a 3% chance to score. If the attacking forward is able

to cross the royal road through the slot, his chances increase to 33%.

Deflections are extremely challenging because they initially present themselves as a red shot. A goaltender sets for the initial path and plane but when they are altered, the maximum coverage becomes compromised

A green rebound is any scoring opportunity that comes off a goaltender that originated from the green shots listed above..

Green opportunities account for over three quarters of all goals scored in this study, yet they only account for one quarter of all shots taken during a typical NHL game. To put that in perspective, during an average 30 shot NHL game a team will take 22-23 Red shots.

Red Shots are low percentage shots on net where goaltender has more than a half a second to see the shot. Goaltenders have an extremely high success rate with these opportunities because without lateral movement across the Royal Road or significant pre-shot movement, they are able to set angle, depth and create strong visual attachment to the puck. At this point the shooter is relying on either a perfect shot or goaltender incompetence for success. Only 18% of goals were scored in this situation.

Red Rebounds are possible entirely because of goaltender failure. They differ from green rebounds because of the nature of the initial shot. All rebound opportunities have a higher probability of success.

An area created by starting from the center of the net and creating a line towards where the boards and centerline connect defines a yellow shot. At the intersection of where this and the vertical Royal Road intersects, we connect them to form a triangle. A yellow shot is defined by any red shot that takes place inside this triangle. It isn't easy to skate into this area without being forced to cut laterally or wide and because of this, they only occur once or twice every 2-3 games.

The yellow shot is preferred to a red shot because of the proximity to the scoring zone in the slot area. As a result, it has a 300% greater success rate than the red shot, but without the benefit of deceiving the goaltender with pre-shot movement or reducing a goaltenders visibility, the success rate is below the preferred green shot.

(www.msg.com)

3.4. Shooting techniques to score a goal

The ability to shoot the puck is important technique to be able to score goals. There are five different types of shooting: wrist shot, snap shot, slap shot, flip shot, and backhand shot.

Four of the techniques the puck is released from forehand side. Wrist shot is the most accurate shot as the puck is in contact with the stick throughout the shooting motion. The wrist shot can also be deceptive, as a pass can be made from the same motion. The snap shot is similar to the wrist shot with the exception that the blade of the stick is removed from the puck immediately after the shot is taken. The shot is almost as powerful as a slap shot but can be released as quickly as a wrist shot, but is not as accurate. The slap shot is the most powerful of all the shots. The draw back with the slap shot takes the longest to release. The objective of the flip shot is to get the puck up high in the air as quickly as possible. "Scooping" the puck carries this out. The flip shot is valuable when a player is in close on the net and the goalkeeper is down on the ice.

The backhand shot is both fast and accurate is can be used by a player who has faked a move to the forehand side to bring the puck to the backhand for a quick shot on the goalkeeper. There is also a backhand flipshot. It is similar action as on forehand, but it is executed from backhand side. (IIHF Coach Manual, 2007)

Only one out of ten shots goes into the net. Reasons for this are: shooting too close to the net, too far from the net, too high, or the shot is too soft. Most of these flaws are simply due to that the player has not learned the right technique how to shoot the puck. (Tarasov, 1975)

4. SM-League

In regular season all teams play 60 matches. Each match consists of 60 minutes regulation time and in the event of a tie, winner is decided by a four-on-four sudden death, 5-minute overtime. Ties after overtime are decided by a shootout, where each team has three shooters in the beginning. If the game is tied after three shooters the individual shooters go against one another until one scores and the other does not. A win in regulation time is worth three points, a win by sudden death overtime or in a shoot out two points and loss by sudden death overtime or in a shoot out one point. Teams ranked by points and teams tied by points are ranked by goal differential. Teams tied by goal differential as well are ranked by number of goals scored. So scoring goals is very much needed in this sport.

Play-offs: The six best teams at the conclusion of regular season proceed directly to quarter-finals. Teams placing between seventh and tenth will play preliminary play-offs. Teams are paired up for each round according to regular season results, so that the highest-ranking team will play against the lowest-ranking, second highest against the second lowest and so on. (wikipedia SM-liiga)

This reseach is about finding the key elements for scoring because scoring goals at least one more than a opposing team makes all the differences in a game. Compared to the 2006 Olympic Games the percentages between even strength, power play, and special situation, there is a slight difference. In the Olympics, goals scored on even strength were 58,3%, on power play 33,5%, and special situation goals 8,3%. The percentage on power play goals is quite significant, so power play is even more important in a short tournament than in a long season. Does the difference come also from the fact, that in the Olympics, there are better and more skilled players? Most likely it does. (Saarinen co. 2010)

While the average length of all puck-possessions measured was 8.81 seconds, the average length of a possession that produced a scoring chance (SC) was 12.59 seconds. The Even-Strength scoring chances (EVSC) averaged 10.94 seconds, and the Even-strength chances from counter-attacks (CAEV) were even shorter, at an average of 6.83 seconds. The precipitous drop in length of SC was due to the fact that 55-60% of Power Play goals are scored after possessions of more than 10 seconds (Saarinen, Mensonen & Small 2009, 20). In hockey 65 percent of the goals come after a rebounb

or deflection. Mosto goalies can make the first save if they see the shot. In other words, at least two players are needed to score a goal. The small-games method signifies an alternative approach to the tradional way of running a practice in goal-sentered games. This method is based on the traditional and natural methods of pick-up games. Lininig up of players is avoided and the various modified games take care of teaching skills like scoring.

The game and the game-situation roles of the player can be learned. Also the use and the improvement of individual skils can be proved by playing small games. The ultimate goal is learning to play. Even though we talk about hockey as a team sport, the coaching has to be focused on one single player. Good habits, such as face the, keep the stick on ice, keep the feet moving, make good passes, shoot on the net, etc.(Wahlsten & Molloy 2002, 69-75). All of these need to be in place before scoring a goal.

It has come a common knowledge over the years that most even-strength scoring chances come from fast turnover-attacks in the Offensive and Neutral Zones, the research has left many with the mistaken impression that such events are standalone occurrences. Thus, many coaches have trained their players to move the puck forward, quickly, in the hope of producing a scoring chance within the 'key', fast-attack window. Examples of this adherence to 'common knowledge' are plentiful in coaching literature. According to Perron, "The key ingredients of a counter-attack are surprise and quickness" (Perron, 161). When a defensive player gains the puck from attackers, he should, according to this philosophy, attempt to advance the puck as quickly as possible:

"I would hope that they play the games on this ice surface, because the games are so much better," Wilson said. "The game tonight had so much intensity. Canada and the United States play the game like it should be -- not sitting back and playing on your heels and waiting for something bad to happen and counter-punching, but actually going on the attack. (Roarke, S. 14.6.2010)

5. Research methods

Ruutu.fi, internet site provided all the goals from SM-league. Typical length of each videoclip was approximitely ten seconds. Every goal was analysed and divided to three main categories: equal strength, power play and special situations. Equal strenght goals are broken down in rush, turnover and offensive zone play. Rush is divided into six sub-categories: equal strength, odd man, short handed, breakaway, via end/deep attacking zone and rush + rebound. Goals scored in turnovers are broken down in three sub-categories: offensive zone, neutral zone, and defensive zone. Goals scored on offensive zone play are broken down into six sub-categories: pass from end boards, rebound, defender´s shot, lateral pass, carrying + shooting, and up behind the net. Power play goals are broken down in seven sub-categories: set play, rebound, set play from blue line, rush, deflection, turnover and face off win. Special situation goals are broken down in three categories: empty net, short-handed and face off wins

5.1. Rush

Rush means controlled attacks from defensive zone or neutral zone, when the end result of these attacks is goal. Combined factor to these are, that the goals are scored against the opponents organized defense.

5.1.1. Rush: via end/deep attacking zone

When situation starts from team's defensive or neutral zone from other reason than turnover, and leads straight to a scoring chance via end
boards.
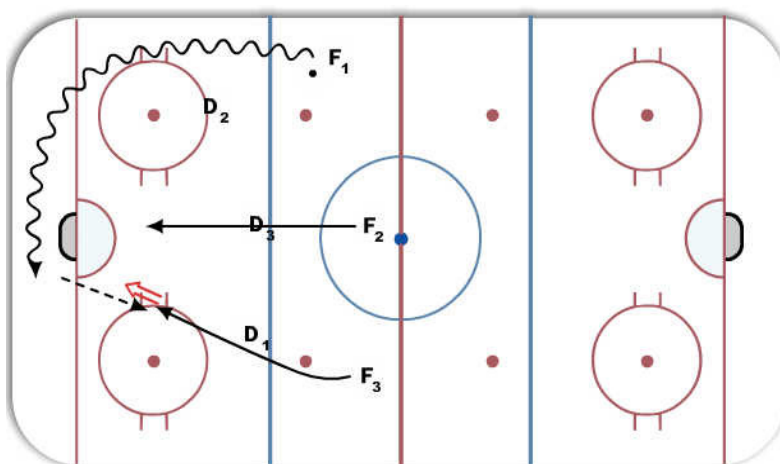
5.1.2. Rush: rebound

When situation starts from team's defensive or neutral zone from other reason than an instant turnover and leads to a scoring chance after the rebound.
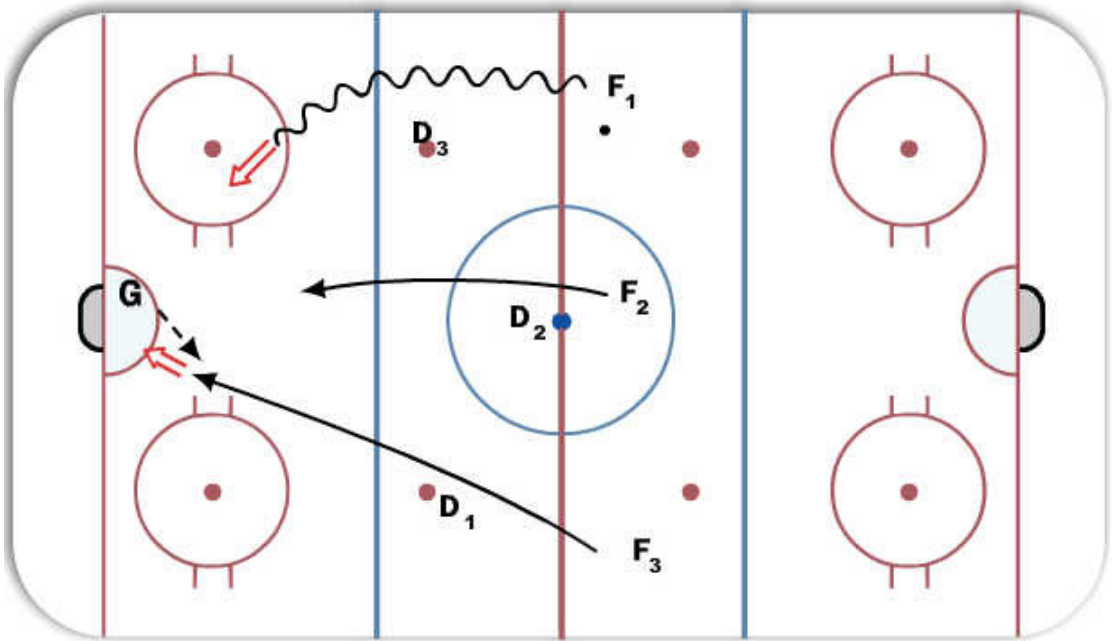
5.1.3. Rush: equal strength

When situation starts from team's defensive or neutral zone from other reason than an instant turnover and leads straight to scoring chance. **A criterion is the situation in the offensive blue line. For example, 1-1, 2-2 etc. situations**

5.1.4. Rush: odd man

When situation starts from team's defensive or neutral zone from other reason than an instant turnover and leads to scoring chance. **A criterion is the situation in the offensive blue line. For example, 2-1, 3-2, etc. situations**

5.1.5. Rush: short handed

When situation starts from team's defensive or neutral zone from other reason than an instant turnover and leads to scoring chance. **A criterion is the situation in the offensive blue line. For example, 1-2, 2-3, etc. situations**
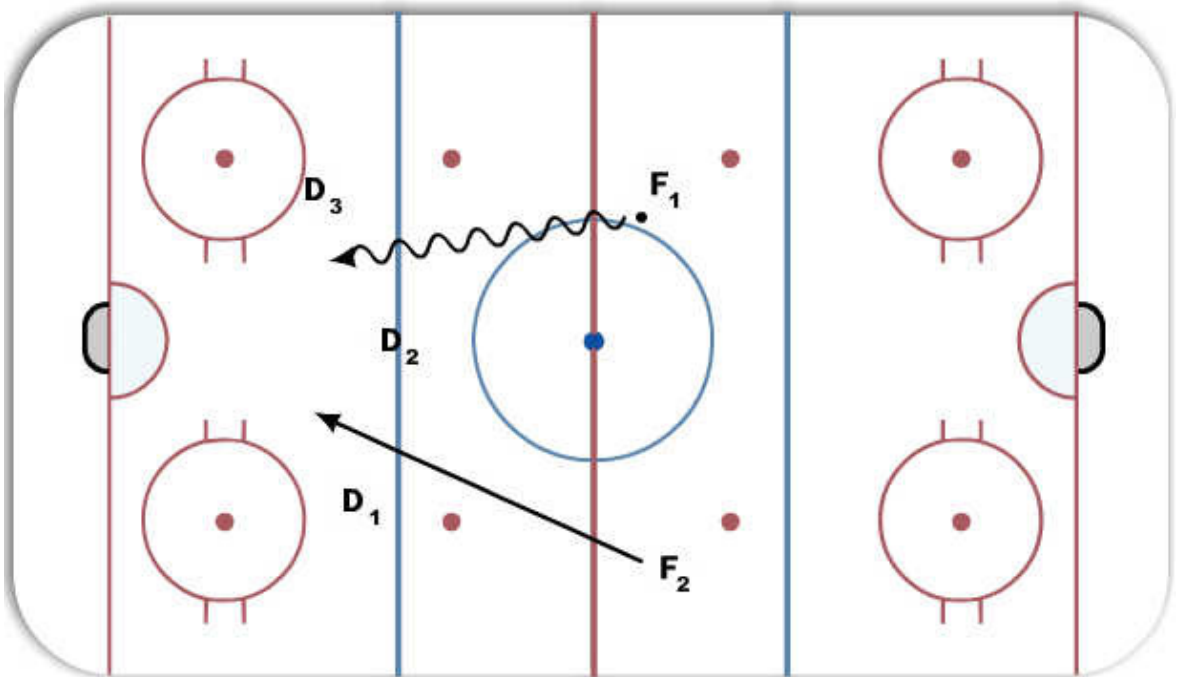
5.1.6. Rush: breakaway

When attack starts from team's defensive or neutral zone from other reason than an instant turnover and leads to scoring chance, **criteria being here breakaway, → player alone against the goalie**
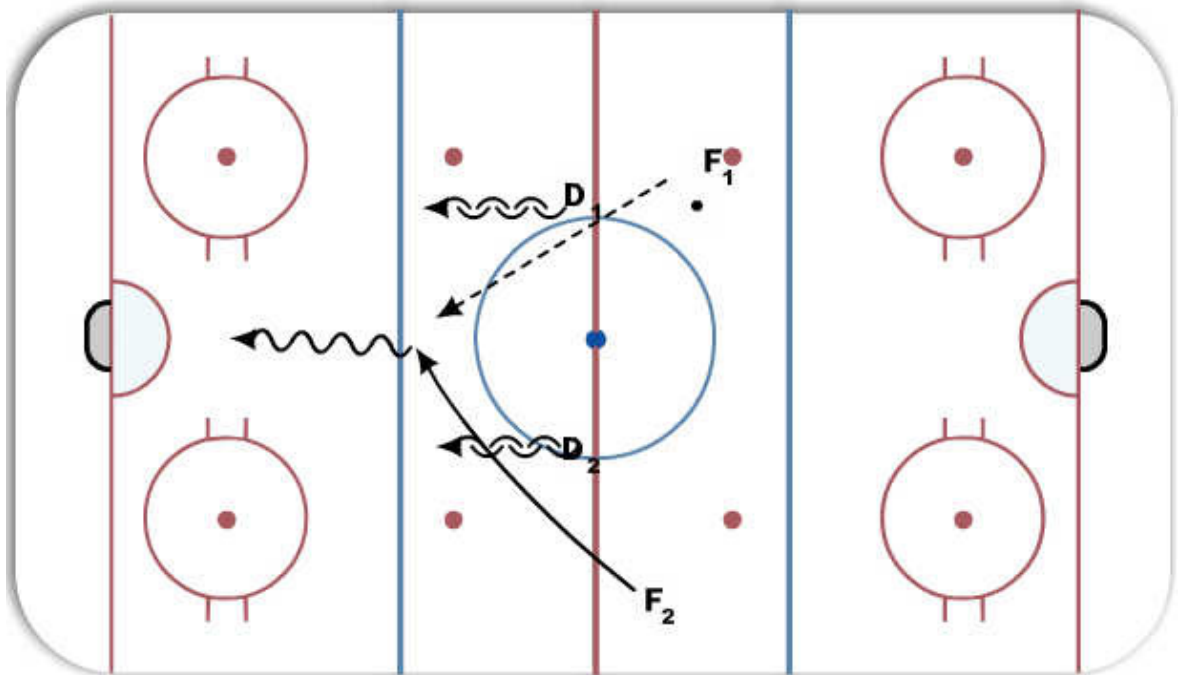
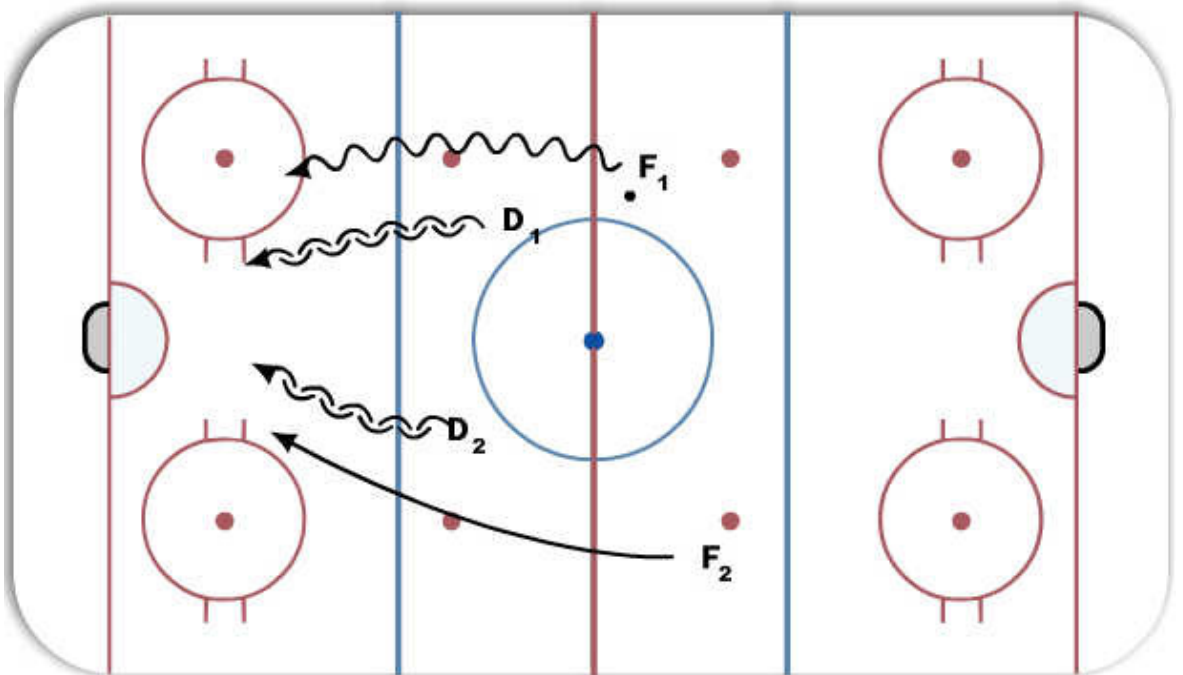### 5.1.7. Rush + rebound

When situation starts from team's defensive or neutral zone from other reason than an instant turnover leads to a scoring chance after the rebound created straight from a rush.
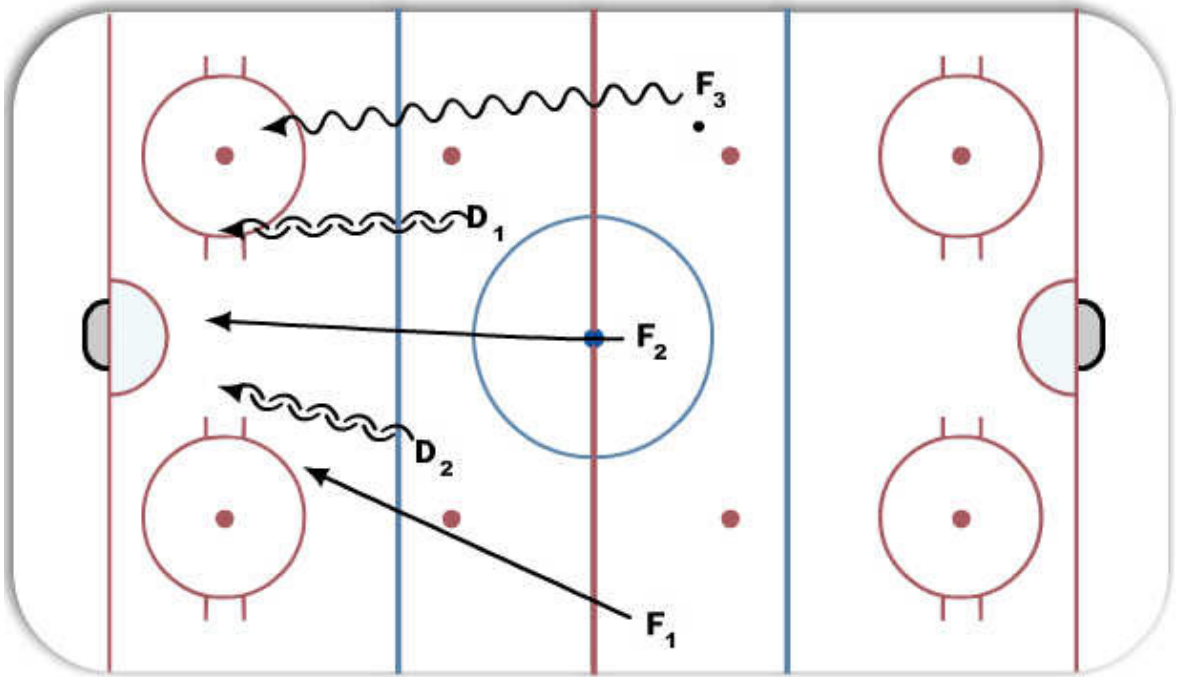
5.2. Turnover

A turnover situation means those scoring chances created by turning over the puck and it leads to offensive situations immediately (offensive zone, neutral zone, defense zone). Common for these kinds of situations is that opponent's defense is unorganized.

5.2.1. Turnover: offensive zone

A scoring chance created immediately after a turnover in the offensive zone.

5.2.2. Turnover: neutral zone

A scoring chance created immediately after a turnover in the neutral zone.

5.2.3. Turnover: defensive zone
A scoring chance created immediately after a turnover inside own blue line.

5.3.   End-zone play
End-zone play means those situations, which are created by "forced play". Common to different categories is that real scoring chance has developed from puck holding or passing chains in the offensive zone. Rush and turnover turns into end zone play, if the attacking team can hold the puck at least 5 seconds, and it is not straight consequence from stealing the puck.

5.3.1. Carrying + Shooting
A goal created after carrying the puck in the end-zone play
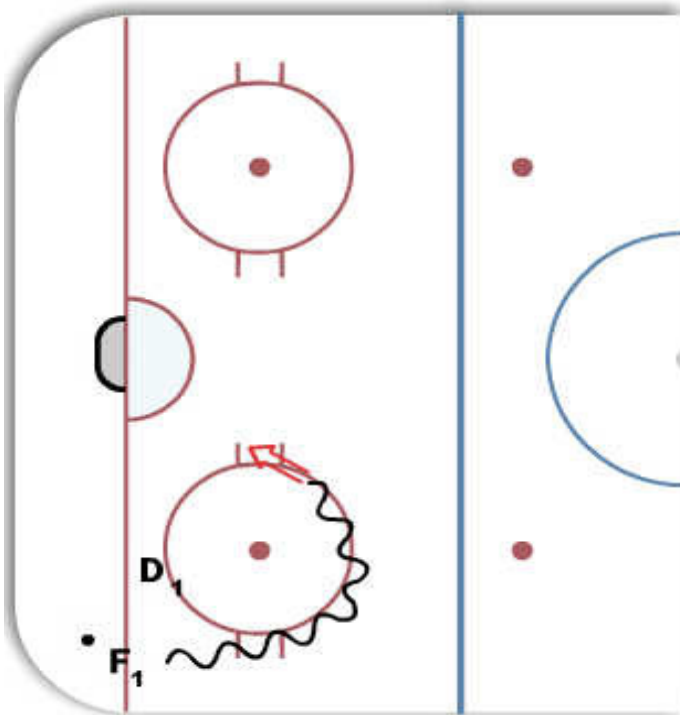
5.3.2. Defender´s shot
Defenders shot under the blue line, and after end-zone play.
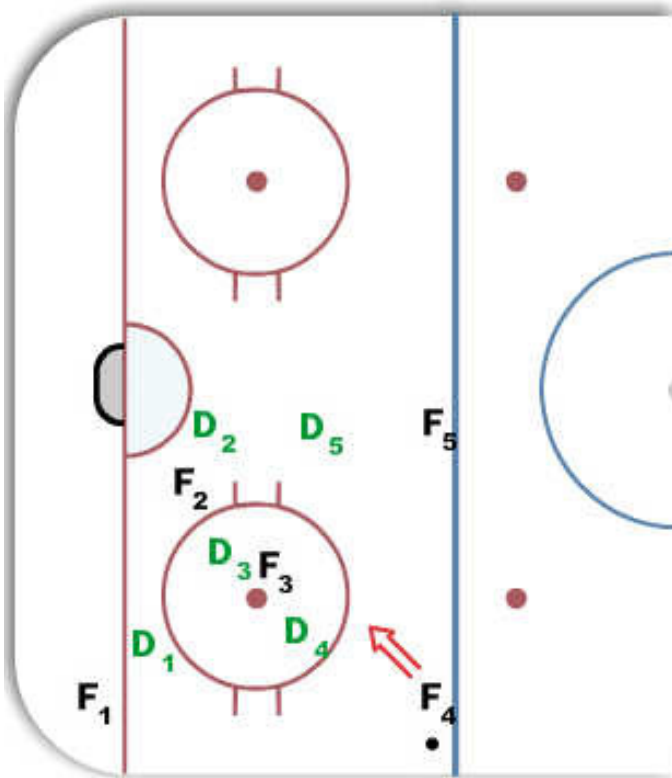
5.3.3. Pass from end boards
One-time shot to a pass coming from behind the goal line, created after end-zone play.
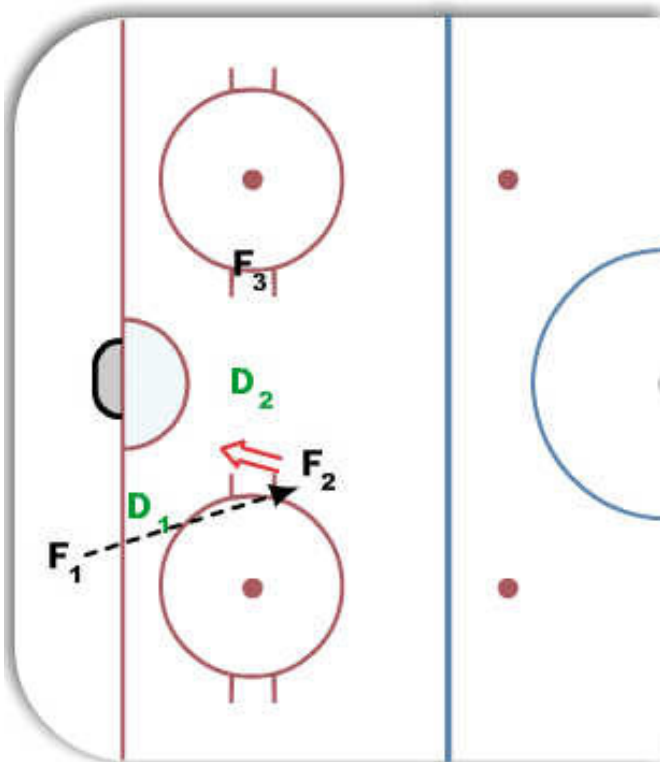
5.3.4. Rebound
Scoring chance created from a rebound after end-zone play.
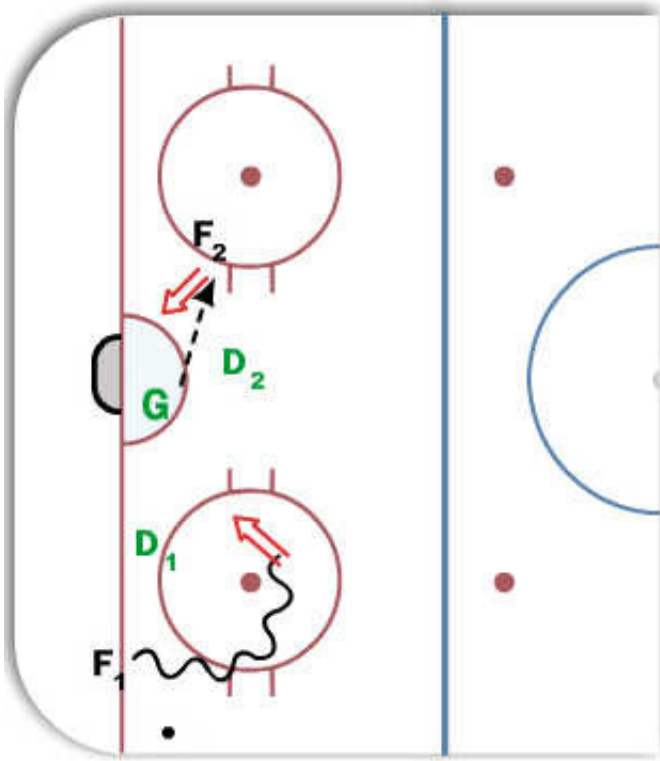
5.3.5. Lateral pass

One-timer shot to a lateral pass after an end-zone play. (Defenders shot can also be like this)
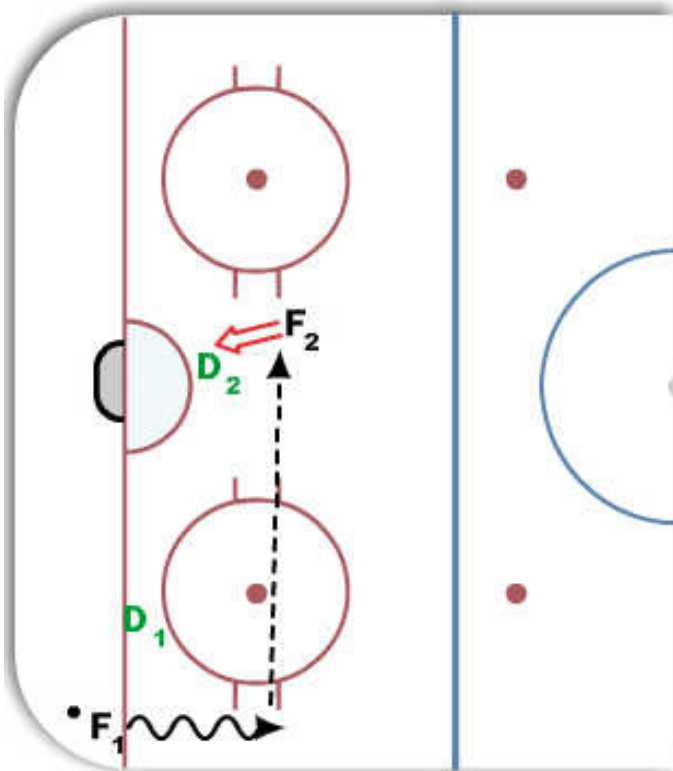
5.3.6. Up behind the net

Up from behind the net, after an end-zone play.
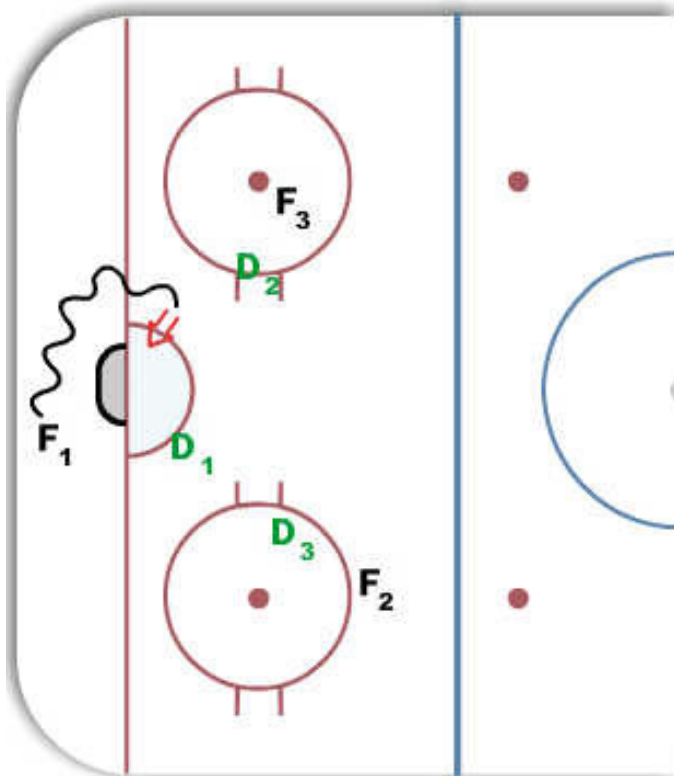
5.4. Power play
Goals scored during power-play (5-4, 5-3, 4-3) or delayed penalty.

5.4.1. Rush
A immediately shot in power-play in a direct attack without the "forced play" period.

5.4.2. Turnover
In this category the attack starts when team steals the puck from the opponent, in the offensive zone, neutral zone or defensive zone. It can also be the result of a won face off at the offensive zone.

5.4.3. Set play from blue line
When a power-play goal is scored by a shot coming from the blue line.
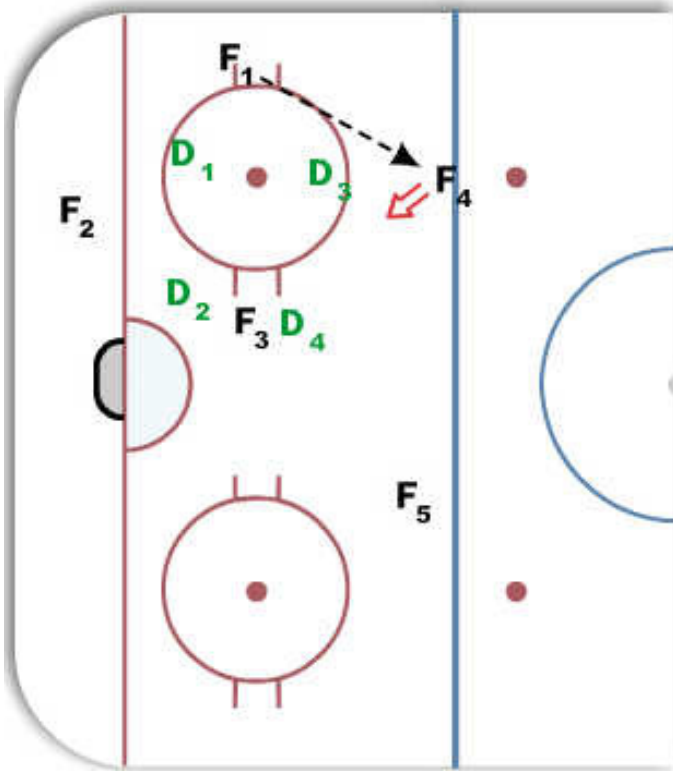
5.4.4. Set play
Power-play goal scored after an end-zone play. (Includes all the other set plays except those created from a shot coming from the blue line)
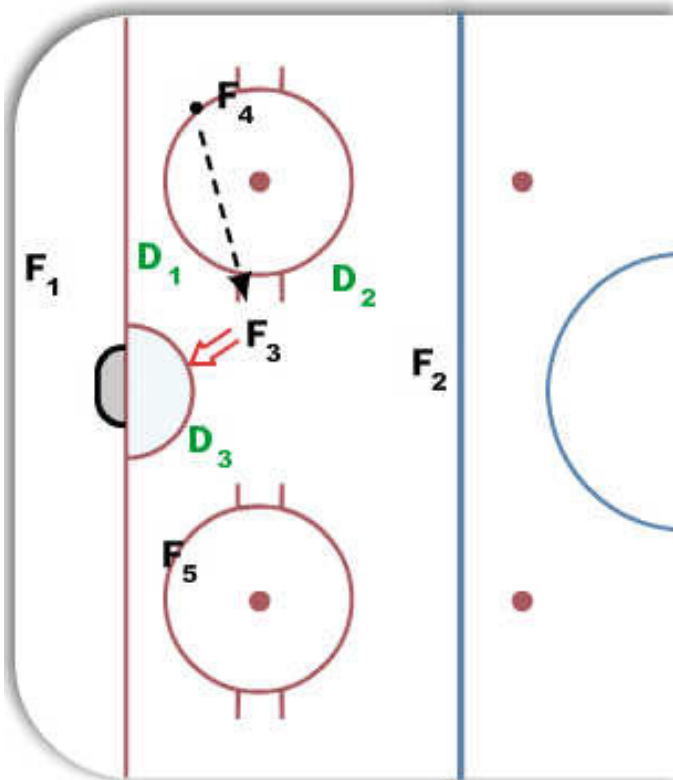
5.4.5. Rebound

Power-play goal scored from a rebound.
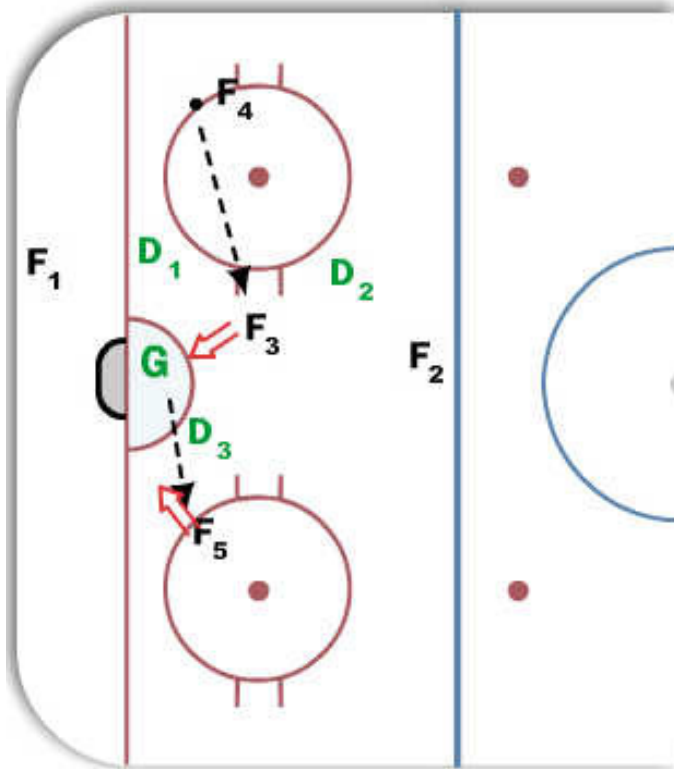
5.5.   Short handed

When team manages to create a scoring chance while being short-handed.

5.6.   Won face off

Goal scored after winning a face-off in the offensive zone while playing 5 on 5.

5.7.   Empty net

Goal scored into an empty net.

6. Goal analyzis

6.1. Goal Data categorization

The 1349 even strength goals are broken down in to:

1. rushes (443 goals)
2. turnovers (423 goals)
3. offensive zone play. (483 goals)

The 443 goals scored in rushes are broken down in six categories:

1. equal strength rush (106 goals)
2. odd man rush (76 goals),
3. short hand rush (94 goals),
4. breakaway (41 goals),
5. rush from behind opponent's goal line (54 goals)
6. rebound. (74 goals)

In the percentage outcome is clearer. Equal strength 24%, short handed 21%, odd man and rebound 17%, behind the goal line 12% and breakaways 9%

The 423 goals scored in turnovers are broken down in three categories.

1. offensive zone turnover (265 goals)
2. neutral zone turnover (97 goals)
3. defensive zone turnover (61 goals)

In percentage same thing is clearer. Offensive zone 63%, neutral zone 23% and defensive zone 14%.

The 483 goals scored on offensive zone play are broken down in six categories.

1. pass behind the goal line (108 goals)
2. rebound (107 goals)
3. shot from a blue line (93 goals)
4. lateral pass (75 goals)
5. carrying the puck and shot (64 goals)
6. driving with the puck to the net (36 goals)

In percentage pass from behind the goal line 22%, rebounds 22%, shot from a blue line 19%, lateral pass 16% carrying the puck and shot 13% and driving with the puck to the net 8%.

Power play goals are broken down in seven categories:

1. set play (197 goals)
2. rebound (128 goals)
3. set play from blue line (122 goals)
4. rush (73 goals)
5. deflection (56 goals)
6. turnover (26 goals)
7. face off win (24 goals)

In percentage Set play 32%, rebounds 20%, set play from blue line 19%, rushes 12%, deflections 9%, turnovers 4% and face off wins 4%.

The 219 special situation goals are broken down in three categories:

1. empty net (100 goals)
2. short handed (67 goals)
3. face off wins (52 goals)

In percentage empty net 46%, short handed 30% and face off wins 24%.

7. Results of study

This research shows that most goals (1349) are scored in even strength and inside the even strength goals all three categories are really close to each other. On offensive zone play 483 goals (36%), on rushes 443 goals (33%) and on turnovers 423 goals (31%).

Power play goals come in a major role. Research shows that 626 goals are scored on power play, which is huge number, and it shows that one power play goal is 2,15 even strength goals. (1349 even strength goals divided by 626 power play goals). In 420 games the averages goals scored was 3,2 even strength goals and 1,5 power play goals per game. Research shows that main categories do not give answer what is the best way to score except between even strength and power play. When looking inside the three even strength categories and power play the categories shows clearly which is the most effective way to score. Number one is turning the puck in a offensive zone. Turning the puck there leads to a goal in 20% chance. Does that tell that right way to play is for check hard and try to get the puck over in opponents zone? Yes, if there is no other things involved. This quick forward pass will most likely create a numerical advantage. The defenseman could have chosen to pass laterally; this would not have produced a quick transition...you don't want to give the opposition time to recover their ideal defensive alignment (Perron, 161).

Second most effective way to score is offensive zone play where the pass comes from behind the net. Pass from behind the net leads to a goal in 8% chance. Does that support cycling in opponents zone? No, but there is other things involved. The third most effective way to score is even strength rush which leads to goal in 7,8% chance. Does that support control breakouts and attacking against five-man unit. No, but there is other things involved. Research shows that all these areas are lethal to have a winning team, but the 20% chance to score is very high percent if compare in any other ways to score a goal on even strength game. Power play is the one that stands out from this research out of all 2194 goals 626 is scored on power play the percentage is 28,5. It is huge number and research shows that only way to be able to score even close that percentage is turning the puck in opponents zone.

7.1. Comparing three best teams against three worst teams in regular season best (Kalpa, Pelicans, HIFK)/worst (Ilves, HPK, Tappara)

Regular season winner was Kalpa. Kalpa scored on rushes 37 goals when league averages was 32 goals. When comparing Kalpa versus opposing team the opponent score only 30 times on rushes. Kalpa is way better than league averages and their opponents. Turnovers Kalpa scored 32 times when league averages was 30 and opponent scored on 34 goals. Kalpa is little above league averages, but lost the turnover game for their opponents. Offensive zone play Kalpa scored 30 goals when league averages was 35 goals. Versus their opponents Kalpa suffered turnover goals only 23 times. Kalpa is way under the leagues averages, but won clearly offensive zone play versus their opponents.

On power play Kalpa scored 53 three goals when league averages was 45 goals so way above the averages. Kalpa versus opponents' power play the opponent scored only 30 goals on them.

Regular season second was Pelicans. Pelicans scored on rushes 48 goals when league averages was 32 goals. When comparing Pelicans versus opposing team the opponent score only 32 times on rushes. Pelicans is superb than league averages and their opponents. Turnovers Pelicans scored 36 times when league averages was 30 and opponent scored on 27 goals. Pelicans is way above league averages and a lot better than their opponents. Offensive zone play Pelicans scored 44 goals when league averages was 35 goals. Versus their opponents Pelicans suffered turnover goals on 42 times. Which goes almost even with opponents.

On power play Pelicans scored 62 three goals when league averages was 45 goals so way above the averages. Pelicans versus opponents' power play the opponent scored only 39 goals on them. Difference is huge

Regular season third was HIFK. HIFK scored on rushes 35 goals when league averages was 32 goals. When comparing HIFK versus opposing team the opponent score only 16 times on rushes and it is superb versus opposing teams. On turnovers HIFK scored 38 times when league averages was 30 and opponent scored 40 goals. HIFK is way above league averages, but lost offensive zone play versus their opponents. Offensive zone play HIFK scored 45 goals when league averages was 35 goals. Versus their opponents HIFK was outstanding versus their opponents whom scored only 22 goals.

On power play HIFK scored 44 goals when league averages was 45 goals.

HIFK versus opponents' power play the opponent scored 47 goals on them. Power play goes almost even in all three categories

Regular season finish last Ilves. Ilves scored on rushes 34 goals when league averages was 32 goals. When comparing Ilves versus opposing team the opponent scored 39 times on rushes. Ilves is close to averages and behind their opponents. Turnovers Ilves scored 27 times when league averages was 30 and opponent scored 23 goals. Ilves is under the league averages, but won the turnover game against their opponents. Offensive zone play Ilves scored 35 goals when league averages was 35 goals. Versus their opponents Ilves lost the area clearly and was scored on 48 times.

On power play Ilves scored 32 goals when league averages was 45 goals so way under the averages. Ilves versus opponents' power play the opponent scored 61 goals on them which a clear weakness.

Regular season finish second last HPK. HPK scored on rushes 28 goals when league averages was 32 goals. When comparing HPK versus opposing team the opponent scored 49 times on rushes. HPK is under the averages and behind very far away from their opponents. Turnovers HPK scored 25 times when league averages was 30 and opponent scored 30 goals. HPK is under the league averages and lost the turnover game against their opponents. Offensive zone play HPK scored 32 goals when league averages was 35 goals. Versus their opponents HPK lost the area clearly and was scored on 44 times.

On power play HPK scored 36 goals when league averages was 45 goals so way under the averages. HPK versus opponents' power play the opponent scored 54 goals on them, which they lost clearly.

Regular season third last was Tappara. Tappara scored on rushes 23 goals when league averages was 32 goals. When comparing Tappara versus opposing team the opponent scored 37 times on rushes. Tappara is under the averages and behind very far away from their opponents. Turnovers Tappara scored 28 times when league averages was 30 and opponent scored 35 goals. Tappara is under the league averages and lost the turnover game against their opponents. Offensive zone play Tappara scored 32 goals when league averages was 35 goals. Versus their opponents Tappara lost the area clear-

ly and was scored on 44 times.On power play Tappara scored 32 goals when league averages was 45 goals so way under the averages. Tappara versus opponents' power play the opponent scored 47 goals on them, which they lost clearly.

7.2. Comparing in numbers three best against three worst

Three best teams scored goals on even strength 345 goals, power play 159 goals and other special situations 66 goals. In total 570 goals.Three worst teams scored even strength 264 goals, power play 100 goals and other special situations 31 goals. In total 395 goals.

This research shows that there is a very big difference in al the areas total goals for three best teams are 175 goals plus versus three last teams. When it is broken down in categories it shows the difference more clearly.

7.3. Even strength game and power play

On rushes best versus worst the numbers are 120 goals versus 85 goals. Difference 35 goals plus for the best teams.

On offensive zone play best versus worst the numbers are 119 goals versus 99 goals. Difference 20 goals plus for the best teams.

On turnovers best versus worst the numbers are 106 goals versus 80 goals. Difference 26 goals plus for the best teams.

All together difference is 81 goals plus for the best teams.Power play three best teams scored 159 goals and three worst teams 100 goals. A difference is 59 goals plus for the best teams. In a short handed the numbers are for three best teams 116 goals allowed and for the three worst teams 162 goals allowed. This shows that three best teams allowed 46 goals less when played short handed. Together power play and short-handed play is 127 goals better than three worst teams had.

8. Discussion

This research gave answers to four questions: 1. Reason behind the goals? 2. How many goals scored on equal strength versus power-play? 3. Can you see a difference between three best teams versus three worst teams in a regular season? 4. How many goals scored in different game situations?

The research involved information from 420 games, but the games were not actually filmed by the researchers. The video clips were produced by 4Pro TV channel and were watched from ruutu.fi, sometimes, the clips started later than the actual play that happened which led to a final game situation were the goal was scored. Results garnered from those incomplete videos are still in this research. Without full video of a game, it is impossible to generalize any results for creating the perfect game plan. The decision was made to use the partial video clips also.

Despite the loss of that information, important results and conclusions have still been garnered from the SM- league season 2011-2012 there was 420 games played and in those games 2194 goals were scored. In this research clearly evidence is broken down what was the reason behind al the goals. Even strength goals were scored 1349; power play goals 626 and other special situation goals were scored 219. In percentage 61% was scored even strength. In power play percent were 29% and special situations 10%. Research gives still a very good result what is the difference between the three best teams and the three worst teams and why the goals were scored. In all categories the difference between three best and three worst is remarkable and the best teams were overall stronger in every area of how the goals were scored.

Furthermore, very little separates a goal from a save or a shot that hits the goalpost. By examining only goals-scored, and not all scoring chances, we are implying that goals are scored from chances that are somehow of a different quality than those that produce saves or ricochets off goalposts. However, as noted by journalist David Staples, ... it really hits home that little separates a goal from a great save, a scoring chance from a goal. Most goals are scored on the very best of scoring chances, leaving the goalie with little chance of making a save, but some goals are scored on marginal scoring chances, or on shots that can't be considered scoring chances at all. There's some luck that comes into play here. (Staples, 2010)

When you try analyze how are goals scored there is a lot of different aspects to be considered. Our research goal was to analyze the situation that leads to goal, but it only

gives one-sided information. It does not give answers for example where did the specific shot was taken. Royal Road gives one answer to the position of the shot, but actual quality of the scoring opportunity and the shot is really hard to analyze.

Humans at high speed play the game of hockey in tight quarters on a slippery, but imperfect, surface with a disk made of rubber. If this does not sound like a recipe for chaotic events, watch a hockey game. There is a great deal of statistical proof that goals occur randomly. This does not mean that skill, strategy and execution give way to luck. It means that outcomes are uncertain, influenced by a myriad of factors including skill, strategy and execution.

To better analyze the nature of what is the most effective way to score a goal and how to manage the best game plan it would require a quantity of research that cannot be accomplished by two persons working together or separated during a one season. An interesting continuation to this research, then, might have the Degree Program students in Vierumäki continue the research. They should develop new questions or premises, and examine many season's worth of scored goals to see if the results hold up.

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Attachments:

SUORAHYÖ	JYP	VAS	KAL	VAS	SAI	VAS	PEL	VAS	ILV	VAS	TAP	VAS	HPK	VAS	KÄR	VAS	ÄSS	VAS	LUK	VAS	TPS	VAS	HIF	VAS	JOK	VAS	BLU	VAS		
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K-RIISTO	JYP	VAS	KAL	VAS	SAI	VAS	PEL	VAS	ILV	VAS	TAP	VAS	HPK	VAS	KÄR	VAS	ÄSS	VAS	LUK	VAS	TPS	VAS	HIF	VAS	JOK	VAS	BLU	VAS	0	0
h-alue	13	15	21	25	11	15	19	17	18	13	19	19	17	19	17	16	30	13	15	20	17	27	24	25	29	18	14	24	530	265
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kulj./lauk.	7	6	3	2	7	7	7	9	3	6	7	5	4	5	5	4	2	1		5	4	3	6	5	2	3	7	3	128	64
pakin veto	9	4	10	4	3	9	8	5	7	7	8	7	5	6	6	6	4	9	7	9	2	2	9	6	10	8	5	11	186	93
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rebound	5	5	4	6	8	8	7	10	10	14	7	10	11	8	8	10	9	8	13	3	6	7	10	7	7	3	4	6	214	107
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TASAK.YHT.	**90**	**71**	**99**	**87**	**87**	**86**	**128**	**101**	**96**	**110**	**83**	**116**	**85**	**123**	**98**	**92**	**118**	**84**	**89**	**103**	**66**	**110**	**118**	**78**	**104**	**86**	**93**	**97**	2698	1349
YV	**53**	**32**	**53**	**30**	**48**	**58**	**62**	**39**	**32**	**61**	**32**	**47**	**36**	**54**	**44**	**35**	**37**	**43**	**50**	**48**	**45**	**44**	**44**	**47**	**52**	**40**	**38**	**48**	1252	626
MUUT	18	16	24	13	9	13	17	11	10	20	13	14	8	14	14	12	23	20	19	14	13	23	25	17	19	16	7	16	438	219
TOTAL	**161**	**119**	**176**	**130**	**144**	**157**	**207**	**151**	**138**	**191**	**128**	**177**	**129**	**191**	**156**	**139**	**178**	**147**	**158**	**165**	**124**	**177**	**187**	**142**	**175**	**142**	**138**	**161**	4388	2194

SM-League scoring analysis 11-12

Total goals
420 games

	Goals	%
Even strenght	1349	61
Power play	626	29
Special situations	219	10
Total	2194	100

■ Even Strenght ■ Power Play ■ Special Situations
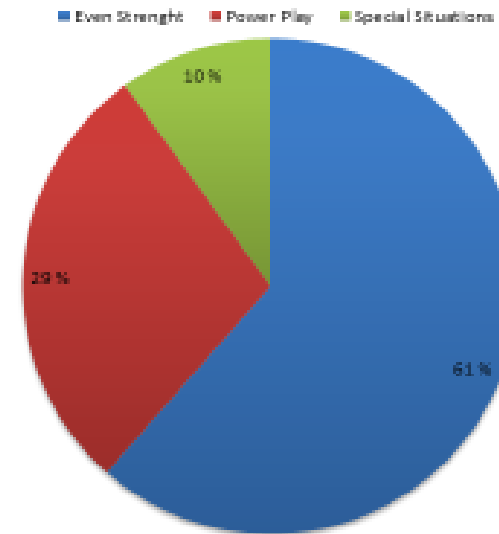
Goals/ game

Regular season
2194 goals/ 420 games = 5,22 goals/game

	Goals	Goals/ Game
Even strenght	1349	3,21
Power play	626	1,49
Special situations	219	0,52
Total	2194	5,22

Even strenght

Regular season, all teams

	Goals	%
Straight Attack	443	33
Turnover	423	31
Offenzive Zone Play	483	36
Total	1349	100

■ Straight Attack ■ Turnover ■ Offensive Zone Play
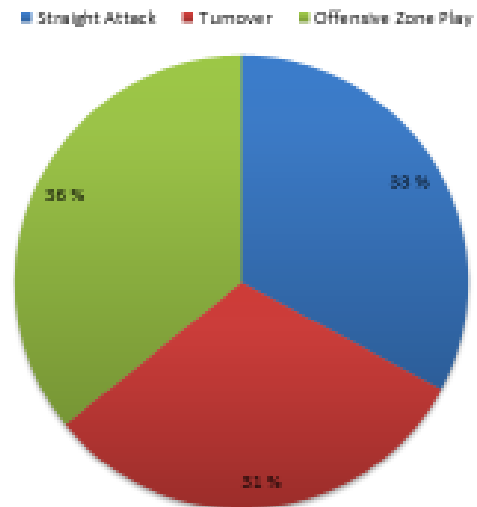
All even strenght goals

Regular season 1349 goals

Straight attack	Goals	%
Behind the net	52	12
Rebound	74	17
Equal strength	106	24
Odd Man	76	17
Short hand	94	21
Breakaway	41	9
Total	443	100

Turnover	Goals	%
Attacking zone	265	63
Neutral zone	97	23
Defensive zone	61	14
Total	423	100

Offensive Zone Play	Goals	%
Puck carrying+ shot	64	13
Shot from defender	93	19
Pass behind the net	108	22
Cross ice pass	75	16
Rebound	107	22
Break to the net	36	8
Total	483	100

Power play and special situations

	Goals	%
Power play	626	74
Empty net	100	12
Short handed	67	8
Face off win	52	6
Total	845	100
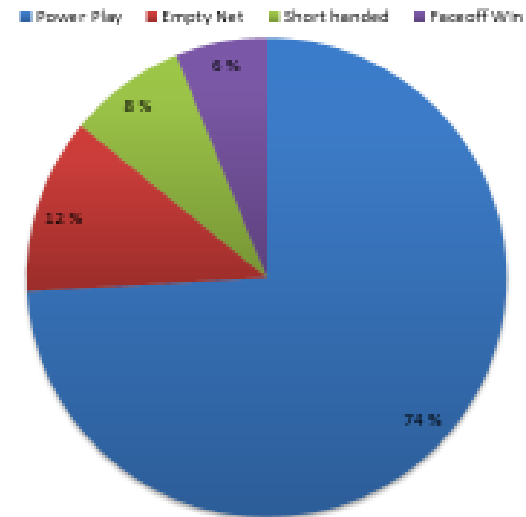
Power play and special situations

Power play	Goals	%
Rush	73	12
Turnover	26	4
Set play/blueline	122	19
Set play	197	32
Rebound	128	20
Deflect	56	9
Faceoff win	24	4
Total	626	100

Special situation	Goals	%
Empty net	100	46
Short handed	67	30
Faceoff win	52	24
Total	219	100

Comparison-

regular seasons three best teams against three worst teams

Scored goals	3 Best	3 Worst	Separation
Even strenght	345	264	+81
Power play	159	100	+59
Special situations	66	31	+35
Total	570	395	+175

Comparison-

regular seasons three best teams against three worst teams

Scored- even strenght	3 Best	3 Worst	Separation
Straight attack	120	85	+35
Turnover	106	80	+26
Offensive zone play	119	99	+20
Total	345	264	+81

Comparison-
regular seasons three best teams against three worst teams

Scored- Power play	3 Best	3 Worst	Separation
Straight attack	26	12	+14
Turnover	5	6	-1
Set play/blueline	28	27	+1
Set play	59	23	+36
Rebound	25	22	+3
Deflect	12	10	+2
Faceoff win	4	0	+4
Total	159	100	+59

Comparison-

regular seasons three best teams against three worst teams

Goals allowed short handed	3 Best	3 Worst	Separation
Straight attack	12	21	-9
Turnover	1	9	-8
Set play/ blueline	25	27	-2
Set play	37	49	-12
Rebound	24	30	-6
Deflect	13	16	-3
Faceoff win	4	10	-6
Total	116	162	-46

Comparison-
regular seasons three best teams against three worst teams

	Scored	Allowed	Separation
3 Best- Power play	159	118	+41
3 Best- Even strenght	345	250	+95
3 Worst- Power play	100	136	-36
3 Worst- Even strenght	264	349	-85